April, 2014

FINAL REPORT

SD 2-3 Tailings Storage Facility Preliminary Design - Meliadine Gold Project, Nunavut

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REPORT

Reference Number: Doc 255-1314280007 Ver. 0

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Executive Summary

Agnico Eagle Mines Limited is currently evaluating the feasibility of developing the Meliadine Gold Project (Project). The proposed project aims to build, operate and decommission an underground and open-pit gold mine. The Project site is 25 kilometres north of Rankin Inlet, on Inuit Owned Land in the Kivalliq Region of Nunavut, Canada.

This report has been prepared to present the Project tailings storage facility preliminary design.

The Project is located within the Southern Arctic terrestrial ecozone, one of the coldest and driest regions of Canada, in a zone of continuous permafrost, where daylight reaches a minimum of 4 hours per day in winter and a maximum of 20 hours in summer. The climate is extreme with long, cold winters and very short, cool summers. The mean annual air temperature at the site is approximately -10°C.

Geotechnical and geothermal investigations have been completed at the Project site in 2007, 2009, and 2011.

Key design criteria for the preliminary design of the TSF are summarized. Based on CDA (2007), the Meliadine TSF Dike is classified as a High consequence of failure structure.

A preliminary deposition plan has been presented to confirm the storage capacity of the facility and to evaluate the feasibility of the proposed closure concept. The TSF has been sized to store the planned 34.5 million tonnes of tailings and manage excess process water and runoff throughout operations. The general closure concept for the TSF is to place an engineered cover over a graded tailings surface with the tailings grading from northwest to the southeast. An operating spillway at the southwest corner of the facility will be maintained at closure so that surface runoff from the TSF will be directed through the spillway to Tiriganiaq Pit.

The preliminary design drawings are presented in Figures 1 through 10. To meet the design criteria, the dike crest elevation will be elevation 86 m and the height of the dike will vary around the perimeter of the facility, ranging from approximately 10 m to 25 m. The proposed dike cross section includes a rockfill shell to support coarse and fine filter zones and a liner system. The liner system is installed along the upstream slope and is tied into a compacted fill trench at the upstream dike toe. The proposed construction materials and quantities are summarized. Stability and Seepage analyses have been completed for the preliminary design and found to meet the design criteria. Recommendations are provided for additional geotechnical investigations and analyses to support the detailed design.

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1.0 INTRODUCTION

Agnico Eagle Mines Limited (AEM) is currently evaluating the feasibility of developing the Meliadine Gold Project (Project). The proposed Project aims to build, operate and decommission an underground and open-pit gold mine. The Project site is 25 kilometres north of Rankin Inlet, on Inuit Owned Land in the Kivalliq Region of Nunavut, Canada. The Inuit Owned Land is governed under the Nunavut Land Claims Agreement.

Situated on the western shore of Hudson's Bay, the Project site is located on a peninsula between the east, south, and west basins of Meliadine Lake (63^{o}01'N, 92^{o}12'W within the Zone 15 of the North American Datum of 1983). Current access to the property is via airways with Rankin Inlet acting as a staging post for transhipment of equipment and personnel.

The Project is comprised of five gold deposits which are located in relative close proximity to one another: Tiriganiaq, F Zone, Pump, Wesmeg and Discovery. The deposits will be mined using conventional open pit mining methods, and in the case of the Tiriganiaq deposit, the most important deposit, additional mining by underground mining methods will be undertaken. Approximately 8,500 tonnes of ore will be processed per day. The Tiriganiaq, F Zone, Pump and Wesmeg deposits are located, respectively, 1.2, 4.0, 2.7, and 1.6 km from the planned mill while the Discovery deposit is approximately 15.9 km south-east of the planned mill.

Development of the new gold mine will include a mill, camp, powerhouse, tank farm, tailings storage facility (TSF), waste rock piles, water and sewage treatment plant, port facility and an all-weather access road from Rankin Inlet to the project site.

Located within a polar tundra climate, the biophysical characteristics of the Project site are typical of a remote, relatively undisturbed northern environment and are comprised of a hummocky topography having glacial landforms draped with water bodies and tundra vegetation that are home to northern fish, wildlife and birds. The area is subject to great seasonal changes in the length of days and nights causing long, cold winters and short, cool summers. A zone of continuous permafrost underlies the Project site. The Tiriganiaq deposit is the only deposit that is planned to be mined below the inferred depth of permafrost at the site. Half of the mean annual precipitation of the area occurs as snow and the other half occurs as rain. The regional surface drainage patterns are controlled by a series of low relief ridges composed of glacial deposits.

A general site plan of the proposed Meliadine Mine is shown in Figure 1. The proposed TSF is located north of the Tiriganiaq Open Pit and encompasses Lake B7. This report has been prepared to present the TSF preliminary design.

This report has been prepared in accordance with the "Study Limitations" which are presented at the beginning of this report. The reader's attention is specifically drawn to this information for reference during the use of this report.

2.0 GENERAL SITE CONDITIONS

Much of the following description of general site conditions is summarized from site studies carried out by Golder (Golder 2008; SD 7-1 2009 Aquatics Synthesis Baseline; Golder 2009b; SD 6-1 Permafrost Baseline Report; and FEIS Volume 7 Appendix 7.2-A).

2.1.1 Climate

The Project site lies within the Southern Arctic Climatic Region where daylight reaches a minimum of 4 hours per day in winter and a maximum of 20 hours in summer. The climate is extreme with long, cold winters and very short, cool summers. Temperatures are cool, with an average monthly air temperature of 12°C in July and -31°C in January. The mean annual air temperature at the site is approximately -10°C.

Winds are moderate to strong and generally originate from the north-northwest and north. Mean monthly wind speeds are typically between 19 km/hr and 29 km/hr, with an average of 23 km/hr.

The average annual precipitation for the site was estimated to be 306 mm with approximately 60% as rainfall (181 mm) and 40% as snowfall (129 mm water equivalent). Snow falls in every month except in July, and rain generally only occurs between May and October. The net annual average runoff, defined as precipitation minus evapotranspiration and sublimation, is 185 mm.

A summary of climate data, as recorded by the nearest long-term climate station to Meliadine (Rankin Inlet A, MSC Station 2303401), for the years 1981 to 2009 are presented in Table 1.

Table 1: Annual Data from Rankin Inlet - A Weather Station

Mean Annual Air Temperature	- 10 °C
Maximum Temperature	15 °C
Minimum Temperature	- 37 °C
Average Number of Days with Temperatures Below Zero	265 days
Mean Annual Precipitation	306 mm

Source: SD 7-1 2009 Aquatics Synthesis Baseline

Table 2 summarizes the mean monthly air temperatures measured at the Rankin Inlet A (MSC Station number 2303401) and Meliadine Project weather stations and the mean monthly ground temperatures as measured at the Meliadine Project weather station. Table 3 summarizes the monthly precipitation from approximately 1998 to 2009 measured at the Rankin Inlet A weather station (MSC Station number 23030401).

Table 2: Mean Monthly Air and Ground Temperatures for Rankin Inlet A and Meliadine Project Weather Stations

	Air Temperature, °C		Ground Temperature, °C
	Rankin Inlet A Weather Station, 1981-2009	Meliadine Project Weather Station, 1997-2001	Measured at 5 cm depth at Meliadine Project Site, 1997-2001
Month	**Mean**	**Mean**	**Mean**
January	-30.9	-31.4	-25.3
February	-30.1	-27.8	-24.3
March	-25.1	-21.7	-19.5
April	-15.7	-14.0	-14.5
May	-5.9	-3.8	-6.9
June	4.1	5.0	2.5
July	10.5	12.1	8.4
August	9.7	10.7	7.9
September	3.8	4.3	4.0
October	-4.6	-5.0	-1.3
November	-17.2	-15.1	-8.2
December	-25.9	-24.9	-17.9
Annual Average	**-10.4**	**-9.3**	**-7.9**

Source: SD 7-1 2009 Aquatics Synthesis Baseline

Table 3: Mean Monthly Precipitation for Rankin Inlet A Weather Station (1981-2009)

Month	Rainfall (mm)	Snowfall (mm)	Precipitation (mm)
January	0.0	8.6	8.4
February	0.0	8.7	8.4
March	0.0	12.4	12.2
April	1.2	19.2	20.0
May	6.8	12.8	19.1
June	23.4	4.7	28.0
July	38.7	0.1	38.8
August	56.4	0.2	56.5
September	40.0	3.8	43.8
October	13.7	24.6	37.9
November	0.3	22.2	21.6
December	0.0	12.6	12.0
Annual Average	**180.7**	**128.8**	**305.5**

Source: SD 7-1 2009 Aquatics Synthesis Baseline

2.1.2 Topography and Lake Bathymetry

The dominant terrain in the Project area comprises glacial landforms such as drumlins (glacial till), eskers (gravel and sand) and lakes. A series of low relief ridges are composed of glacial deposits oriented in a northwest-southeast direction, and control the regional surface drainage patterns.

The Tiriganiaq, F Zone, Pump and Wesmeg Deposits are located on a large peninsula separating the east, south, and west basins of Meliadine Lake. The Discovery Deposit is located south and east of Meliadine Lake.

The surveyed lake surface elevations in the Project area range from about 51 meters above sea level (masl) at Meliadine Lake to about 74 masl for local small perched lakes. Kettle lakes, and other lakes formed by glacio-fluvial processes or glacial processes, are common throughout the project area. Several of the lakes will be affected by development of the project components including the open pits, waste rock piles and the TSF.

The TSF will encompass Lake B7 which is about 2000 m long and a maximum of about 400 m wide. The bathymetric contour data for Lake B7 is shown on Figure 2. The mean depth for Lake B7 is about 2.5 m and the maximum depth is about 5.5 m.

Late winter ice thicknesses on freshwater lakes in the Project area range between 1.0 m and 2.3 m with an average thickness of 1.7 m. Therefore, lake ice freezes to the lake bottom at depths shallower than approximately 1.0 to 2.3 m. Ice covers usually appeared by the end of October and were completely formed in early November. The spring ice melt typically begins in mid-June and is complete by early July.

2.1.3 Permafrost

The Project is located within the Southern Arctic terrestrial ecozone, one of the coldest and driest regions of Canada, in a zone of continuous permafrost. SD 6-1 Permafrost Baseline Report presents the permafrost thermal regime baseline studies for the Meliadine site. Continuous permafrost to depths of between 360 m and 495 m is expected based on historical and recent ground temperature data from thermistors installed near Tiriganiaq, F Zone and Discovery deposits. The ground temperature data indicates that the active layer is 1.0 m to 3.0 m in areas of shallow soil and away from the influence of lakes. It is anticipated that the active layer adjacent to lakes or below a body of moving water such as a stream will be deeper.

Taliks (areas of unfrozen ground) are to be expected where lake depths are greater than about 1.0 to 2.3 m. Formation of an open-talik which penetrates through the permafrost would be expected for lakes which exceed a critical depth and size. It is anticipated that an open-talik exists below Lake B7 based on the depth and geometry of this lake.

The salinity of groundwater also influences the temperature at which the groundwater will freeze. High salinity groundwater typically results in a freezing point depression. For the Project area, information about the salinity level of groundwater is currently limited. One groundwater sample was collected and tested, during a hydrogeologic investigation carried out in 2009 on borehole GT09-19 (beneath Lake B7). The groundwater sample was collected at a down hole depth between 70.9 m and 199.5 m (Golder 2009b). Laboratory analytical certificates for this groundwater sample (Golder 2009b) indicate a salinity level of approximately 4.2 ppt, which would cause a freezing point depression of about 0.25 ^{o}C. A thermistor installed into this borehole indicated down hole temperatures between about -0.6 ^{o}C and -0.2 ^{o}C over the interval from which the groundwater sample was taken.

A Westbay monitoring and sampling well (M11-1257) was installed in 2011 to a depth of 663 m below ground surface. Details of the installation, sampling procedures, and groundwater quality analytical results are presented in Golder (FEIS Volume 7 Appendix 7.2-A). A sample was collected at a depth of approximately 454 m below ground surface. The salinity of the sample was approximately 60.9 ppt corresponding to a freezing point depression of approximately 3.3 ^{o}C, suggesting the depth to the basal cryopeg (frozen ground) is between about 350 m and 375 m below ground surface.

3.0 GEOTECHNICAL CHARACTERIZATION

3.1 Geotechnical Investigations

This section presents a summary of the geotechnical and geothermal soil investigations completed in the Lake B7 area of the proposed TSF. Geotechnical and geothermal investigations have been completed at the Project site in 2007, 2009, and 2011.

The 2007 investigation was conducted by SRK (SRK 2007). Six boreholes were completed from April to May 2007 at preliminary locations for the mill site, waste rock piles and TSF. The boreholes were logged and sampled and then five of the boreholes were instrumented immediately with thermistors.

The 2009 investigation was conducted by Golder (Golder 2010). Five boreholes were completed in the area around the proposed Lake B7 TSF between August and September 2009. Thermistor cables were installed in four of the boreholes.

Two investigation programs were conducted by Golder during 2011. To study the thermal regime beneath the larger lakes in the project area, two thermistor cables, GT11-A and GT11-B, were installed in two deep boreholes near Lakes B5 and B7 in June 2011 (Golder 2011). The boreholes were drilled for the purpose of installing the thermistors, so the boreholes were not logged. A geotechnical investigation was completed for the proposed TSF around Lake B7 in August and September 2011. The program included the installation of an additional 8 thermistors (SD 2-4A 2011 Geotechnical Field Investigation Report).

3.2 Subsurface Conditions

The details of the subsurface conditions encountered are summarized in the geotechnical investigation reports for each program. Simplified summaries of the soil and bedrock conditions are provided below.

3.2.1 Soil Conditions

In general, the local overburden stratigraphy consists of a thin layer of top soil overlying a layer of non-cohesive soil with variable amounts of silt, sand and gravel. Observed throughout the entire site and through various depths is the presence of dispersed cobbles and boulders. Particle size gradations for the soils on site, based on laboratory analysis performed on samples collected during the 2011 field program (Volume 2, SD 2-4A), are as follows: fines (<0.075 mm particles) content ranges from 9 to 91%, sand

(4.75mm > particles > 0.075mm) content ranges from 6% to 91%, and gravel (particles > 4.75mm) content ranges between 0% and 65%. Laboratory results also show a moisture content varying between 5 % and 33% with excess ice contents varying between 0% and 519%. Excess ice contents were calculated from the volume of free water decanted off the sample after allowing it to thaw. The total moisture content of the sample is the moisture content plus the excess ice content which ranged from 5% to 540%.

Frozen soils and the presence of ice were observed in every hole. Evidence of ice lenses containing little disseminated soil were observed in boreholes GT07-11, GT09-16, GT11-03, GT11-05, GT11-09, GT11-10, and GT11-11 at depths ranging from 1.25 m to 3 m. Ice rich materials are considered to be soils with more than 10% visible ice and/or having a total moisture content greater than 20%. Ice rich soils were typically encountered to depths of 2 to 3 meters; however, in some areas ice rich soils were encountered to depths of 4 to 5 meters.

Lenses of clay were observed at various depths in a few locations in boreholes GT11-06, GT11-08, GT11-11 and GT11-16. The clay layers were observed within the overburden soils and were found with no particular spatial pattern. The type of clay observed on site also includes various fractions of sand, silt and gravel.

The thickness of the soils ranges between 2.0 m (GT11-13) and 17.5 m (GT11-09).

3.2.2 Bedrock Conditions

Bedrock in the project area consists of a stratigraphic sequence of clastic sediments, oxide iron formation, siltstones, graphitic argillite, and mafic volcanic flows (Snowden 2008, Golder 2009a). Bedrock types consisting of metavolcanics, gabbro, greywacke, iron formation, siltstone and argillite were encountered during geotechnical field investigations (Golder 2010).

The bedrock encountered in the TSF area was typically greywacke and was generally described as slightly to moderately weathered, medium strong to strong. The rock quality designation (RQD) is generally between 50% and 100%. The bedrock typically had an RQD approaching 100% below a depth of about 1 m to 2 m. No obvious major shallow fault zones were encountered at any of the geotechnical boreholes in the TSF area. However, a deep fault, on the order of 55 to 117 m deep, was encountered in some condemnation boreholes drilled near the north end of the TSF. This fault is thought to run east-west and will require further drilling to define its extents.

4.0 GEOCHEMICAL CHARACTERIZATION

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 2.2), 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 test) 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 minor proportion of 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 areas, 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 test) 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 0.5mg/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, total 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, 2012).

5.0 DESIGN BASIS

5.1 Design Criteria

The key design criteria for the preliminary design of the Meliadine TSF are summarized in Table 4.

Table 4: TSF Dike Key Design Criteria

Description	Assessment	Reference / Comments
Mine Design Life	13 years	AEM
Average Tailings Production Rate	2,903,756 tonnes per year	AEM
Total Life of Mine Tailings Tonnage	37,748,834 tonnes	AEM
Total Life of Mine Tailings sent underground	3,317,192 tonnes	AEM
Total Life of Mine Tailings sent to TSF	34,431,643 tonnes	AEM
Tailings Slurry Solids Content	55 %	AEM - Yearly Production sheet
Average Specific Gravity (SG) of Tailings	2.73 to 2.82	Golder (Saskatoon and Sudbury) laboratory testing
Average Estimated Settled Void Ratio of Tailings	1.0	Previous experience with similar materials
Dry Density of Tailings		
Average Settled Dry Density of Tailings	1.37 t/m^3	Calculated using void ratio of 1.0
Bulking due to ice	10-40 %, assumed 20% average	Estimated based on experience
In-situ Dry Density of Tailings, including bulking due to ice	1.14 t/m^3	Calculated based on SG of 2.73 and 20% bulking due to ice.
Required Tailings Storage Volume	30,203,196 m^3	Based on *in-situ* tailings dry density 1.14 t/m^3 which includes bulking due to ice
Tailings Beach Slope from hydraulic deposition	1%	Experience with similar tailings
Tailings under water slope from hydraulic deposition	5%	Experience with similar tailings
TSF pond volume for design	2.9 Mm^3	AEM
Dike Crest Elevation	86 m	
Maximum Tailings Surface Elevation	85.5 m	See technical memorandum on parameters and criteria for deposition modeling in Appendix C
Design Storm Event Volume for Storage	315,200 m^3	Maintain storage for 24-hour, 500-year return period storm event (171 mm) below spillway invert
Spillway Design Storm Event	152 mm: 112 mm precipitation, plus 40 mm snowmelt (peak flow of 10.5 m^3/s)	IDF – 1/3 between the 1/1000 year and PMF (CDA 2007). See Section 5.4
Minimum freeboard for passing Design Storm Event	1.2 m across dike crest 0.5 m across waste rock pile, downstream of dike	

Table 4: TSF Dike Key Design Criteria (continued)

Description	Assessment	Reference / Comments
Spillway Invert	84 m	
Minimum setback from pit crest to toe of dike	100 m	Experience with similar projects
Maximum size of haul trucks on dike	Caterpillar 777F/ Caterpillar 785C	AEM, dike crest to serve as part of haul road
■ Width	6.49 m/ 6.64 m	Caterpillar handbook edition 38
■ Tire diameter	2.7/3.06	Goodyear specifications book
Maximum dike crest width	20 m	AEM, includes requirements for safety berms.
Dam Classification	High	Using CDA (2007) Dam Classification See Section 4.3
Operating freeboard	2.0 m above maximum pond elevation.	See Section 5.5
Maximum ice thickness for freshwater lakes	2.3 m	Golder 2009
Slope Stability Factors of Safety	FoS = 1.5 Long-term (steady-state seepage, normal reservoir level) FoS = 1.1 for Long-term pseudo-static conditions FoS=1.3 for end of construction static conditions	CDA (2007), Section 6.6 (See Section 5.2)
Seepage and Drainage Control	Seepage exit gradients should be within acceptable limits for the embankment and foundation materials. Downstream seepage collection system.	
Peak Ground Acceleration (1 in 2,475 year return period)	0.036 g	CDA (2007) and National Building Code Seismic Hazard Calculation (see Section 5.6)

5.2 Preliminary TSF Water Balance

A preliminary site wide water balance has been prepared for the Meliadine Project (SD 2-6 Surface Water Management Plan) which includes as a component a water balance for the TSF. The following section provides a brief summary of the TSF water balance.

Slurry water is pumped from the mill to the TSF at rate of 257 m^3/hr (at 92% mill availability). During the first year of operations the quantity of reclaim water is gradually increased to 50% of the slurry water, while the remaining 50% of the slurry water is assumed to be stored permanently within the tailings deposit. In addition to the slurry water, the TSF also receives water from the following sources;

- Precipitation;
- Water in Ore;
- Water from Tiriganiaq Pit; and
- A small portion of runoff from the Waste Rock Facilities surrounding the TSF.

In addition to reclaim of 50% of the slurry water, losses from the facility include evaporation, and pumping to the treatment plant. Seepage losses from the facility are assumed to be collected and pumped back to the reclaim pond. The treatment plant rate and the timing of the start-up of treatment are set in the water balance to maintain the tailings pond at a maximum volume of 2.9 Mm^3 under average conditions. During the last two years of operations treatment is increased so that the tailings pond volume is reduced to 1.0 Mm^3 in preparation for closure.

5.3 Dam Consequence Classification

The Canadian Dam Association (CDA) Dam Safety Guidelines (CDA 2007) ranks dams (dikes) according to the consequences of a hypothetical dam failure. Potential life loss, economic losses, environmental losses, and cultural losses are considered in the classification. Table 5 presents the Dam Classification categories.

Table 5: Dam Classification (CDA 2007, Section 2.5.4)

Dam Class	Population at Risk [note 1]	Incremental Losses		
		Loss of life [note 2]	Environmental and Cultural Values	Infrastructure and Economics
Low	None	0	▪ Minimal short-term loss. ▪ No long-term loss.	▪ Low economic losses; area contains limited infrastructure or services.
Significant	Temporary Only	Unspecified	▪ No significant loss or deterioration of fish or wildlife habitat. ▪ Loss of marginal habitat only. ▪ Restoration or compensation in kind highly possible.	▪ Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes.
High	Permanent	10 or fewer	▪ Significant loss or deterioration of *important* fish or wildlife habitat. ▪ Restoration or compensation in kind highly possible.	▪ High economic losses affecting infrastructure, public transportation, and commercial facilities.
Very High	Permanent	100 or fewer	▪ Significant loss or deterioration of *critical* fish or wildlife habitat. ▪ Restoration or compensation in kind possible but impractical.	▪ Very high economic losses affecting important infrastructure or services (*e.g.*, highway, industrial facility, storage facilities for dangerous substances).
Extreme	Permanent	More than 100	▪ Major loss of *critical* fish or wildlife habitat. ▪ Restoration or compensation in kind impossible.	▪ Extreme losses affecting important infrastructure or services (*e.g.*, hospital, major industrial complex, major storage facilities for dangerous substances).

Note 1: Definition for population at risk:

None – There is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure.

Temporary – People are only temporarily in the dam-breach inundation zone (e.g., seasonal cottage use, passing through on transportation routes, participating in recreational activities).

Permanent – The population at risk is ordinarily located in the dam-breach inundation zone (e.g., as permanent residents); three consequence classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life (to assist in decision-making if the appropriate analysis is carried out).

Note 2: Implications for loss of life:

Unspecified – The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

Based on Table 5, the Meliadine TSF Dike is classified as a High consequence of failure structure due to economic reasons, with the following dam class descriptions:

- **Population at Risk:** Temporary Only (site personnel);
- **Loss of Life:** 10 or fewer;
- **Environmental and Cultural Values:** Significant loss or deterioration of important fish or wildlife habitat if tailings were to breach through dike. Restoration or compensation in kind highly possible; and
- **Infrastructure and Economics:** High economic losses affecting infrastructure.

5.4 Design Storm Event

A design storm event for the TSF facility has been selected based on the dam classification. Table 6 presents a summary of the suggested design events by dam class from CDA (2007).

Table 6: Suggested Design Flood Levels (for use in Deterministic Analyses) (CDA 2007, Section 6.3)

Dam Class (note 1)	AEP
	IDF (note 2)
Low	1/100
Significant	Between 1/100 and 1/1,000 (note 3)
High	1/3 between 1/1,000 and PMF (note 4)
Very High	2/3 between 1/1,000 and PMF (note 4)
Extreme	PMF (note 4)

Acronyms:
AEP, annual exceedance probability; EDGM, earthquake design ground motion; IDF inflow design flood; PMF probable maximum flood
Note 1: As defined in Table 2-1 Dam Classification
Note 2: Extrapolation of flood statistics beyond 1/1000 year flood (10^{-3}) AEP is discouraged.
Note 3: Selected on the basis of incremental flood analysis, exposure, and consequences of failure.
Note 4: PMF has no associated AEP. The flood defined as “1/3 between 1/1000 year and PMF” or “2/3 between 1/1000 year and PMF” has no defined AEP.
Note 5: The EDGM value must be justified to demonstrate conformance to societal norms of acceptable risk. Justification can be provided with the help of failure modes analysis focused on the particular modes that can contribute to failure initiated by a seismic event. If the justification cannot be provided, the EDGM should be 1/10,000.

5.5 Freeboard

Freeboard is the minimal vertical distance between the still water surface elevation in the reservoir (pond) and the top of the containment structure. This safety margin is maintained at all times in order to restrict overtopping of the containing structure by large waves, including due consideration of wind and wave setup, and wave run up (CDA 2007, Section 6.4).

CDA (2007) (Section 6.4) states that for an embankment structure, the crest level should be set so that the structure is protected against the most critical of the following cases:

- No overtopping by 95% of the waves caused by the most critical wind with a frequency of 1/1000 year when the reservoir (pond) is at its maximum normal elevation.
- No overtopping by 95% of the waves caused by the most critical wind when the reservoir (pond) is at its maximum extreme level during the passage of the Inflow Design Flood, IDF.

Additional considerations for the Freeboard (CDA 2007, Section 6.6) are:

- Freeboard should be sufficient to prevent heave of the crest due to frost action;
- Final freeboard, including camber, should be sufficient to accommodate expected settlement of the crest and cracks caused by frost action; and
- The dam (dike) should be designed to retain the reservoir safely despite any cracking that may be induced by arching, settlement, or hydraulic fracturing.

For this conceptual design a freeboard of 2 m has been provided to meet the above criteria. The freeboard requirements should be reviewed as part of the detailed design stage.

5.6 Design Earthquake and Seismic Hazard

Based on the CDA (2007) guidelines dams shall be designed based on an Earthquake Design Ground Motion (EDGM). Selection of the EDGM is based on the consequence of failure of the dam as shown in Table 7.

Table 7: Suggested Design Earthquake Levels (for use in Deterministic Analyses) (CDA, 2007, Section 6.3)

Dam Class (note 1)	AEP
	EDGM (note 2)
Low	1/500
Significant	1/1,000
High	1/2,500 (note 3)
Very High	1/5,000 (note 3)
Extreme	1/10,000

Acronyms:
AEP, annual exceedance probability; EDGM, earthquake design ground motion;
Note 1: As defined in Table 2-1 Dam Classification
Note 2: AEP levels for EDGM are to be used for mean rather than median estimates of the hazard.
Note 3: The EDGM value must be justified to demonstrate conformance to societal norms of acceptable risk. Justification can be provided with the help of failure modes analysis focused on the particular modes that can contribute to failure initiated by a seismic event. If the justification cannot be provided, the EDGM should be 1/10,000.

For a High consequence of failure structure, the suggested design earthquake has an annual exceedance probability (AEP) of 1 in 2,500 years.

A query of the Earthquake Canada website using the Meliadine Gold 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. Details of the Seismic Hazard Calculation for the Project site are included in Appendix A.

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 1000	0.001	0.019
1 in 2475	0.000404	0.036

Peak hazard values are determined for firm ground (NBCC 2010 soil class C).

5.7 Conceptual Closure and Reclamation Plan

A site wide closure and reclamation plan is being prepared as a separate document (FEIS SD 2-17). The general closure concept for the TSF is to place an engineered cover over a graded tailings surface with the tailings grading from northwest to the southeast as shown in plan on Figure 9 and in section on Figure 10. The intent of the engineered cover will be to limit vertical infiltration to the tailings surface. Freeze back of the tailings is not required for stability and is not anticipated to be required for water quality issues based on geochemistry results to date (Section 4.0; FEIS SD 6-3); however, there is a benefit to maintaining the tailings in a frozen condition as it will minimize potential seepage from infiltration of precipitation post closure. The operating spillway at the southwest corner of the facility will be maintained at closure so that surface runoff from the TSF will be directed through the spillway to Tiriganiaq Pit.

Preliminary tailings deposition planning has been completed for this stage of the design, which supports the closure plan. Deposition will be from the perimeter of the facility, with a focus on deposition from the northwest in order to facilitate the closure concept of directing seepage to the southeast corner of the facility. During the last years of the mine life, it is anticipated that the spigots along the northwest boundary of the facility will be progressively advanced to the southeast to develop the final tailings surface shown on Figure 8. This will allow for progressive placement of the closure cover from northwest to southeast. Additional details of the deposition plan are presented in Section 6.2.

It is assumed that the tailings reclaim pond will require treatment at closure and that the water quality of surface runoff from the facility once the cover has been placed will be monitored until it meets discharge criteria. Further discussion on the closure concept for the TSF is presented in Section 9.0 below.

5.8 Anticipated Environmental Performance

The Meliadine TSF will be designed and operated to minimize the impact on the environment. Dust and seepage have been considered as potential mechanisms that could lead to impacts on the environment and are discussed in this section.

Experience with hydraulic placement of tailings indicates that dust is not a significant issue during operation. Tailings are most often either submerged, moist, or frozen so do not allow for significant dust production. The tailings are also deposited below the crest of the containment dikes; therefore, it is difficult for wind to distribute the tailings dust beyond the containment dikes. At closure the tailings will be covered with an engineered cover which will prevent dust production. The progressive placement of the closure cover as the tailings reach their maximum elevation will also help prevent dust production during the final years of operation.

During operation of the TSF, seepage through the foundation and liner of the containment dikes is anticipated. The facility will be designed and operated to minimize this seepage; however, not all seepage can be avoided. Seepage from the TSF will be collected and managed using downstream perimeter ditching and sumps, as required. Seepage analyses were completed assuming conservative material properties and with thawed foundation conditions (see Section 0). It is estimated that the actual seepage from the TSF dikes would be less than predicted by the seepage analyses. Where possible the TSF will be operated to promote freeze back of the till cut-off trench in the perimeter dike foundation and to maintain frozen conditions in the remainder of the foundation, which will reduce the volume of seepage through the foundation of the TSF. Seepage through the liner on the TSF containment dikes has been estimated in Section 0. Construction of the TSF dikes will include a Quality Control and Quality Assurance (QA/QC) Program, which will help to reduce the defects in the liner that can lead to seepage.

Seepage in to the talik below Lake B7 within the footprint of the TSF during operation is anticipated to be at a very low flux rate and with very minimal quantity. Seepage flux in to the foundation will be controlled by the low hydraulic conductivity tailings deposited over the base of the TSF and the low hydraulic conductivity of the bedrock that is anticipated to be within 5 to 10 m of the surface within the TSF footprint. Hydrogeology tests indicate that the deeper bedrock at the project site below the base of the permafrost or in taliks is generally of low hydraulic conductivity, on the order of 3×10^{-9} m/s. Groundwater velocities in the deep groundwater regime are very low, on the order of 0.2 to 0.3 m per year, and it is estimated that groundwater from Lake B7 would take over 5,000 years to travel in a northeast direction to Meliadine Lake.

At closure of the TSF, the tailings pond will be pumped out and an engineered cover will be placed over the tailings to limit vertical infiltration to the tailings surface. Without a head of ponded water, seepage from the TSF is anticipated to significantly decrease at closure. Post closure, the tailings are anticipated to freeze back.

6.0 CONCEPTUAL DESIGN

6.1 TSF Dike Alignment and Foundation Conditions

A longitudinal section along the centreline of the proposed TSF dike alignment is presented in Figures 3 through 6 and includes the simplified stratigraphy from the 2011 boreholes in the TSF area and the inferred bedrock data provided by AEM. The boreholes in the TSF area indicate the following:

- In general, the containment dike foundation stratigraphy consists of a thin layer of top soil overlying a layer of non-cohesive soil with variable amounts of silt, sand and gravel. Observed throughout the entire site and through various depths is the presence of dispersed cobbles and boulders. Ice rich soils were typically encountered to depths of 2 to 3 meters; however, in some areas ice rich soils were encountered to depths of 4 to 5 meters;

- The inferred depth to bedrock along the dike alignment ranges from approximately 3 m to 17.5 m; and
- The bedrock is generally greywacke and is described as slightly to moderately weathered in the upper most 1 m to 2 m.

6.2 Preliminary Deposition Plan

A preliminary deposition plan was prepared to confirm the storage capacity of the facility and to evaluate the feasibility of the conceptual closure concept. The deposition of tailings was modelled at four stages during the operation of the TSF. Table 9 presents the deposition periods considered with the corresponding tonnages and volumes of tailings modelled as well as the estimated pond volumes. The deposition parameters (tailings beach slope and average settled dry density) used for the model are presented in Plate 1 and also in the technical memorandum on parameters and criteria for deposition modeling included in Appendix C.

Table 9: Deposition Model Input Values

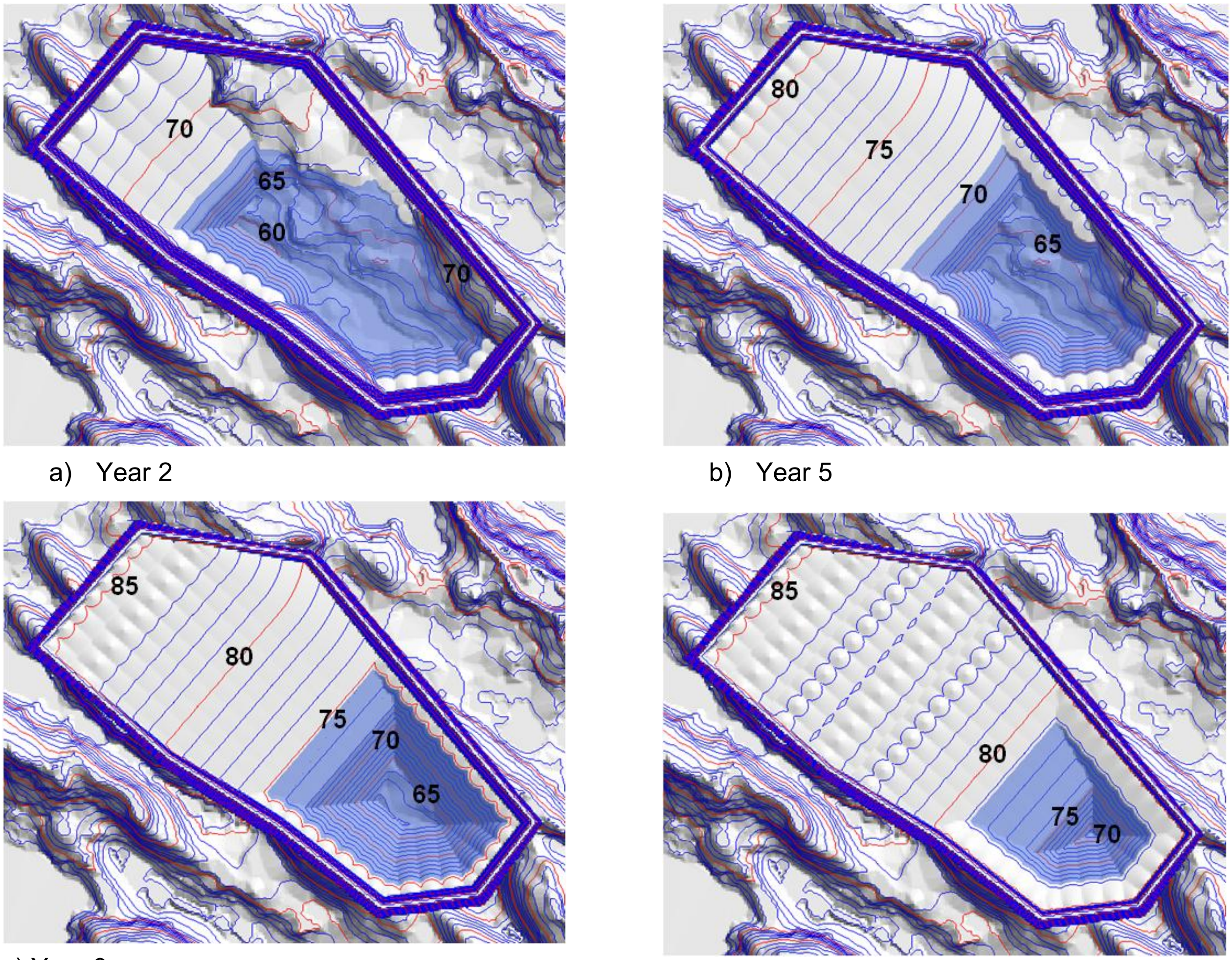
Time Period	Tailings Stored		Tailings Stored		Estimated Pond Volume ($M\ m^3$)
	Incremental (M t)	Cumulative (M t)	Incremental ($M\ m^3$)	Cumulative ($M\ m^3$)	
Year 2	4.76	4.76	4.18	4.18	2.9
Year 5	8.57	13.33	7.51	11.69	2.9
Year 9	11.28	24.61	9.90	21.59	2.9
Year 13	9.82	34.43	8.61	30.20	1.0

A key consideration in the deposition modelling was to allow for progressive reclamation of the TSF. Progressive reclamation is planned to start in the northern sector of the TSF and progressively move towards the south of the facility. Considering this, the main guidelines taken into account during deposition modelling were:

- Gradually move the pond towards the south and center of the facility towards the end of the mine life to facilitate closure; and
- Aim for a gently sloping tailings surface towards the south of the TSF at the end of the operation to facilitate closure of the facility.

Deposition was modelled using discharge points positioned all around the perimeter of the facility and tailings beaches were maintained in front of the TSF dikes. Most of the deposition was done from the northwest end of the facility to develop beaches and a sloping surface towards the south. Deposition around the southern portion of the facility was required to maintain beaches in front of the TSF dikes around the southern portion of the facility. Near the end of the operation, spigots along the northwest boundary of the facility were progressively advanced to the southeast to develop the final tailings surface and allow progressive reclamation to take place in the northwest sector. With this deposition plan, it is assumed that access roads or platforms (possibly as part of the TSF reclamation cover) will be constructed, if required, to set up the discharge points inside the facility.

Plate 1 presents a summary of the deposition modelling results showing the evolution of the tailings deposition surfaces throughout the mine life.



a) Year 2

b) Year 5

c) Year 9

d) Year 13

Plate 1: Modelled Tailings Deposition Surface throughout the Life of the Operation

The current geochemistry characterization indicates that the last three years of tailings production are non PAG; however, some of the tailings produced prior to that have an uncertain acid generation potential. The current tailings deposition plan would result in non PAG tailings deposition over the majority of the deposit in the last three years, except at the north end of the facility. Modifications will be made to the tailings deposition plan to extend non PAG tailings deposition at the north end of the facility toward the end of the mine life to ensure that non PAG tailings cover the entire surface area of the TSF.

6.3 Tailings Capacity

The required tailings storage capacity is calculated using the total life of mine tailings production mass (~34.4 million tonnes) and the estimated average in-situ tailings density (1.14 t/m^3, including bulking due to ice) and requires a total storage volume of 30.2 million m^3.

Plate 2 shows the storage capacity - elevation curve for the proposed TSF. The total capacity of the TSF (struck level) is 36 million m^3 at elevation 84 m. Therefore, there is about 6 million m^3 of storage volume available above the final tailings surface that can be used as contingency for ice entrapment, reclaim water or additional tailings.

For the given modelling parameters, the maximum tailings elevation is 85.5 m at the northwest end of the facility at the end of the operation. The tailings elevation decreases to 80.1 m at the southeast end of the facility. The pond elevation reaches its maximum elevation of 78.8 m at year 13.

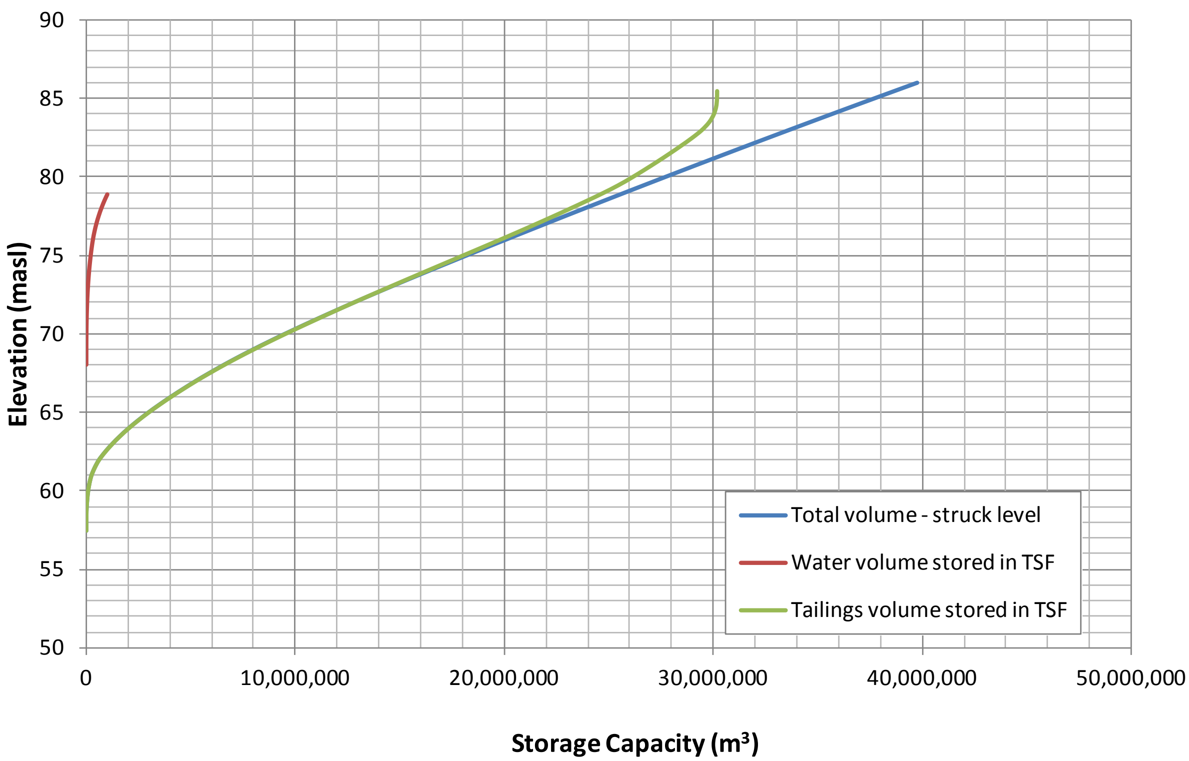


Plate 2: Final TSF Storage Capacity by elevation Curves – Year 13

6.4 TSF Dike Design Cross Section

The proposed typical TSF dike cross section and details are shown on Figure 7. The proposed dike cross section consists of:

- Excavation of ice-rich foundation soils below the entire lined portion of the upstream slope;
- A rockfill shell, constructed from run-of-mine waste rock with a 3H:1V upstream face and 2H:1V downstream face and 20 m crest width;
- A coarse and fine filter zone on the upstream face and wrapping around to the foundation under the upstream toe;
- A compacted low hydraulic conductivity till placed as cut-off trench backfill;

- A Linear Low Density Polyethylene (LLDPE) liner or a bituminous geomembrane liner tied in to the till cut-off trench backfill; and
- A granular liner cover layer to reduce thermal effects on the liner and minimize biologic intrusion directly over the liner. The liner cover will be optimized in detailed design and will vary depending on the type of liner chosen for the containment dikes. The maximum particle size for a cover over an LLDPE liner is 20 mm and the maximum particle size for a cover over a bituminous geomembrane liner is 50 mm. The tailings material may also be considered for use as liner cover.

The crest elevation of the dike will be El. 86 m and the height of the dike will vary around the perimeter of the facility, ranging from approximately 10 m to 25 m. The final crest width of the dike downstream of the liner crest anchor will be a minimum of 20 m.

6.5 Construction

6.5.1 Foundation Preparation

Foundation preparation in all footprint areas of the TSF dikes will include removing snow and ice, stripping, and scalping organic hummocks. The upstream footprint area of the TSF that is below where the final liner will be installed will also require removing ice rich foundation materials. Ice rich material is defined as soils that contain more than 10% visible ice or have a moisture content that is greater than 20%. As has been noted in previous sections, ice rich soils are typically encountered at depths up to 2 m to 3 m; however, ice rich soils have been encountered to depths of 4 m to 5 m in some areas.

6.5.2 Materials

All dike construction materials will be non-potentially acid generating (NPAG) and non-metal leaching.

6.5.2.1 Rockfill

Rockfill to be placed at the TSF shall be 1000 mm minus, run-of-mine material consisting of sound, hard, durable, well graded rock fragments reasonably free from ice, frozen chunks, organic matters, debris and other deleterious materials. Rockfill shall satisfy the gradation limits after placement as shown in Table 10.

Table 10: Rockfill Gradation Limits

Size (mm)	Percent Passing (%)
1000	100
300	40-100
100	20-55
19.1	0-27
2.5	0-10

6.5.2.2 Coarse Filter

Coarse Filter shall be obtained from a native source or processed from rockfill to satisfy the gradation limits in place on the dike, as shown in Table 11. Coarse Filter shall be free of clay, organic matters, debris, cinders, ash, refuse, snow, ice and other deleterious material.

Table 11: Coarse Filter Gradation Limits

Size (mm)	Percent Passing (%)
152.4	100
76.2	50-100
25.4	25-55
19.1	20-45
4.76	0-20
2	0-15

6.5.2.3 Fine Filter

The Fine Filter will also form the Liner Bedding and shall be obtained from a native source, or processed from rockfill and shall fall within the gradation limits in place on the dike as shown in Table 12. Fine Filter and Liner Bedding shall be free of organic material, debris, cinders, ash, refuse, snow, ice and, other deleterious material.

Table 12: Fine Filter and Liner Bedding Gradation Limits

Grain Size (mm)	Percent Passing by Mass (%)
15	100
4.76	50-100
2.0	30-65
0.425	12-35
0.075	0-15

6.5.2.4 Cut-off Trench Till Backfill

Cut-off trench Till backfill material shall be unfrozen silty sand and gravel and shall fall within the gradation limits, after placement, as shown in Table 13. Till shall be free of organic material, debris, cinders, ash, refuse, snow, ice and, other deleterious materials. The material shall have a water content that is between +1 to +3% of the optimum moisture content obtained from standard proctor testing and shall be compacted to a minimum of 98% of the standard proctor density (SPD).

Table 13: Till Gradation Limits

Grain Size (mm)	Percent Passing by Mass (%)
152.4	100
50.1	85-100
4.75	60-100
2.0	55-85
0.075	35-55

A borrow source evaluation will be required to identify a source for the cut-off trench till backfill. Samples that were collected and tested in the laboratory during the site investigations in 2007 (SRK 2007), 2009 (Golder 2010), and 2011 (SD 2-4A 2011 Geotechnical Field Investigation Report) were evaluated against the gradation limits in Table 13 and approximately half of the samples met the required gradation limits.

6.5.2.5 Liner

Liner installed on the liner bedding zones shall be a Linear Low Density Polyethylene (LLDPE) liner or an ES2 or ES3 bituminous geomembrane liner. A geotextile will be required if an LLDPE liner is chosen. The type of liner can be chosen during more detailed design phases.

6.5.2.6 Granular Liner Cover

Liner Cover is material placed directly over the Liner. The Liner Cover shall have a maximum particle size of 20 mm for LLDPE liner or 50 mm for bituminous geomembrane liner and shall be placed such that it does not puncture or damage the liner. Liner Cover material shall be free of organic material, debris, cinders, ash, refuse, snow, ice and other deleterious material.

6.6 Construction Quantities

Material quantities for dike construction to the final crest El. 86 m are presented in Table 14. Quantities are based on limited topography data and are considered accurate to within ±30%. Staged construction of the perimeter containment dikes is planned and will be defined in future stages of design.

Table 14: Summary of Dike Construction Quantities

Material	Quantity
Length of dike	6125 m
Foundation Preparation Area - upstream	413,500 m^2
Foundation excavation of Ice Rich Soil - upstream	1,230,000 m^3
Foundation Preparation Area - downstream	332,950 m^2
Rockfill	6,965,500 m^3
Cut-off trench till backfill	257,000 m^3
Coarse Filter (Sand and Gravel)	224,000 m^3
Fine Filter (Sand and Gravel)	224,000 m^3
Liner area	396,500 m^2
Granular Liner Cover	140,000 m^3
Closure Cover	9,489,000 m^3

6.7 Proposed Construction Methodology

The TSF dike alignment crosses the edge of Lake B7 on the northwest perimeter and crosses the lake outlet on the western perimeter. The TSF dike will be constructed under ‘dry’ conditions; therefore, partial dewatering of Lake B7 and/or temporary dikes will likely be required in these locations to manage water during initial construction.

A phased construction plan for the dikes has not been completed for this level of the design; however, it is anticipated that initial dike construction will include construction of the dike where the original ground topography is the lowest at the northwest (approximately Station 2+400 to 3+100), southeast (approximately Station 5+300 to 5+900), and west (approximately Station 4+000 to 4+600). Future phases would include raising and extending the initial sections to eventually complete the perimeter structure.

7.0 PRELIMINARY DESIGN ANALYSES

The following sections present a summary of the geotechnical design analyses performed for the proposed Meliadine TSF dike including: seepage, stability, and filter compatibility.

7.1 Model Geometry

The dike section used in the stability and seepage analyses was selected at Station 3+000 along the northwest boundary of the facility. This section was selected based on height and thickness of foundation soils. Based on the geometry of the dike layout, the required height of the dike is approximately 23 m at Station 3+000, which is close to the maximum height of 25 m, and the foundation is generally flat with an inferred soil thickness of about

9 m for this section of the dike. The stability analyses also considered a section which included the closure cover.

The models considered a rockfill dike with a transition zone and liner on the upstream face tied in to a cut-off trench at the upstream toe. The slopes of the upstream and downstream faces of the dike are 3H:1V and 2H:1V, respectively. The foundation of the dike was modelled as 4 m of ice rich soil underlain by 5 m of ice poor soil over bedrock, based on observations from the geotechnical drilling completed in 2011 (SD 2-4A 2011 Geotechnical Field Investigation Report). For the stability analysis a closure case was assessed which included a 3 m closure cover over the final tailings surface. Figures B-2 and B-4, in Appendix B, show the typical dike cross sections used in the modelling.

7.2 Filter Compatibility Assessment

A filter compatibility assessment was completed to review the proposed construction material gradation limits provided in Section 6.5. The assessment was completed following methods proposed by Fell et al. (2005) to determine gradation limits that would minimize movement of fines into adjacent zones in the embankment. The criterion considered from Fell et al. (2005) was:

$$D_{15}^{\text{coarse soil}} / D_{85}^{\text{fine soil}} < 5$$

Where D_{15} is the particle size for which 15% by weight of particles are smaller and D_{85} is the particle size for which 85% by weight of particles are smaller.

The filter compatibilities of all adjacent zones in the dike were assessed and are summarized in Table 15. Although the liner will be installed between both the fine filter (liner bedding) and the till, and the fine filter and the tailings, the filter compatibility of the fine filter was compared to the cut-off trench till and the tailings. It is recommended to maintain filter compatibility of these materials in case of a tear in the liner.

Table 15: Filter Compatibility Analysis Results

Materials	$D_{15}^{\text{coarse soil}}$	$D_{85}^{\text{fine soil}}$	Ratio of: $D_{15}^{\text{coarse soil}} / D_{85}^{\text{fine soil}}$	
			Actual	Criteria (Fell et al. 2005)
Rockfill/Coarse Filter	67	39.7	1.7	<5
Coarse Filter/Fine Filter	13.5	3.3	4.1	<5
Fine Filter/Tailings	0.6	0.13	4.6	<5
Fine Filter/Till	0.6	2	0.3	<5

7.3 Seepage Assessment

The finite element code Seep/W version 7.17 (GEO-SLOPE International Inc) was used for the analysis to determine seepage rates through the foundation and to compute pore water pressures in the foundation materials.

All analyses were carried out as steady state analysis and considered hypothetically thawed conditions for dike and foundation materials to conservatively assess the upper limit for anticipated seepage and the lower limit for the factor of safety for slope stability. Observations during the 2011 geotechnical drilling program conducted in late summer indicated that the foundation materials along the dike alignment were frozen, with the exception of the upper 1 to 3 m active layer. Thermistors installed in the area also indicate that the ground is frozen. Foundation material properties used for the analyses were assigned using available site information from along the proposed dike alignment based on the geotechnical field program conducted in 2011 (SD 2-4A 2011 Geotechnical Field Investigation Report).

7.3.1 Material Properties and Boundary Conditions

The hydraulic conductivities of the materials used in the seepage analysis are listed in Table 16 below.

Table 16: Seepage Analysis Material Properties

Material	Saturated Hydraulic Conductivity (k)
	(m/s)
Rockfill	$1x10^{-2}$
Transition	$1x10^{-3}$
Tailings	$2x10^{-7}$
Ice Rich Soil	$2x10^{-7}$
Ice Poor Soil	$1x10^{-6}$
Till Trench	$1x10^{-7}$, $1x10^{-6}$ (1)
Bedrock - weathered	$5x10^{-6}$
Bedrock	$3x10^{-7}$
Liner	$<1x10^{-12}$

Notes: 1) Sensitivity Case

The hydraulic conductivity of ice rich/poor foundation soils was estimated based on representative gradation tests performed on samples taken from borehole GT11-01 (closest borehole to the seepage/stability section) during the 2011 drilling program with consideration of the samples collected from the remaining boreholes (SD 2-4A 2011 Geotechnical Field Investigation Report). Ice rich soils were assumed to be located in the upper 4 m of the foundation and were considered to consist of 50% coarse material (sand and gravel) and 50% fine material (silt and clay). Ice poor soils were assumed to be located from 4 m to 9 m depths and were considered to consist of 75% coarse material and 25% fine material.

The hydraulic conductivity values of the dike fill and tailings materials were estimated based on available information at this level of study and experience with similar materials.

The boundary conditions used in the seepage models were as follows:

- **Upstream** – A constant head was set equal to 2 m below the dike crest at the elevation of 84 m, along the entire length of the tailings.
- **Downstream toe** – The condition considered was a constant head at ground elevation (El. 64 m) to represent saturated ice rich soils at the base of the dike.

7.3.2 Seepage Analysis Results

The results of the seepage analysis for the scenarios modelled are summarised in Table 17, and are shown in Figure B-5 in Appendix B.

Table 17: Seepage Analysis Results

Scenario	Description	Flow through the foundation soils near the downstream toe of the dike	
		Section Seepage Flux (m^3/day per m length of dike)	Seepage per 1000 m Dike length (L/s)
1	Cut-off Till trench hydraulic conductivity, k = 1×10^{-7} m/s	0.27	3
2	Cut-off Till trench hydraulic conductivity, k = 1×10^{-6} m/s	0.37	4

Note: Seepage quantity estimates assume fully thawed foundation conditions.

Seepage through the liner as a result of potential defects was estimated to be in the order of 1 to 2 L/s per 1000 m of dike length based on published values of liner leakage.

7.4 Slope Stability Assessment

Slope/W from Geostudio 2007, version 7.17, created by GEO-SLOPE International Inc. was used for the slope stability analysis.

The slope stability analysis was carried out considering hypothetically thawed conditions for dike and foundation materials and using pore water pressures from the seepage analysis. Slope stability was assessed for static and pseudo-static conditions and also considered drained and undrained conditions for the ice rich foundation soils.

7.4.1 Slope Stability Model Scenarios

The stability analysis considered three scenarios including, static conditions, pseudo-static conditions, and static-undrained conditions for the ice rich foundation soil layer. A brief description of each scenario is as follows:

- **Scenario 1** – Considers the analysis under static conditions.
- **Scenario 2** – Considers the analysis under pseudo-static (seismic) conditions. To model seismic conditions, the pseudo-static method of analysis was used, which applies a horizontal force to the failure mass proportional to the design horizontal acceleration. To account for the non-rigid response of the foundation soils and waste rock, the PGA was reduced to a horizontal seismic coefficient of one half the PGA and the material strength of the foundation soils was reduced to 80% of the peak strength (after Haynes-Grifffin & Franklin, 1984).
- **Scenario 3** – Considers undrained conditions for the ice rich foundation soils. The friction angle was decreased as indicated in Table 18.

The slope stability analysis assessed three possible slip surface locations through the dike and foundation under all scenarios. The slip surfaces were located near the downstream crest, through the center of the dike crest, and through the upstream crest, to evaluate the factors of safety for a range of potential failures. The approximate locations of the slip surfaces are shown in Figure B-7 in Appendix B.

7.4.2 Material Properties and Design Criteria for Slope Stability Analysis

Table 18 summarizes the strength properties used for the stability models.

Table 18: Material Properties for Slope Stability Analysis

Material	For Slope Stability Analysis		
	Friction Angle Φ' (°)	Cohesion C (kPa)	Unit Weight (kN/m³)
Rockfill	Leps (low) (1)	0	20
Transition	38	0	18
Cover (2)	38	0	18
Tailings	35	0	19
Ice Rich Soil (static condition)	32	0	19
Ice Rich Soil (pseudo-static condition)	26	0	19
Ice Rich Soil (undrained conditions)	22.5	0	19
Ice Poor Soil	34	0	20
Till Trench	32	0	20

Notes:
(1) Obtained from a shear strength function. See Figure B-3.
(2) Cover used for final closure analysis only.

Table 19 shows the design criteria for the slope stability analysis including static and pseudo-static analyses.

Table 19: Design Criteria for Slope Stability Analysis

Design Criteria	Value and/or Description	Source or Comments
Design seismic event (1 in 2475 year return period)	Peak Ground Acceleration (PGA) = 0.036 Horizontal acceleration (50% of PGA)=0.018	2010 National Building Code of Canada, Canadian Dam Association Dam Safety Guidelines (2007)
Minimum factor of safety for slope stability	■ Steady state seepage end of construction static conditions = 1.3 ■ Steady state seepage with maximum tailings deposition = 1.5 ■ Pseudo-static conditions = 1.1	Canadian Dam Association Dam Safety Guidelines (2007)

7.4.3 Slope Stability Analyses Results

Table 20 and Figure B-7 summarize the slope stability analyses results for the three slip surfaces locations considered.

Table 20: Slope Stability Analyses Factor of Safety Summary

Slip Surface Close to Downstream Face (DS)			
	Factor of Safety (FoS)		
	Static	Pseudo-static	Static-Undrained
FoS Criteria	**1.5**	**1.1**	**1.3**
Operation Case	1.7	1.4	1.4
Closure Case	1.7	1.4	1.3
Slip Surface Close to Dike Centre Line (CL)			
	Factor of Safety		
	Static	Pseudo-static	Static-Undrained
FoS Criteria	**1.5**	**1.1**	**1.3**
Operation Case	1.7	1.5	1.4
Closure Case	1.8	1.5	1.4
Slip Surface Close to Upstream Face (US)			
	Factor of Safety		
	Static	Pseudo-static	Static-Undrained
FoS Criteria	**1.5**	**1.1**	**1.3**
Operation Case	2.0	1.6	1.7
Closure Case	1.9	1.6	1.6

7.5 Analyses Conclusions

Based on the estimated hydraulic conductivity values assumed and the thawed condition scenarios assessed, the seepage flow rate through the foundation soils underneath the TSF dike at the downstream toe varied between 0.27 and 0.37 m^3/day per m of dike. The seepage gradients from the dike foundation in to the dike fills are shown in Figure B-6 in Appendix B. The fine filter along the upstream of the dike foundation extends 20 m downstream from the cut-off trench which is well beyond where the seepage gradients are the most significant, as shown in Figure B-6.

The design criteria factors of safety of 1.5 for static end of construction (drained conditions), 1.3 for static end of construction (undrained conditions), and 1.1 for pseudo-static conditions (drained conditions) were met for all the slip surfaces using a downstream slope of 2H:1V.

Slope stability analyses were carried out on sections which did not consider the placement of the downstream waste rock and overburden piles. Approximately 75% of the length of the TSF dike is proposed to be buttressed on the downstream by waste rock and overburden piles. The sequencing of the dike construction to the waste rock piles is not known at this stage of the design; however, it is likely that at least a portion of the waste rock piles will be in place before the TSF dike reaches the final elevation. This buttressing will significantly increase the stability of the TSF dikes.

Creep of the downstream dike slope founded on ice-rich soils may be an issue for long term stability. Thermal analyses should be carried out to estimate the expected range of foundation soil temperatures based on the planned tailings deposition and water management scenarios. Additional laboratory testing should be carried out to confirm the strength and creep properties of the ice-rich soils.

7.6 Expected Thermal Performance

Based on ground temperatures measured in thermistors installed in the TSF footprint area and climate data for the Project site, it is anticipated that the TSF will freeze in the long term. During operation efforts can be made to operate the facility to promote freezing of the foundation and the tailings deposit, which will help to minimize seepage from the facility. Monitoring data from other mine sites in the north (e.g., Meadowbank) indicates that tailings freezeback begins shortly after deposition.

A simplified 1-dimensional thermal model was developed to evaluate the potential rate of tailings and TSF foundation freezeback at the Project, both under current climate conditions and with climate change. The model was run for a period of 100 years considering instantaneous placement of the tailings to the full capacity of the facility at time zero, and at a temperature of 6°C. This is considered conservative as the tailings would in fact be placed in layers and would freeze progressively throughout the mine life. To investigate the potential effect of climate change, a 6.4°C temperature increase was assumed to occur uniformly over the 100 year period, equivalent to an annual increase of 0.064°C. The 6.4°C temperature increase follows the worst case "high sensitivity" model described by the Intergovernmental Panel on Climate Change (IPCC 2007). Further details on the analytical methodology, input parameters, and results from the thermal model are provided in FEIS Volume 6 Appendix 6E.

Tables 21 and 22 summarize the modelled length of time required to freeze the tailings and foundation materials within the Lake B7 footprint and on the surrounding dry ground, respectively. Results are presented for both current temperatures and temperatures affected by climate change.

Table 21: Time to Freeze Tailings and Foundation within the Lake B7 Footprint

Location in Section	Approximate Time to Freeze (years)	
	Current average temperature	Assuming Climate Change Predictions
Mid-depth of tailings (El. 71.5 m)	12 years	12 years
Base of Tailings (El. 58 m)	28 years	28 years
Bedrock surface (El. 52 m)	40 years	41 years
Bedrock 66 m below tailings surface (El.19 m)	95 years	100 years

Table 22: Time required to Freeze Tailings and Foundation on Dry Ground

Location in Section	Approximate Time to Freeze (years)	
	Current average temperature	Assuming Climate Change Predictions
Mid-depth of tailings (El. 74.5 m)	3 years	3 years
Base of Tailings (El. 64 m)	Less than 1 year	Less than 1 year
Bedrock surface (El. 55.5 m)	Remains Frozen	Remains Frozen

The simplified thermal model results indicate that complete freezing of the tailings, foundation soils and bedrock will occur with time even when climate change is considered. The model results also suggest that minimal thawing of the original ground is expected in permafrost areas.

It is recommended that a detailed thermal assessment be completed during the detailed design phases of the Project to update the expected thermal performance.

7.7 Instrumentation

It is recommended that thermistors and piezometers are installed within the TSF dike and foundation to monitor temperatures and pore water pressure conditions. The locations and number of instruments should be defined during the detailed design phase. The temperatures and pore water pressures that are measured should be compared to the analyses to determine if the actual conditions are consistent with those assumed in the models. If actual conditions vary then the modelling should be updated.

8.0 CONCEPTUAL SURFACE WATER AND SEEPAGE MANAGEMENT

There are two main objectives related to the water management of the TSF; diversion of non-contact water from any undisturbed lands away from the TSF, and interception and containment of seepage and runoff from the TSF. Seepage and runoff will be collected so that these water sources can be analyzed and treated if required, prior to discharge to the receiving environment. Water sources from the TSF will be managed as follows during operations;

- Seepage and runoff from the north side of the facility will be collected in a series of seepage collection ponds and pumped back to the TSF;
- Seepage and runoff from the east side of the TSF will report to attenuation pond 1 (AP01) through natural topographic gradients;
- Seepage and runoff from the south side of the facility will be collected in a diversion channel that drains to Lake A54. The water will then be pumped from Lake A54 to AP01 for discharge to the environment;
- Seepage and runoff from the west side of the facility will report to Attenuation Pond 2 (AP02) through natural topographic gradients. The water will then be pumped from AP02 to AP01 for discharge to the environment; and
- In the unlikely event that the emergency spillway is used during operation, water would be contained within the system and report to Tiriganiaq Pit.

During closure water will continue to be managed through the methods as defined above until such time when water quality criteria can be met.

8.1 Emergency Spillway

A lined spillway is proposed in the south corner of the TSF to discharge to Tiriganiaq Pit 1. Figure 10 presents the TSF spillway plan and sections. The spillway is designed to pass the 24-hour inflow design storm of 112 mm precipitation plus 40 mm snowmelt (peak flow of 10.5 m^3/s). As the spillway crosses the dam crest the section is designed as a trapezoidal channel with 2H:1V side slopes, a 10 m bottom width, a 2.0 m depth, and a minimum freeboard of 1.2 m. The spillway invert elevation is 84 m. The spillway on the Waste Rock Facility is designed as a trapezoidal channel with a bottom width of 10 m, a 1.0 m depth, and a minimum freeboard of 0.5 m.

The spillway channel through the B7 the Waste Rock Facility (Figure 10) is proposed to be lined with a 0.3 m thick compacted low hydraulic conductivity soil layer to minimise the potential for TSF water to flow into the waste rock facility. At the crest of the spillway the soil layer should be placed in order to maintain the minimum water elevation of 84 masl. The soil layer must be covered with 0.6 m of a d_{50} 305 mm rock riprap, to protect this liner from erosion. No low permeability soil layer is required for the portion of the spillway channel extending beyond the Waste Rock Facility; however a 0.5 m layer of a D_{50} 230 mm rock riprap is recommended to prevent soil erosion.

During operations it is recommended that either temporary spillways be constructed or the TSF be managed to maintain sufficient storage to hold the IDF as well as regular operating volumes.

9.0 ADAPTIVE MANAGEMENT PLAN

The preliminary design for the TSF, as presented in this report, is based on several assumptions and estimates using the best information currently available. As the project moves in to the operational phase, in-situ conditions can be measured to obtain more accurate information and the TSF construction and operation can be adjusted, as required, to match the updated conditions. For example, the final TSF dike height and staging of dike construction can be updated based on actual production and in-situ tailings properties. Additional instrumentation can also be installed to monitor the dike performance, if required.

The TSF is anticipated to freeze post-closure once tailings deposition is complete and the tailings pond has been pumped out. Freezing of the TSF is not required for closure; however, freezing provides a benefit in that it further reduces the potential for seepage from the facility post-closure.

Current information indicates that the majority of the tailings are non PAG; however, there are three years in the middle of the mine life where the acid generation potential is uncertain and one year that the tailings are anticipated to be PAG, as discussed in Section 4.0 (see also FEIS SD 6-3). There may also be some elevated levels of arsenic in the tailings; however, kinetic testing indicates a decreasing trend in the arsenic concentrations with time (Section 4.0; FEIS SD 6-3). Seepage from the facility is expected during operations, as discussed in Sections 5.8 and 8.0. At closure when the final tailings deposition is complete, the tailings pond has been pumped out, and the engineered cover has been placed, seepage would be anticipated to be significantly reduced and would be expected to continue to reduce as the tailings deposit consolidates, drains, and begins to freeze back. Infiltration from precipitation will be minimized by the final engineered closure cover.

Post closure seepage from the facility will be managed and monitored for water quality until the discharge criteria are met (FEIS SD 2-17).

The final design of the engineered closure cover will be developed in the later years of the mine operation, so that information from monitoring of the tailings geochemistry and water quality during operations can be considered in preparing the design. The degree to which the cover is required to minimize infiltration will depend on the tailings facility geochemical and water quality data collected during operations. The cover may incorporate a low hydraulic conductivity layer which could be constructed using naturally sourced low hydraulic conductivity materials, or with local materials modified with bentonite to create a low hydraulic conductivity material, or from a synthetic liner material. The cover would be instrumented to monitor its performance against the design expectation.

Maintaining the tailings in a frozen condition is a possible design for the engineered closure cover, if the tailings geochemistry and water quality turn out to be problematic. Thermistors can be installed in the northwest area of the TSF during operations as deposition is completed in this area and the pond is shifted to the southeast. Data collected from these thermistors would provide information regarding the anticipated post-closure thermal performance of the facility to support the design for the thickness and the material type for the engineered cover to maintain the tailings in a frozen state, if required.

10.0 CONCLUSIONS AND RECOMMENDATIONS

A preliminary design for the Meliadine TSF has been presented. General site conditions have been reviewed and summarized from existing project documents. Geotechnical and geothermal investigations carried out at the Project site in 2007, 2009, and 2011 were reviewed and summarized to support the preliminary TSF design.

A design basis including key design criteria and a conceptual closure plan have been developed. Based on CDA (2007), the Meliadine TSF Dike is classified as a High consequence of failure structure, and design criteria for the analyses consistent with the dam class have been established.

A preliminary deposition plan has been presented to confirm the storage capacity of the facility and to evaluate the feasibility of the closure concept. The TSF has been sized to store the planned 34.5 million tonnes of tailings and manage excess process water and runoff throughout operations. The general closure concept for the TSF is to place an engineered cover over a graded tailings surface with the tailings grading from northwest to the southeast. An operating spillway at the southwest corner of the facility will be maintained at closure so that surface runoff from the TSF will be directed through the spillway to Tiriganiaq Pit.

The preliminary design drawings are presented in Figures 1 through 10. To meet the design criteria, the dike crest elevation will be elevation 86 m and the height of the dike will vary around the perimeter of the facility, ranging from approximately 10 m to 25 m. The proposed construction materials and quantities are summarized for the preliminary design layout. Stability and seepage analyses have been carried for the preliminary design and found to meet the design criteria.

It is recommended that additional geotechnical investigations should be considered to address the following:

- Delineation of ice poor and ice rich areas of the dam foundation to better define the required foundation excavation extent and volumes;

- Confirmation of borrow source areas for both the quality and quantity of till material required for dike construction;
- Confirmation of the geotechnical properties of the foundation materials. It is recommended that laboratory testing be completed to better define strength properties of the foundation materials, including undrained strengths; and
- Further drilling to investigate bedrock conditions including the potential for a deep fault running east-west near the north end of the TSF.

The seepage and stability models should be revised upon completion of the proposed drilling and laboratory testing programs, to assess the required dike geometry to meet the design factors of safety for operation and post closure conditions.

Creep of the downstream dike slope founded on ice-rich soils may be an issue for long term stability. Thermal analyses should be carried out to estimate the expected range of foundation soil temperatures based on the planned tailings deposition and water management scenarios. Additional laboratory testing should be carried out to confirm the strength and creep properties of the ice-rich soils. Evaluation of the thaw consolidation ratio of the ice rich foundation soils should be carried out to better assess the potential for undrained conditions within the foundation of the dike slope.

It is recommended that a detailed thermal assessment be completed during the detailed design phase to update the expected thermal performance of the facility.

11.0 CLOSURE

We trust this report satisfies your current requirements. If you have any questions or require further assistance, please do not hesitate to contact the undersigned.

Yours very truly,

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

Allison Isidoro, P.Eng. (AB)
Geotechnical Engineer

ORIGINAL SIGNED

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Associate, Senior Geotechnical Engineer

ACI/JCC/lw

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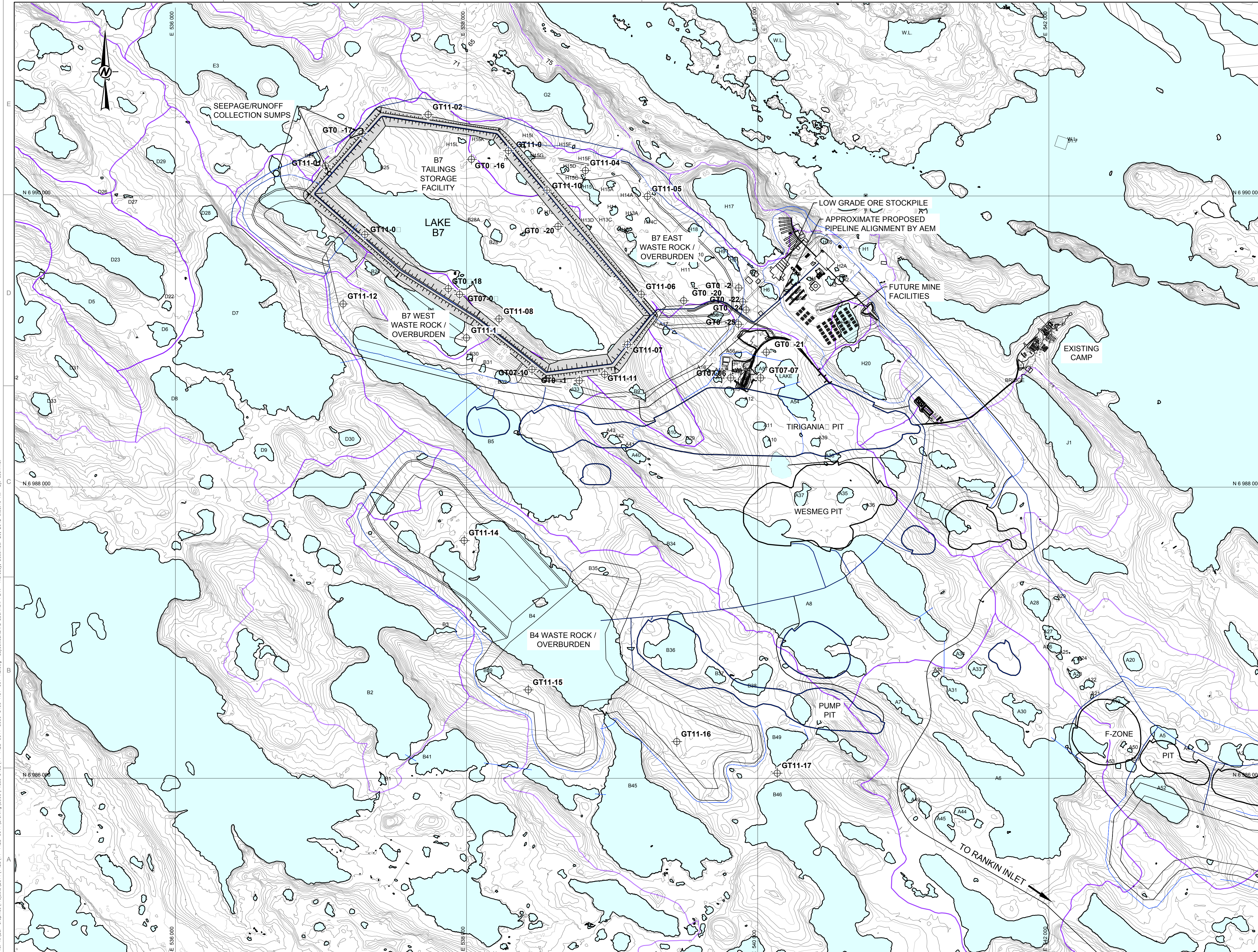

LEGEND

GT11-11 — 2011 BOREHOLE LOCATION
GT09-11 — 2009 BOREHOLE LOCATION
GT07-11 — 2007 BOREHOLE LOCATION
TAILINGS STORAGE FACILITY DIKE
LAKE
WATERSHED BOUNDARY
WATER MANAGEMENT INFRASTRUCTURE
ACCESS / HAUL ROADS
MAJOR TOPOGRAPHIC CONTOUR
MINOR TOPOGRAPHIC CONTOUR

NOTES

1. ALL ELEVATIONS ARE IN METRES TO NORTH AMERICAN DATUM 1983 (NAD 83).
2. ALL COORDINATES ARE IN METRES TO UNIVERSAL TRANSVERSE MERCATOR PROJECTION (UTM) NAD83 ZONE 15.
3. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
4. EXISTING TOPOGRAPHIC CONTOURS SHOWN AT 1m INTERVALS.
5. LAKES TO BE DEWATERED AS RE□UIRED TO CARRY OUT TAILINGS DIKE CONSTRUCTION.

REFERENCES

1. 2007, 2009 AND 2011 TEST HOLE LOCATIONS SURVEYED AND PROVIDED BY AGNICO EAGLE MINES LTD. CAD FILE: GT□HOLES .DWG, NOVEMBER 2011.
2. BASE PLAN PROVIDED BY AGNICO EAGLE MINES LTD. SEPTEMBER 27 AND 29, 2011.

NOT FOR CONSTRUCTION

0 250 500 750m
1:12,500

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C	08/16/12	ISSUED WITH VER. D REPORT	S.S.S.	J.C.C.		
B	06/01/12	ISSUED WITH REPORT	S.S.S.	A.I.		
A	12/16/11	DRAFT - ISSUED WITH REPORT	S.S.S.	A.I.		

CLIENT
AGNICO EAGLE MINES LTD.

CONSULTANT
Golder Associates

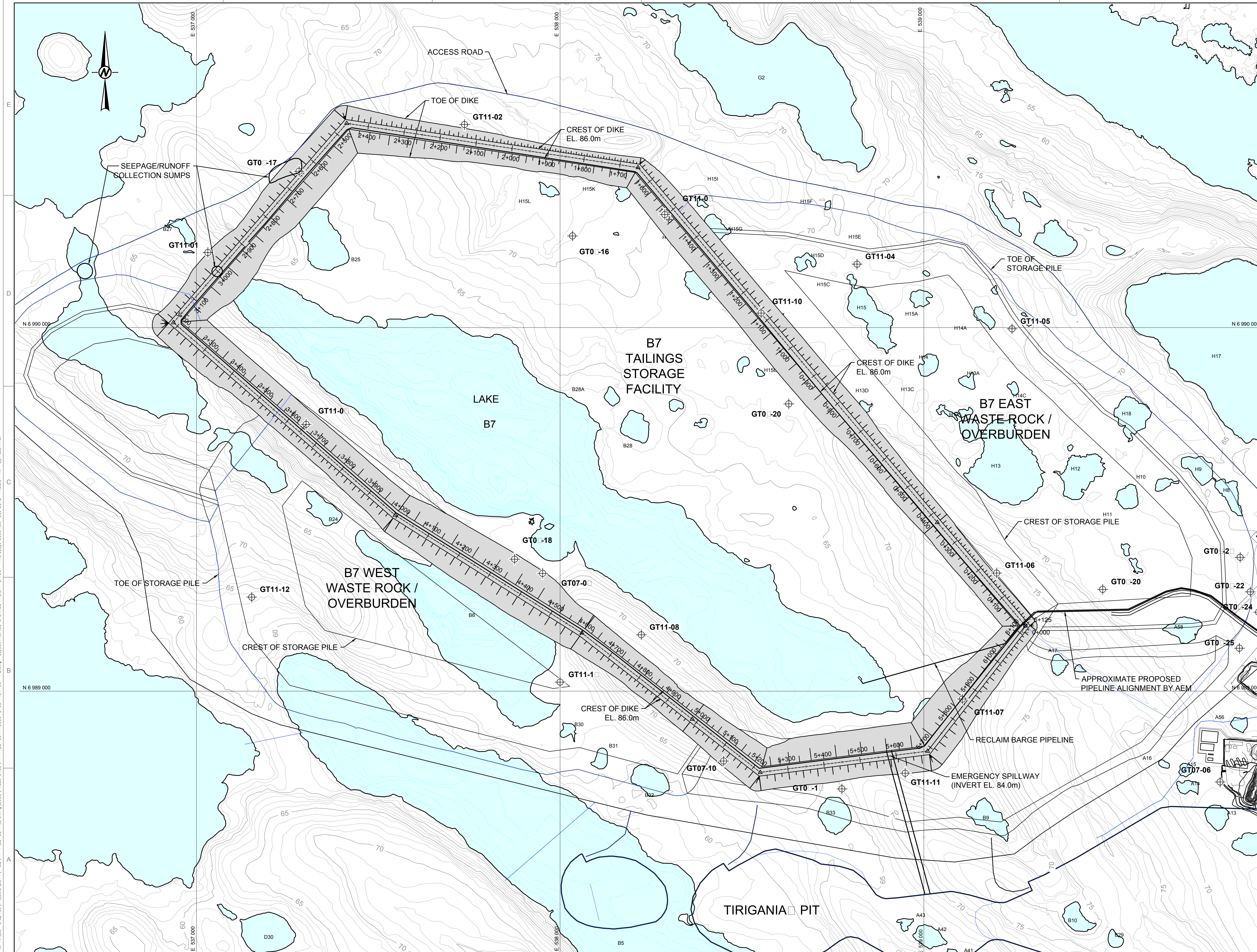
PROJECT 11-1428-0011/3000/3400
MELIADINE MINE TAILINGS STORAGE FACILITY PRELIMINARY DESIGN

TITLE
GENERAL LOCATION PLAN

DRAWING No. FIGURE 1
SHEET No. 1 OF 10

SHEET SIZE ANSI D 25 mm 0

Drawing File: N:\Bur-Graphics\Projects\2011\1428\11-1428-0011\Drafting\3000\Phase 3400\11-1428-0011-3000-3400-FIG1-001-RB.dwg Layout:GENERAL LOCATION PLAN Thursday, December 20, 2012 9:05:49 AM By: sschmidt



LEGEND

- GT11-11 — 2011 BOREHOLE LOCATION
- GT09-11 — 2009 BOREHOLE LOCATION
- GT07-11 — 2007 BOREHOLE LOCATION
- TAILINGS STORAGE FACILITY DIKE
- LAKE
- WATERSHED BOUNDARY
- WATER MANAGEMENT INFRASTRUCTURE
- ACCESS / HAUL ROADS
- 65 — MAJOR TOPOGRAPHIC CONTOUR
- MINOR TOPOGRAPHIC CONTOUR
- 58 — BATHYMETRIC CONTOUR

NOTES

1. ALL ELEVATIONS ARE IN METRES TO NORTH AMERICAN DATUM 1983 (NAD 83).
2. ALL COORDINATES ARE IN METRES TO UNIVERSAL TRANSVERSE MERCATOR PROJECTION (UTM) NAD83 ZONE 15.
3. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
4. EXISTING TOPOGRAPHIC CONTOURS SHOWN AT 1m INTERVALS.
5. EXISTING BATHYMETRIC CONTOURS SHOWN AT 0.5m INTERVALS.
6. LAKES TO BE DEWATERED AS RE□UIRED TO CARRY OUT TAILINGS DIKE CONSTRUCTION.

REFERENCES

1. 2007, 2009 AND 2011 TEST HOLE LOCATIONS SURVEYED AND PROVIDED BY AGNICO EAGLE MINES LTD. CAD FILE: GT□HOLES .DWG, NOVEMBER 2011.
2. BASE PLAN PROVIDED BY AGNICO EAGLE MINES LTD. SEPTEMBER 27 AND 29, 2011.

NOT FOR CONSTRUCTION

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C	08/16/12	ISSUED WITH VER. D REPORT	S.S.S.	J.C.C.		
B	05/28/12	ISSUED WITH REPORT	S.S.S.	A.I.		
A	12/16/11	DRAFT - ISSUED WITH REPORT	S.S.S.	A.I.		

CLIENT
AGNICO EAGLE MINES LTD.

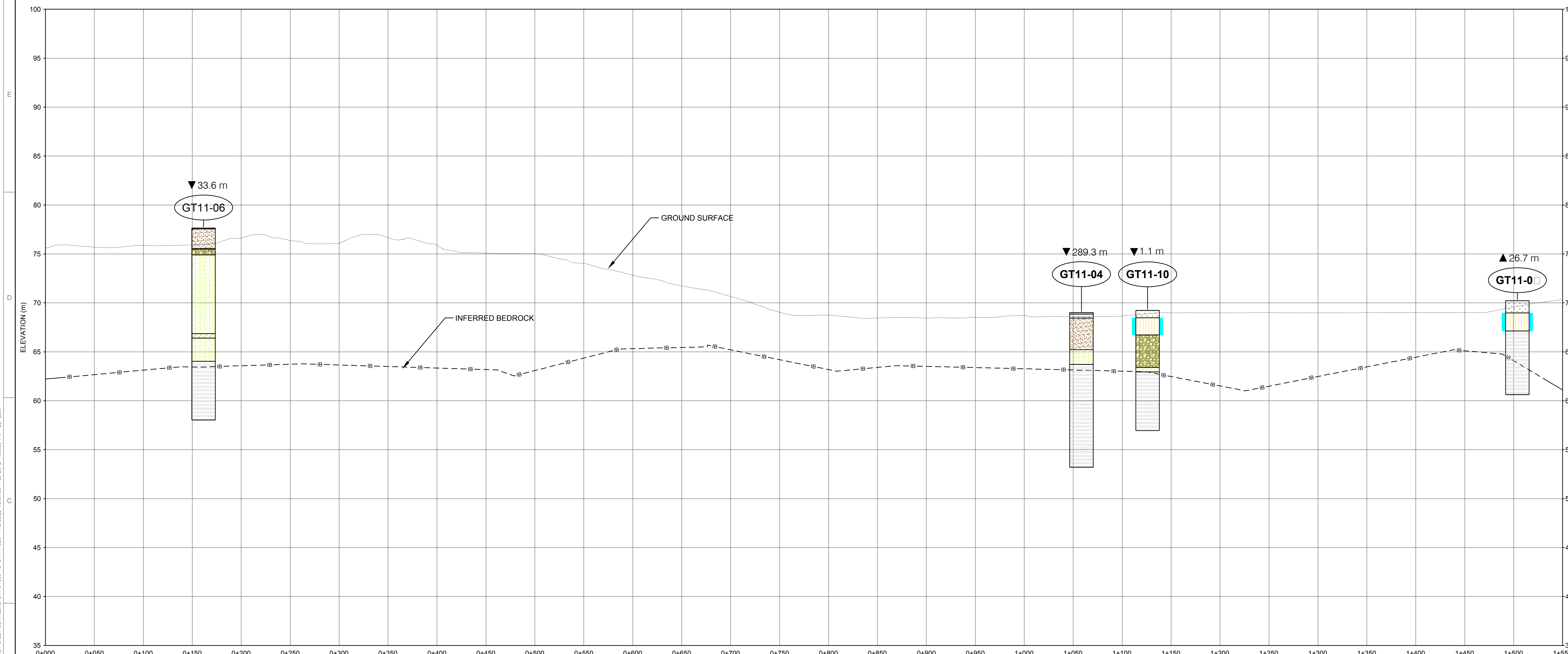
CONSULTANT
Golder Associates

PROJECT 11-1428-0011/3000/3400
MELIADINE MINE TAILINGS STORAGE FACILITY PRELIMINARY DESIGN

TITLE
TAILINGS STORAGE FACILITY LAYOUT

DRAWING No. FIGURE 2
SHEET No. 2 OF 10

SHEET SIZE ANSI D 25 mm 0



PROFILE ALONG CENTERLINE STA 0+000 TO 1+550 - B7 TAILINGS STORAGE FACILITY

0 40 80 120m
HORIZONTAL SCALE

0 4 8 12m
VERTICAL SCALE

LEGEND

- GT11-12 — BOREHOLE ID
- GROUND SURFACE
- IB — INFERRED BEDROCK
- 13 m — DISTANCE AND DIRECTION OF BOREHOLE FROM CENTRELINE
- ▲ — UPSTREAM
- ▼ — DOWNSTREAM

STRATIGRAPHY LEGEND

SILTY PEAT; FILL; ORGANIC SOIL; CLAY; ICE; SANDY CLAY; SILTY CLAY; SAND; SAND AND GRAVEL; SILTY SAND; CLAYEY SAND; SILT; GRAVELLY CLAYEY SILT; CLAYEY SILT; SANDY SILT; SANDY CLAYEY SILT; GRAVEL AND COBBLES; BOULDER; INFERRED BEDROCK; BEDROCK: GREYWACKE; LOST CORE/ NO RECOVERY

NOTES

1. BOREHOLE LOCATIONS ARE AS SURVEYED BY AGNICO EAGLE MINES.
2. GEOTECHNICAL INFORMATION SHOWN ON THE PROFILE IS CONSIDERED APPROXIMATE.
3. CONDITIONS AWAY FROM BOREHOLES ARE ASSUMED.
4. REFERENCES SHOULD BE MADE TO THE FACTUAL REPORT ON 2011 GEOTECHNICAL DRILLING PROGRAM (DOC 273, GOLDER 2012).
5. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
6. ALL ELEVATIONS ARE IN METRES TO NORTH AMERICAN DATUM 1983 (NAD 83).
7. ONLY 2011 BOREHOLES SHOWN ON SECTIONS.

REFERENCE

1. INFERRED BEDROCK PROVIDED BY AGNICO MINES LTD. CAD FILE: 3D bed rock.DWG, NOVEMBER 4, 2011.

NOT FOR CONSTRUCTION

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B	08/16/12	ISSUED WITH VER. D REPORT	S.S.S.	J.C.C.		
A	12/16/11	DRAFT - ISSUED WITH REPORT	S.S.S.	A.I.		

CLIENT
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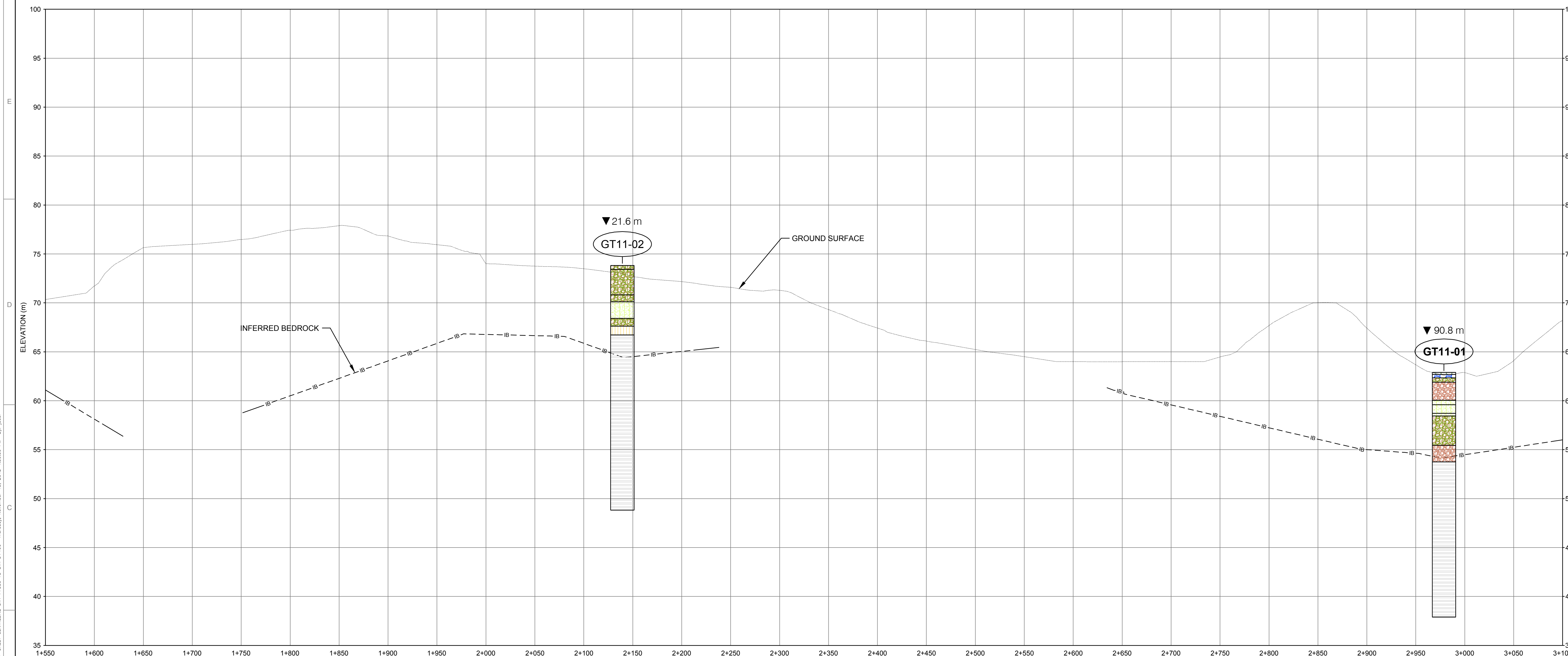
CONSULTANT
Golder Associates

PROJECT 11-1428-0011/3000/3400
MELIADINE MINE TAILINGS STORAGE FACILITY PRELIMINARY DESIGN

TITLE
PROFILE - TSF CREST CENTRELINE
STA 0+000 TO STA 1+550

DRAWING No. FIGURE 3
SHEET No. 3 OF 10

SHEET SIZE ANSI D 25 mm 0



PROFILE ALONG CENTERLINE STA 1+550 TO +100 - B7 TAILINGS STORAGE FACILITY

HORIZONTAL SCALE: 0 40 80 120m

VERTICAL SCALE: 0 4 8 12m

LEGEND

- GT11-12 — BOREHOLE ID
- GROUND SURFACE
- IB — INFERRED BEDROCK
- 13 m — DISTANCE AND DIRECTION OF BOREHOLE FROM CENTRELINE
- ▲ UPSTREAM
- ▼ DOWNSTREAM

STRATIGRAPHY LEGEND

SILTY PEAT, SANDY CLAY, SILTY SAND, CLAYEY SILT, BOULDER, FILL, SILTY CLAY, CLAYEY SAND, SANDY SILT, INFERRED BEDROCK, ORGANIC SOIL, SAND, SILT, SANDY CLAYEY SILT, BEDROCK: GREYWACKE, CLAY, SAND AND GRAVEL, GRAVELLY CLAYEY SILT, GRAVEL AND COBBLES, LOST CORE/ NO RECOVERY, ICE

NOTES

1. BOREHOLE LOCATIONS ARE AS SURVEYED BY AGNICO EAGLE MINES.
2. GEOTECHNICAL INFORMATION SHOWN ON THE PROFILE IS CONSIDERED APPROXIMATE.
3. CONDITIONS AWAY FROM BOREHOLES ARE ASSUMED.
4. REFERENCES SHOULD BE MADE TO THE FACTUAL REPORT ON 2011 GEOTECHNICAL DRILLING PROGRAM (DOC 273, GOLDER 2012).
5. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
6. ALL ELEVATIONS ARE IN METRES TO NORTH AMERICAN DATUM 1983 (NAD 83).
7. ONLY 2011 BOREHOLES SHOWN ON SECTIONS.

REFERENCE

1. INFERRED BEDROCK PROVIDED BY AGNICO MINES LTD. CAD FILE: 3D bed rock.DWG, NOVEMBER 4, 2011.

NOT FOR CONSTRUCTION

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B	08/16/12	ISSUED WITH VER. D REPORT	S.S.S.	J.C.C.		
A	12/16/11	DRAFT - ISSUED WITH REPORT	S.S.S.	A.I.		

CLIENT: AGNICO EAGLE MINES LTD.

CONSULTANT: Golder Associates

PROJECT: 11-1428-0011/3000/3400

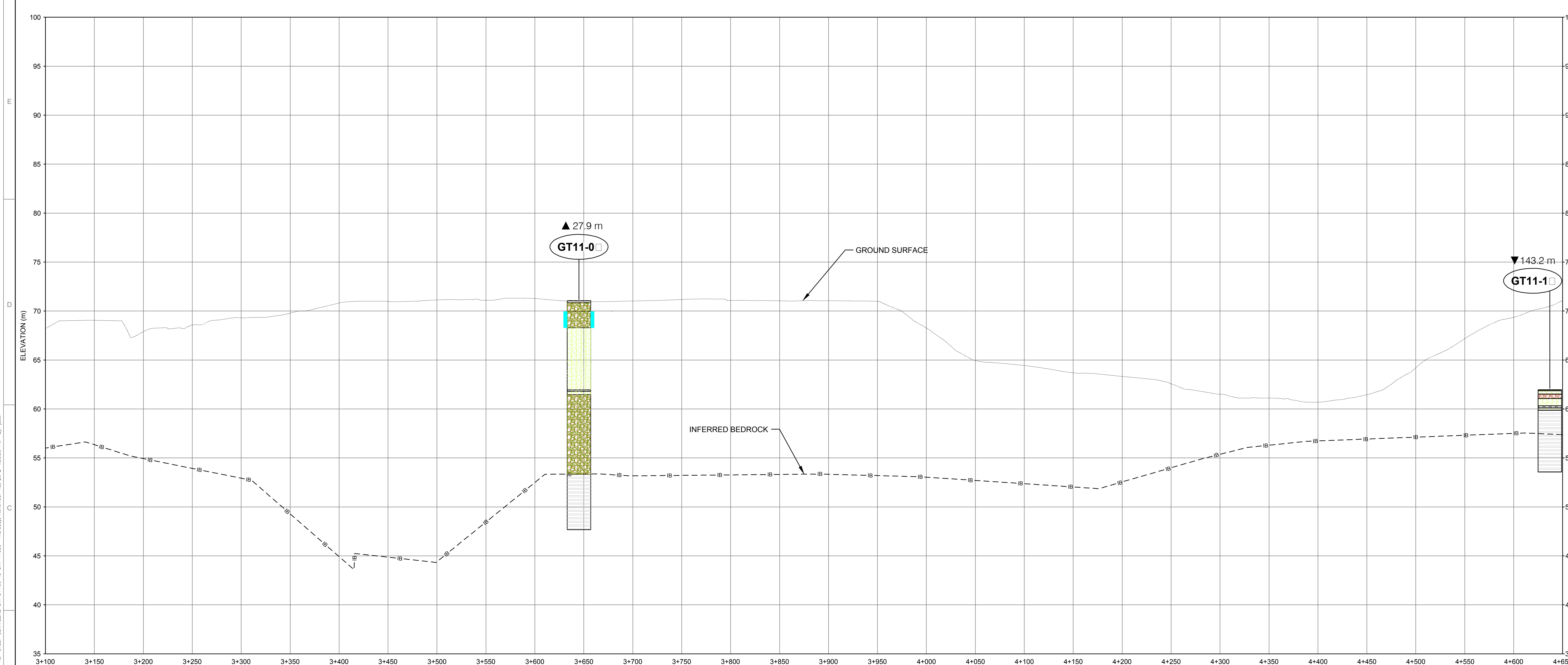
MELIADINE MINE TAILINGS STORAGE FACILITY PRELIMINARY DESIGN

TITLE: PROFILE - TSF CREST CENTRELINE STA 1+550 TO STA 3+100

DRAWING No.: FIGURE 4

SHEET No.: 4 OF 10

SHEET SIZE ANSI D



PROFILE ALONG CENTERLINE STA □+100 TO 4+650 - B7 TAILINGS STORAGE FACILITY

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HORIZONTAL SCALE

0 4 8 12m
VERTICAL SCALE

LEGEND

- GT11-12 — BOREHOLE ID
- GROUND SURFACE
- IB — INFERRED BEDROCK
- 13 m — DISTANCE AND DIRECTION OF BOREHOLE FROM CENTRELINE
- ▲ — UPSTREAM
- ▼ — DOWNSTREAM

STRATIGRAPHY LEGEND

SILTY PEAT, SANDY CLAY, SILTY SAND, CLAYEY SILT, BOULDER, FILL, SILTY CLAY, CLAYEY SAND, SANDY SILT, INFERRED BEDROCK, ORGANIC SOIL, SAND, SILT, SANDY CLAYEY SILT, BEDROCK: GREYWACKE, CLAY, SAND AND GRAVEL, GRAVELLY CLAYEY SILT, GRAVEL AND COBBLES, LOST CORE/ NO RECOVERY, ICE

NOTES

1. BOREHOLE LOCATIONS ARE AS SURVEYED BY AGNICO EAGLE MINES.
2. GEOTECHNICAL INFORMATION SHOWN ON THE PROFILE IS CONSIDERED APPROXIMATE.
3. CONDITIONS AWAY FROM BOREHOLES ARE ASSUMED.
4. REFERENCES SHOULD BE MADE TO THE FACTUAL REPORT ON 2011 GEOTECHNICAL DRILLING PROGRAM (DOC 273, GOLDER 2012).
5. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
6. ALL ELEVATIONS ARE IN METRES TO NORTH AMERICAN DATUM 1983 (NAD 83).
7. ONLY 2011 BOREHOLES SHOWN ON SECTIONS.

REFERENCE

1. INFERRED BEDROCK PROVIDED BY AGNICO MINES LTD. CAD FILE: 3D bed rock.DWG, NOVEMBER 4, 2011.

NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	12/20/12	ISSUED WITH VER. 0 REPORT	S.S.S.	J.C.C.	S.S.S.	J.C.C.
B	08/16/12	ISSUED WITH VER. D REPORT	S.S.S.	J.C.C.		
A	12/16/11	DRAFT - ISSUED WITH REPORT	S.S.S.	A.I.		

CLIENT
AGNICO EAGLE MINES LTD.

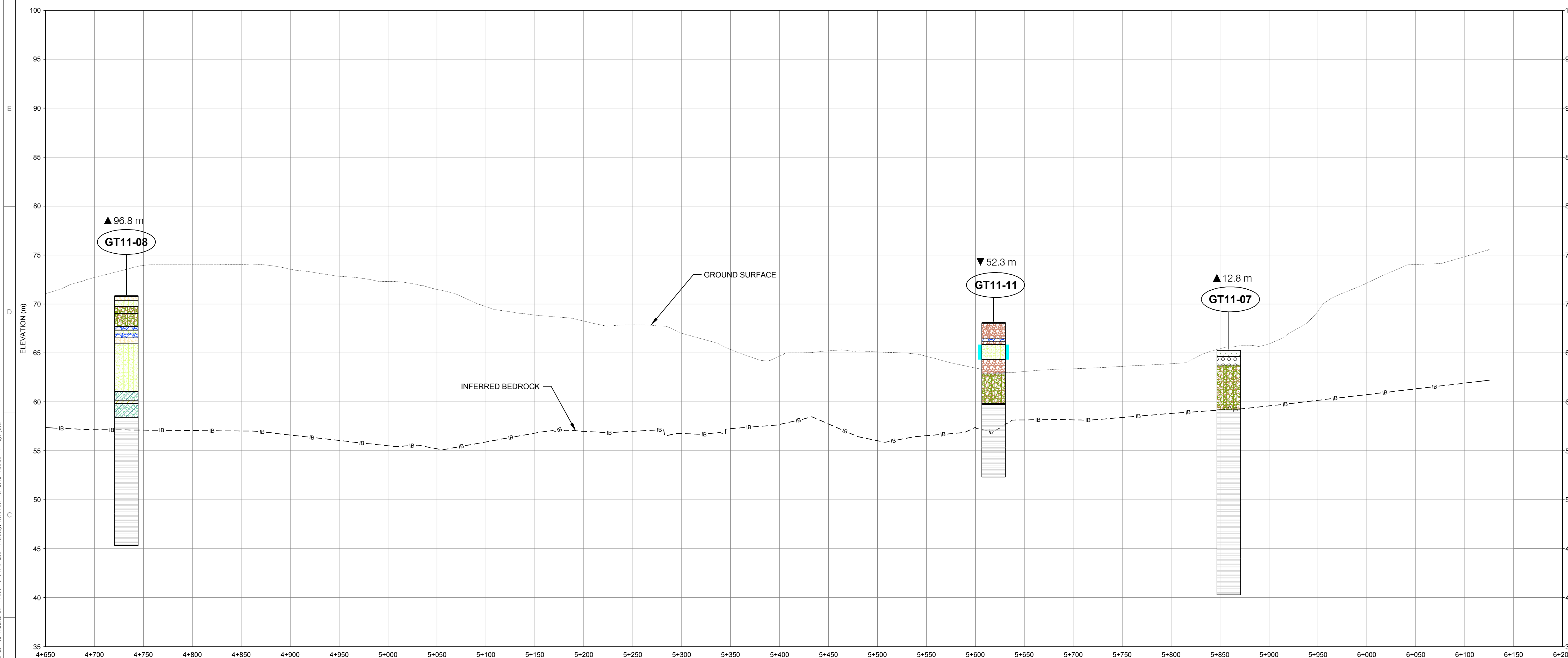
CONSULTANT
Golder Associates

PROJECT 11-1428-0011/3000/3400
MELIADINE MINE TAILINGS STORAGE FACILITY PRELIMINARY DESIGN

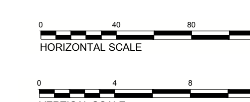
TITLE
PROFILE - TSF CREST CENTRELINE
STA 3+100 TO STA 4+650

DRAWING No. FIGURE 5
SHEET No. 5 OF 10

SHEET SIZE ANSI D 25 mm



PROFILE ALONG CENTERLINE STA 4+650 TO 6+200 - B7 TAILINGS STORAGE FACILITY



REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	12/20/12	ISSUED WITH VER. 0 REPORT	S.S.S.	J.C.C.	S.S.S.	J.C.C.
B	08/16/12	ISSUED WITH VER. D REPORT	S.S.S.	J.C.C.		
A	12/16/11	DRAFT - ISSUED WITH REPORT	S.S.S.	A.I.		

LEGEND

- GT11-12 — BOREHOLE ID
- GROUND SURFACE
- IB — INFERRED BEDROCK
- 13 m — DISTANCE AND DIRECTION OF BOREHOLE FROM CENTRELINE
- ▲ UPSTREAM
- ▼ DOWNSTREAM

STRATIGRAPHY LEGEND

SILTY PEAT; FILL; ORGANIC SOIL; CLAY; ICE; SANDY CLAY; SILTY CLAY; SAND; SAND AND GRAVEL; SILTY SAND; CLAYEY SAND; SILT; GRAVELLY CLAYEY SILT; CLAYEY SILT; SANDY SILT; SANDY CLAYEY SILT; GRAVEL AND COBBLES; BOULDER; INFERRED BEDROCK; BEDROCK: GREYWACKE; LOST CORE/ NO RECOVERY

NOTES

1. BOREHOLE LOCATIONS ARE AS SURVEYED BY AGNICO EAGLE MINES.
2. GEOTECHNICAL INFORMATION SHOWN ON THE PROFILE IS CONSIDERED APPROXIMATE.
3. CONDITIONS AWAY FROM BOREHOLES ARE ASSUMED.
4. REFERENCES SHOULD BE MADE TO THE FACTUAL REPORT ON 2011 GEOTECHNICAL DRILLING PROGRAM (DOC 273, GOLDER 2012).
5. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
6. ALL ELEVATIONS ARE IN METRES TO NORTH AMERICAN DATUM 1983 (NAD 83).
7. ONLY 2011 BOREHOLES SHOWN ON SECTIONS.

REFERENCE

1. INFERRED BEDROCK PROVIDED BY AGNICO MINES LTD. CAD FILE: 3D bed rock.DWG, NOVEMBER 4, 2011.

NOT FOR CONSTRUCTION

CLIENT: AGNICO EAGLE MINES LTD.

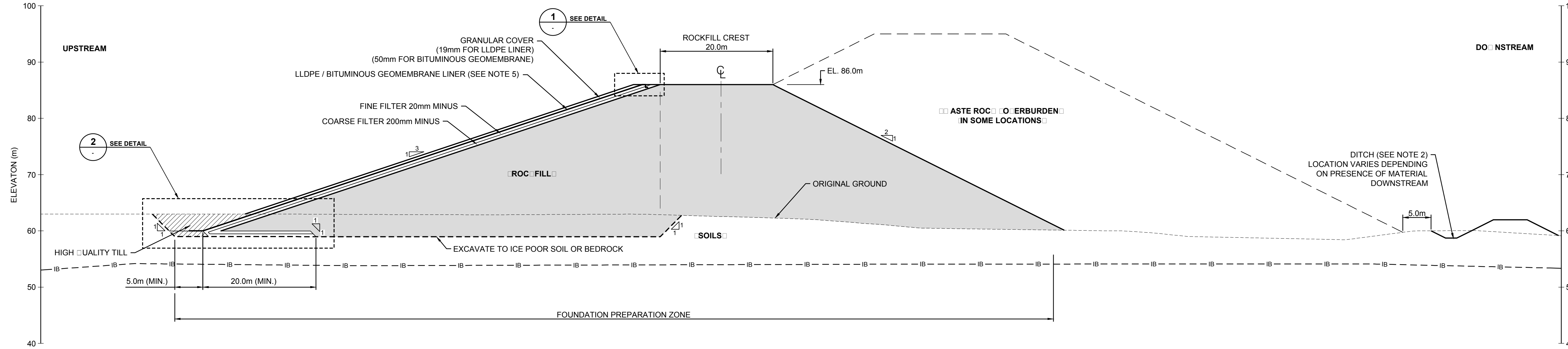
CONSULTANT: Golder Associates

PROJECT: 11-1428-0011/3000/3400
MELIADINE MINE TAILINGS STORAGE FACILITY PRELIMINARY DESIGN

TITLE: PROFILE - TSF CREST CENTRELINE STA 4+650 TO STA 6+200

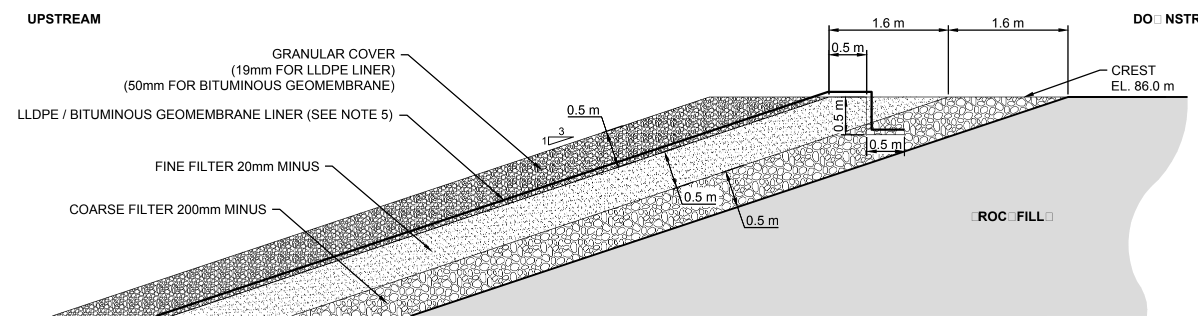
DRAWING No. FIGURE 6 — SHEET No. 6 OF 10

SHEET SIZE ANSI D

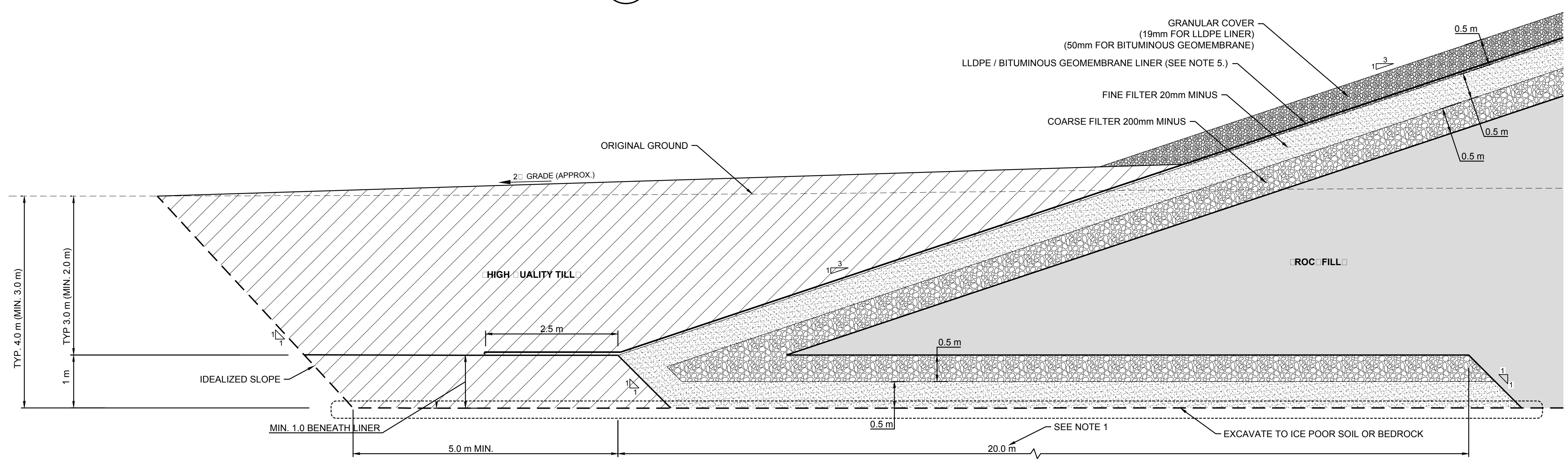


TYPICAL CROSS SECTION - B7 TAILINGS STORAGE FACILITY DIKE

SCALE A



SCALE B 1 DETAIL - LINER BEDDING ZONES AND CREST ANCHOR



SCALE B 2 DETAIL - CUT-OFF TRENCH AND FOUNDATION FILTER ZONES

LEGEND

- IB — INFERRED BEDROCK
- ROCKFILL
- HIGH □UALITY TILL
- COARSE FILTER 200mm MINUS
- FINE FILTER 20mm MINUS
- GRANULAR COVER

NOTES

1. FILTERS MAY BE EXTENDED BASED ON FOUNDATION CONDITIONS, DEPOSITION PLANNING AND/OR THERMAL MODELING.
2. SURFACE RUNOFF/SEEPAGE COLLECTION DITCHES WILL BE DESIGNED USING BEST PRACTICES FOR THE NORTH.
3. ALL DIKE FILL MATERIALS TO BE NON POTENTIALLY ACID GENERATING MATERIAL OF SOUND, HARD, DURABLE, WELL GRADED ROCK FRAGMENTS, FREE FROM ICE, FROZEN CHUNKS, ORGANIC MATTER DEBRIS AND OTHER DELETERIOUS MATERIALS.
4. RELIEF WELLS MAY BE RE□UIRED THROUGH ROCKFILL SHELL TO RELIEVE BACK PRESSURE ON LINER DEPENDING ON SE□UENCING OF OVERBURDEN WASTE MATERIAL PLACED DOWNSTREAM AND TAILINGS DEPOSITION OVER THE LINER.
5. LINER SYSTEM TO BE OPTIMIZED DURING DETAILED DESIGN. LLDPE LINER OPTION RE□UIRES GEOTEXTILE NOT SHOWN ON DETAILS.
6. ALL ELEVATIONS ARE IN METRES TO NORTH AMERICAN DATUM 1983 (NAD 83).
7. ALL CO-ORDINATES ARE IN METRES TO UNIVERSAL TRANSVERSE MERCATOR PROJECTION (UTM) NAD 83 ZONE 15.

SCALE A 0 8 16 24m 1:400

SCALE B 0 1.0 2.0 3.0m 1:50

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	12/20/12	ISSUED WITH VER. 0 REPORT	S.S.S.	J.C.C.	S.S.S.	J.C.C.
C	08/16/12	ISSUED WITH VER. D REPORT	S.S.S.	J.C.C.		
B	05/28/12	ISSUED WITH REPORT	S.S.S.	A.I.		
A	12/16/11	DRAFT - ISSUED WITH REPORT	S.S.S.	A.I.		

CLIENT

AGNICO EAGLE MINES LTD.

CONSULTANT

Golder Associates

PROJECT 11-1428-0011/3000/3400

MELIADINE MINE TAILINGS STORAGE FACILITY PRELIMINARY DESIGN

TITLE

TYPICAL CROSS SECTION AND DETAILS

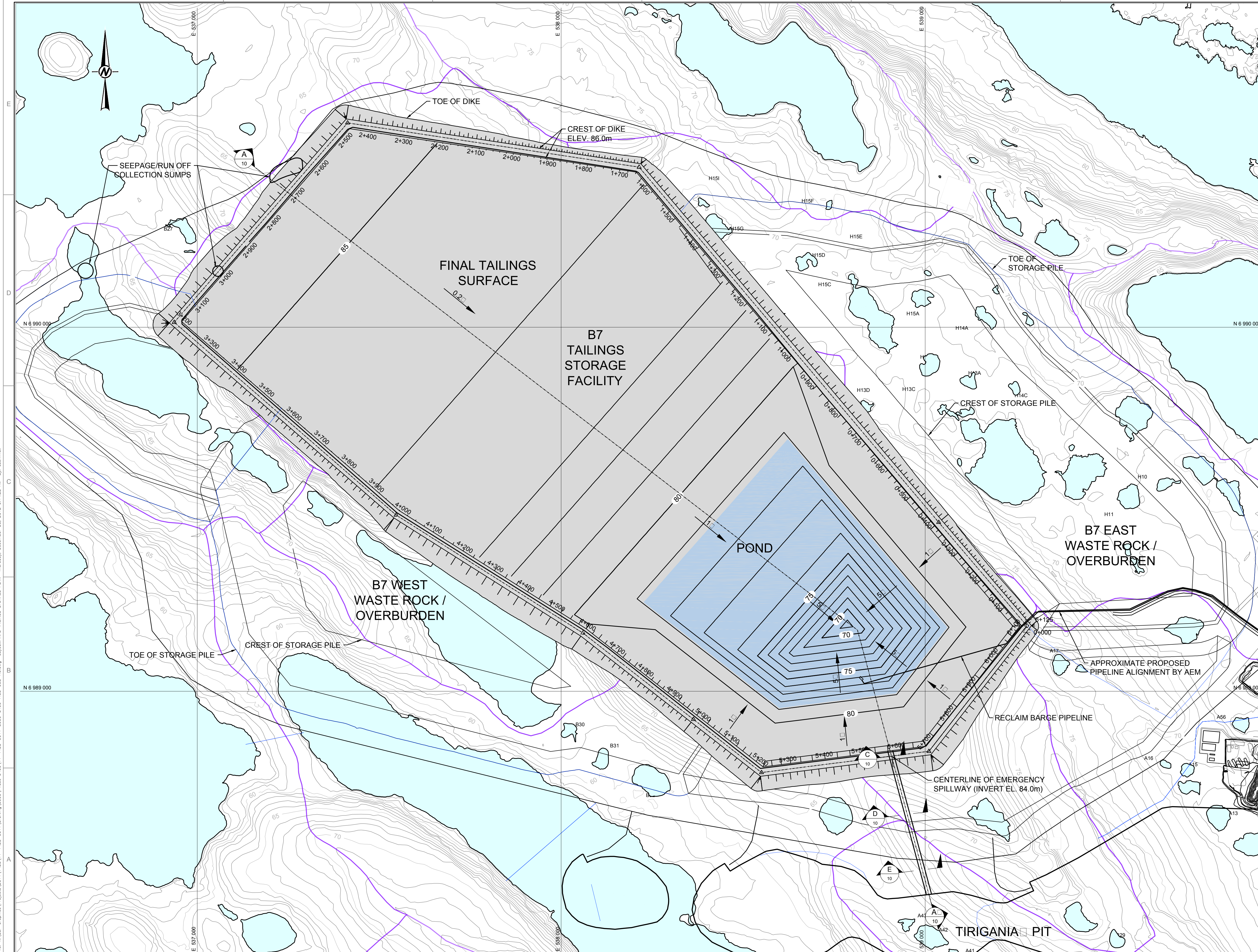
NOT FOR CONSTRUCTION

DRAWING No. FIGURE 7

SHEET No. 7 OF 10

SHEET SIZE ANSI D 25 mm

Drawing File: N:\Bur-Graphics\Projects\2011\1428\11-1428-0011\Drafting\3000\Phase 3400\11-1428-0011-3000-3400-FIG7-007.dwg Layout:TYPICAL CROSS SECTION AND DETAILS Thursday, December 20, 2012 9:26:32 AM By: sschmidt



LEGEND

- TAILINGS STORAGE FACILITY DIKE
- LAKE
- WATERSHED BOUNDARY
- WATER MANAGEMENT INFRASTRUCTURE
- ACCESS / HAUL ROADS
- MAJOR TOPOGRAPHIC CONTOUR
- MINOR TOPOGRAPHIC CONTOUR
- POND
- TAILINGS

NOTES

1. ALL ELEVATIONS ARE IN METRES TO NORTH AMERICAN DATUM 1983 (NAD 83).
2. ALL COORDINATES ARE IN METRES TO UNIVERSAL TRANSVERSE MERCATOR PROJECTION (UTM) NAD83 ZONE 15.
3. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
4. EXISTING TOPOGRAPHIC CONTOURS SHOWN AT 1m INTERVALS.
5. PIPELINE TO BE RELOCATED AS REQUIRED TO ADVANCE TAILINGS DEPOSITION FROM NORTHWEST TO SOUTH EAST.
6. FINAL TAILINGS SURFACE PRESENTED IS CONCEPTUAL AND IS EXPECTED TO BE DEVELOPED THROUGH TAILINGS DEPOSITION PLANNING AND PROGRESSIVE ROCKFILL COVER PLACEMENT FOR CLOSURE.

REFERENCES

1. 2007, 2009 AND 2011 TEST HOLE LOCATIONS SURVEYED AND PROVIDED BY AGNICO EAGLE MINES LTD. CAD FILE: GT HOLES .DWG, NOVEMBER 2011.
2. BASE PLAN PROVIDED BY AGNICO EAGLE MINES LTD. SEPTEMBER 27 AND 29, 2011.

NOT FOR CONSTRUCTION

0 100 200 300m
1:5,000

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	12/20/12	ISSUED WITH VER. 0 REPORT	S.S.S.	J.C.C.	S.S.S.	J.C.C.
D	08/16/12	ISSUED WITH VER. D REPORT	S.S.S.	J.C.C.		
C	05/28/12	ISSUED WITH REPORT	S.S.S.	A.I.		
B	01/05/12	ISSUED FOR CLIENT REVIEW	S.S.S.	A.I.	S.S.S.	J.C.C.
A	12/16/11	DRAFT - ISSUED WITH REPORT	S.S.S.	A.I.		

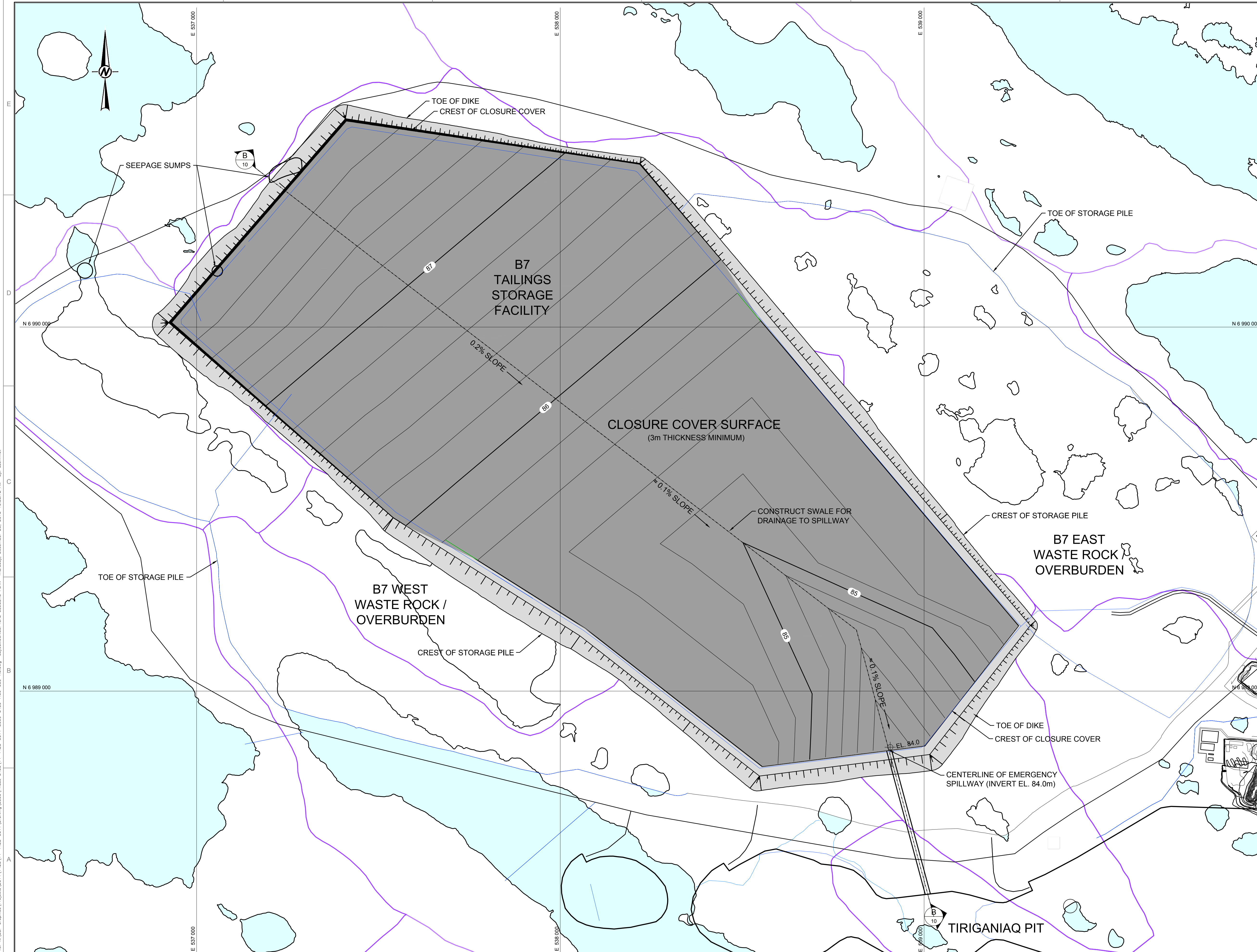
CLIENT
AGNICO EAGLE MINES LTD.

CONSULTANT
Golder Associates

PROJECT 11-1428-0011/3000/3400
MELIADINE MINE TAILINGS STORAGE FACILITY PRELIMINARY DESIGN

TITLE
FINAL TAILINGS STORAGE PLAN

DRAWING No. FIGURE 8
SHEET No. 8 OF 10
SHEET SIZE ANSI D



LEGEND

- CONCEPTUAL ROCKFILL PLACEMENT AT CLOSURE
- TAILINGS STORAGE FACILITY DIKE
- LAKE
- WATERSHED BOUNDARY
- WATER MANAGEMENT INFRASTRUCTURE
- ACCESS / HAUL ROADS
- MAJOR TOPOGRAPHIC CONTOUR
- MINOR TOPOGRAPHIC CONTOUR

NOTES

1. ALL ELEVATIONS ARE IN METRES TO NORTH AMERICAN DATUM 1983 (NAD 83).
2. ALL COORDINATES ARE IN METRES TO UNIVERSAL TRANSVERSE MERCATOR PROJECTION (UTM) NAD83 ZONE 15.
3. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
4. EXISTING TOPOGRAPHIC CONTOURS SHOWN AT 1m INTERVALS.
5. FINAL CLOSURE COVER SURFACE IS CONCEPTUAL AND IS EXPECTED TO BE DEVELOPED BASED ON ACTUAL TAILINGS SURFACE AND THROUGH PROGRESSIVE ROCKFILL COVER PLACEMENT FOR CLOSURE.

REFERENCES

1. 2007, 2009 AND 2011 TEST HOLE LOCATIONS SURVEYED AND PROVIDED BY AGNICO EAGLE MINES LTD. CAD FILE: GT_HOLES .DWG, NOVEMBER 2011.
2. BASE PLAN PROVIDED BY AGNICO EAGLE MINES LTD. SEPTEMBER 27 AND 29, 2011.

NOT FOR CONSTRUCTION

0 100 200 300m
1:5,000

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	12/20/12	ISSUED WITH VER. 0 REPORT	S.S.S.	J.C.C.	S.S.S.	J.C.C.
D	08/16/12	ISSUED WITH VER. D REPORT	S.S.S.	J.C.C.		
C	5/28/12	ISSUED WITH REPORT	S.S.S	A.I.		
B	01/05/12	ISSUED FOR CLIENT REVIEW	S.S.S.	A.I.		J.C.C.
A	12/16/11	DRAFT - ISSUED WITH REPORT	S.S.S.	A.I.		

CLIENT
AGNICO - EAGLE MINES LIMITED

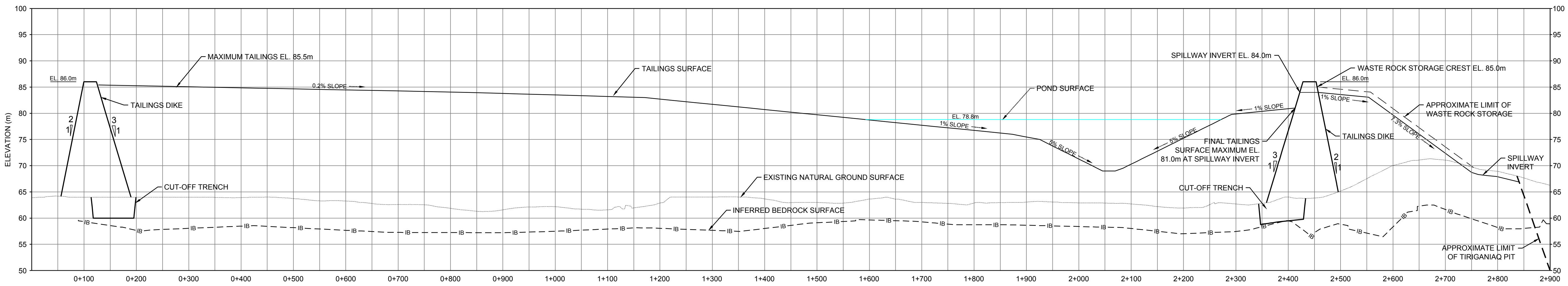
CONSULTANT
Golder Associates

PROJECT 11-1428-0011/3000/3400
MELIADINE MINE TAILINGS STORAGE FACILITY PRELIMINARY DESIGN

TITLE
CONCEPTUAL CLOSURE PLAN

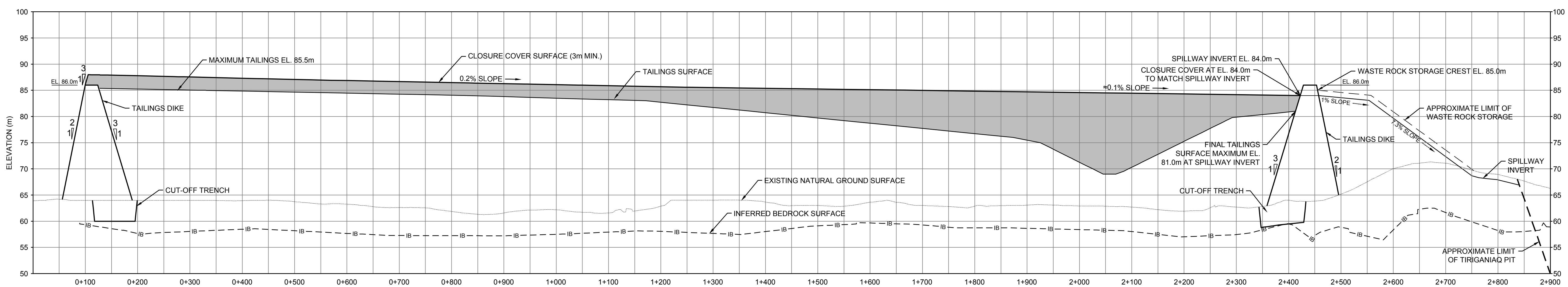
DRAWING No. FIGURE 9
SHEET No. 9 OF 10

SHEET SIZE ANSI D



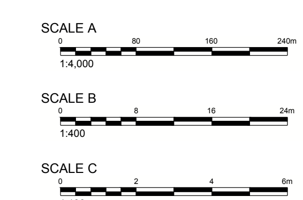
HORIZ. SCALE: SCALE A
VERT. SCALE: SCALE B

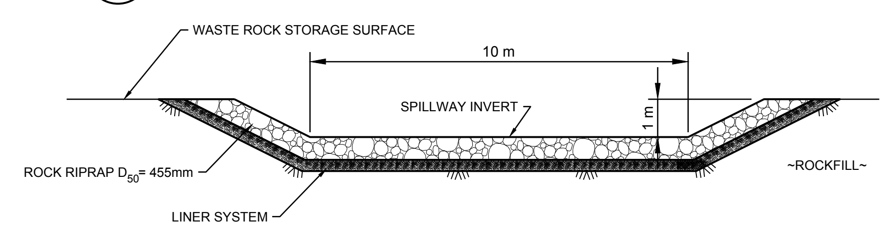
A/8 TYPICAL SECTION - FINAL TAILINGS SURFACE



HORIZ. SCALE : SCALE A
VERT. SCALE : SCALE B

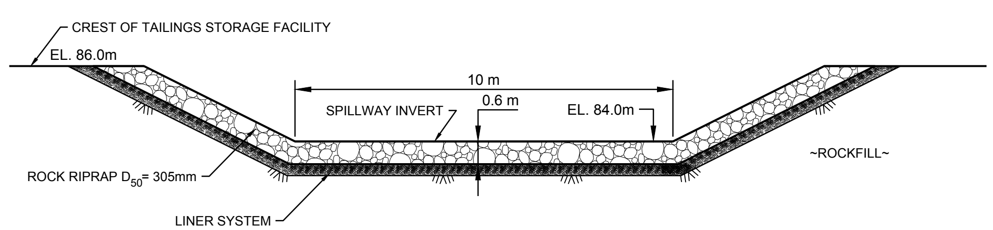
B/9 TYPICAL SECTION - ROCKFILL COVER AT CLOSURE





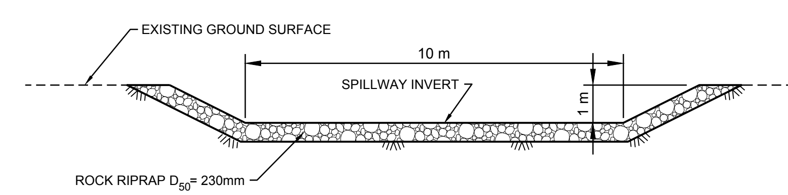
SCALE C

D/8 TYPICAL SECTION SPILLWAY THROUGH WASTE ROCK



SCALE C

C/8 TYPICAL SECTION - SPILLWAY ON TSF AND WASTE ROCK



SCALE C

E/8 TYPICAL SECTION - SPILLWAY ON NATURAL GROUND

NOTES

1. ALL ELEVATIONS ARE IN METRES TO NORTH AMERICAN DATUM 1983 (NAD 83).
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
3. SPILLWAY LINER SYSTEM TO BE DESIGNED WHEN WASTE ROCK/OVERBURDEN PILE DETAILS DEFINED.

REFERENCE

1. INFERRED BEDROCK PROVIDED BY AGNICO MINES LTD. CAD FILE: 3D bed rock.DWG, NOVEMBER 4, 2011.

NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	12/20/12	ISSUED WITH VER. 0 REPORT	S.S.S.	J.C.C.	S.S.S.	J.C.C.
D	08/16/12	ISSUED WITH VER. D REPORT	S.S.S.	J.C.C.		
C	5/28/12	ISSUED WITH REPORT	S.S.S.	A.I.		J.C.C.
B	05/28/12	ISSUED FOR CLIENT REVIEW	S.S.S.	A.I.		J.C.C.
A	12/16/11	DRAFT - ISSUED WITH REPORT	S.S.S.	A.I.		

CLIENT
AGNICO - EAGLE MINES LIMITED

CONSULTANT
Golder Associates

PROJECT 11-1428-0011/3000/3400
MELIADINE MINE TAILINGS STORAGE FACILITY PRELIMINARY DESIGN

TITLE
TYPICAL SECTIONS - FINAL TAILINGS STORAGE, CLOSURE AND SPILLWAY

DRAWING No. FIGURE 10
SHEET No. 10 OF 10

SHEET SIZE ANSI D

APPENDIX A

Seismic Hazard Calculation

2010 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Requested by: , AEM | November 24, 2011

Site Coordinates: 63.0166 North 92.2 West

User File Reference: Meliadine Gold Project

National Building Code ground motions:
2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.2)	Sa(0.5)	Sa(1.0)	Sa(2.0)	PGA (g)
0.095	**0.057**	**0.033**	**0.010**	**0.036**

Notes. Spectral and peak hazard values are determined for firm ground (NBCC 2010 soil class C - average shear wave velocity 360-750 m/s). Median (50th percentile) values are given in units of g. 5% damped spectral acceleration (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are tabulated. Only 2 significant figures are to be used. ***These values have been interpolated from a 10 km spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the calculated values.***

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.2)	0.011	0.035	0.055
Sa(0.5)	0.007	0.022	0.034
Sa(1.0)	0.004	0.012	0.019
Sa(2.0)	0.001	0.004	0.006
PGA	0.003	0.011	0.019

References

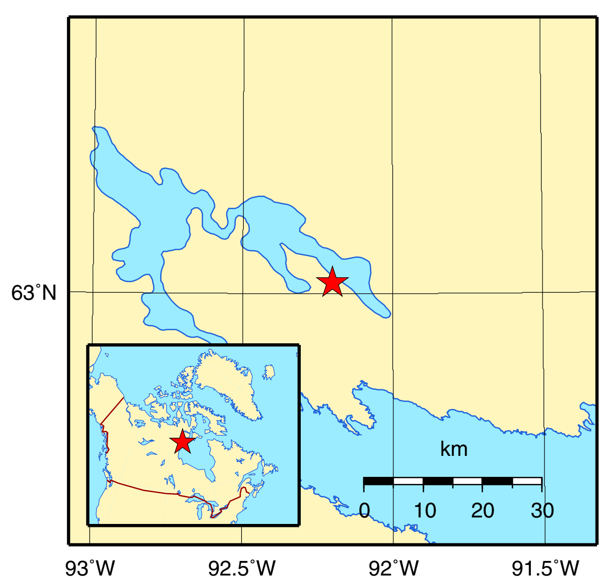
National Building Code of Canada 2010 NRCC no. 53301; sections 4.1.8, 9.20.1.2, 9.23.10.2, 9.31.6.2, and 6.2.1.3
Appendix C: Climatic Information for Building Design in Canada - table in Appendix C starting on page C-11 of Division B, volume 2

User's Guide - NBC 2010, Structural Commentaries NRCC no. 53543 (in preparation)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File xxxx
Fourth generation seismic hazard maps of Canada: Maps and grid values to be used with the 2010 National Building Code of Canada (in preparation)

See the websites *www.EarthquakesCanada.ca* and *www.nationalcodes.ca* for more information

Aussi disponible en français



APPENDIX B

Stability and Seepage Analyses Results

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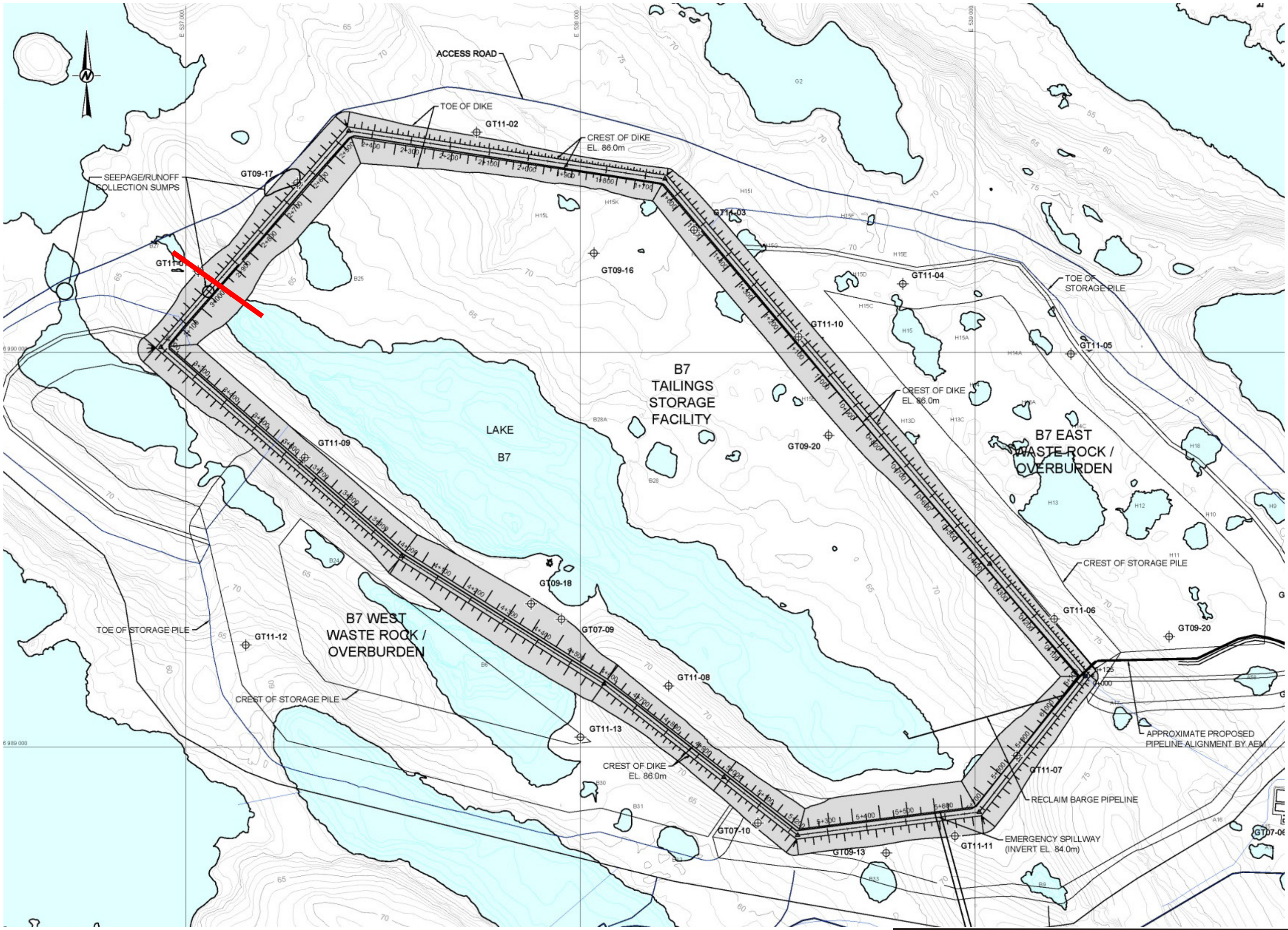


Model Section Location

PROJECT

AGNICO EAGLE MINES LIMITED
MELIADINE TSF PRELIMINARY DESIGN
NUNAVUT

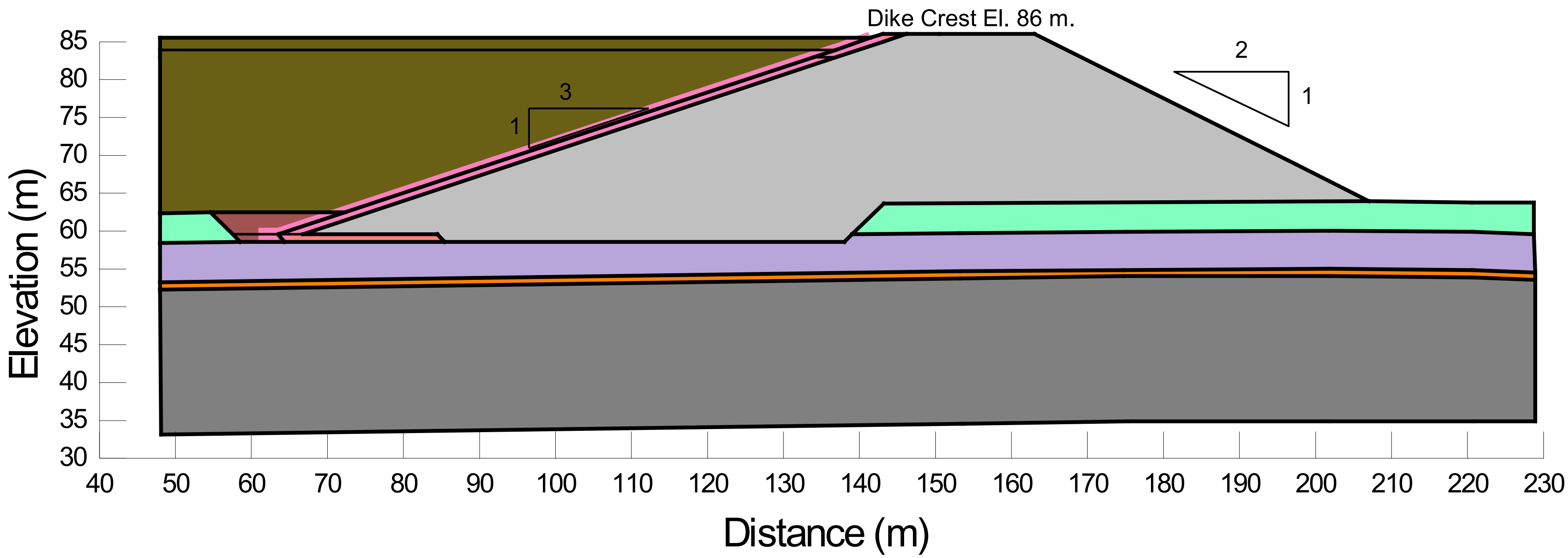
TITLE

Tailings Dike - Location Map

Golder Associates

PROJECT No.	11-1428-0011		FILE No. ----
DESIGN	JV	01DEC11	SCALE NTS REV. 0
CADD	JV	01DEC11	
CHECK	AI	09JAN13	**FIGURE B-1**
REVIEW	DRW	09JAN13	

FILE: O:\Active_2011\1428\11-1428-0011_AEMMeliadineTailings\3000_Phase2\3400_TailingsFacilityDesign



Legend	Material	For Slope Stability Analysis			Saturated hydraulic conductivity
		Phi (°)	C (kPa)	(kN/m^3)	(m/s)
	Rockfill	N/A 1		20	$1x10^{-2}$
	Transition	38	0	18	$1x10^{-3}$
	Tailings	35	0	19	$2x10^{-7}$
	Ice Rich Soil	32, 26(2), 22.5(3)	0	19	$2x10^{-7}$
	Ice Poor Soil	34, 28(2)	0	20	$1x10^{-6}$
	Till Trench	32	0	20	$1x10^{-7}$, $1x10^{-6}$ (5)
	Weathered bedrock	N/A4			$5x10^{-6}$
	Bedrock	N/A4			$3x10^{-7}$
	Liner	Not Included			$1x10^{-12}$

Notes:
(1) Obtained from a shear strength function shown in Figure B-3.
(2) Friction angle under pseudo-static conditions (0.5xPGA) reduced by 20%.
(3) Friction angle under undrained conditions.
(4) Slip surfaces through bedrock not considered.
(5) Sensitivity Case.

Notes:
1. Refer to Figure B-1 for section location.

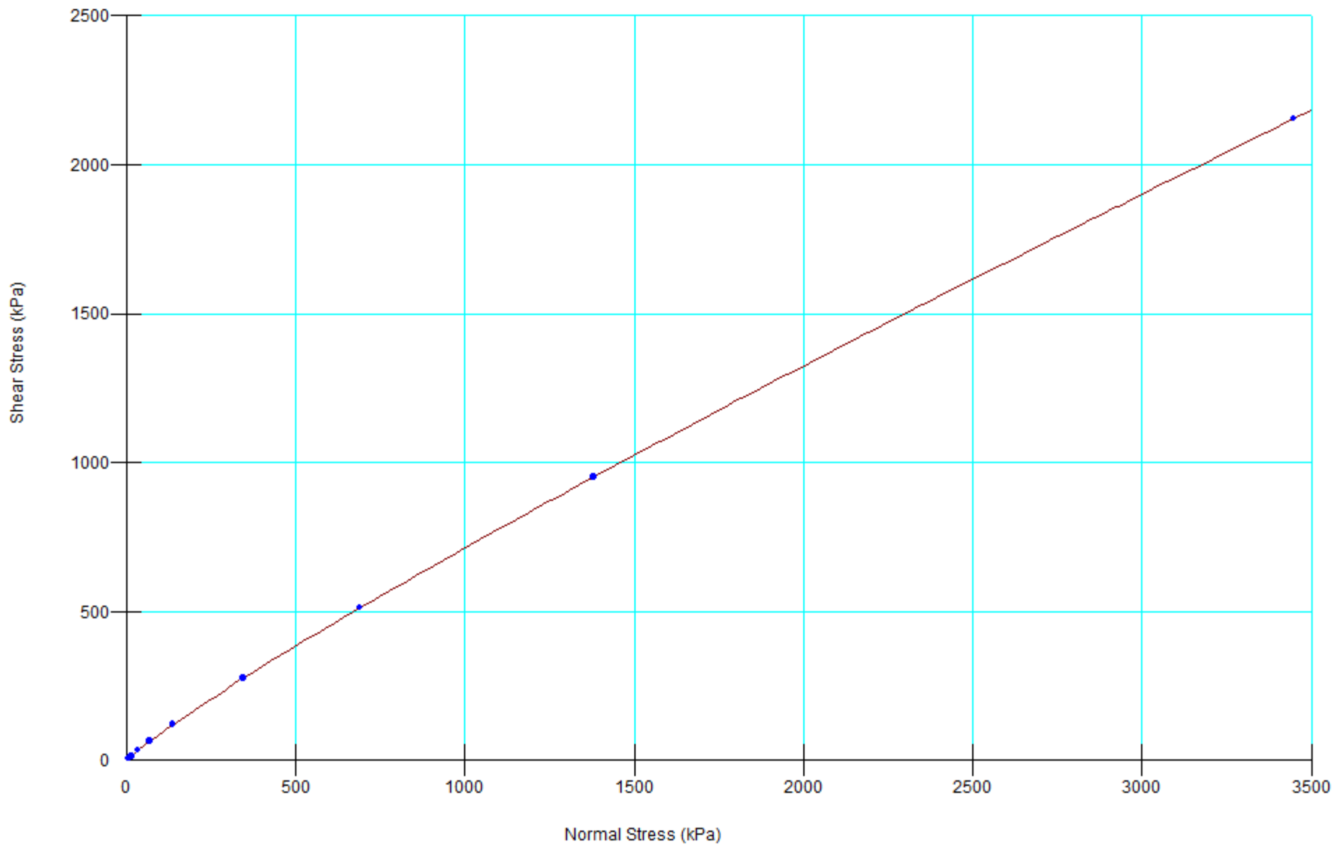
PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE TSF PRELIMINARY DESIGN
NUNAVUT

TITLE
Tailings Dike Typical Model Geometry and Material Properties for Seepage and Slope Stability Analyses

Golder Associates

PROJECT No.	11-1428-0011		FILE No. ----
DESIGN	JV	01DEC11	SCALE NTS REV. 0
CADD	JV	01DEC11	**FIGURE B-2**
CHECK	AI	09JAN13	
REVIEW	DRW	09JAN13	

FILE: O:\Active_2011\1428\11-1428-0011_AEMMeliadineTailings\3000_Phase2\3400_TailingsFacilityDesign



Note: Function based on low bound shear strength of rockfill suggested by Leps (1970).

PROJECT

AGNICO EAGLE MINES LIMITED
MELIADINE TSF PRELIMINARY DESIGN
NUNAVUT

TITLE

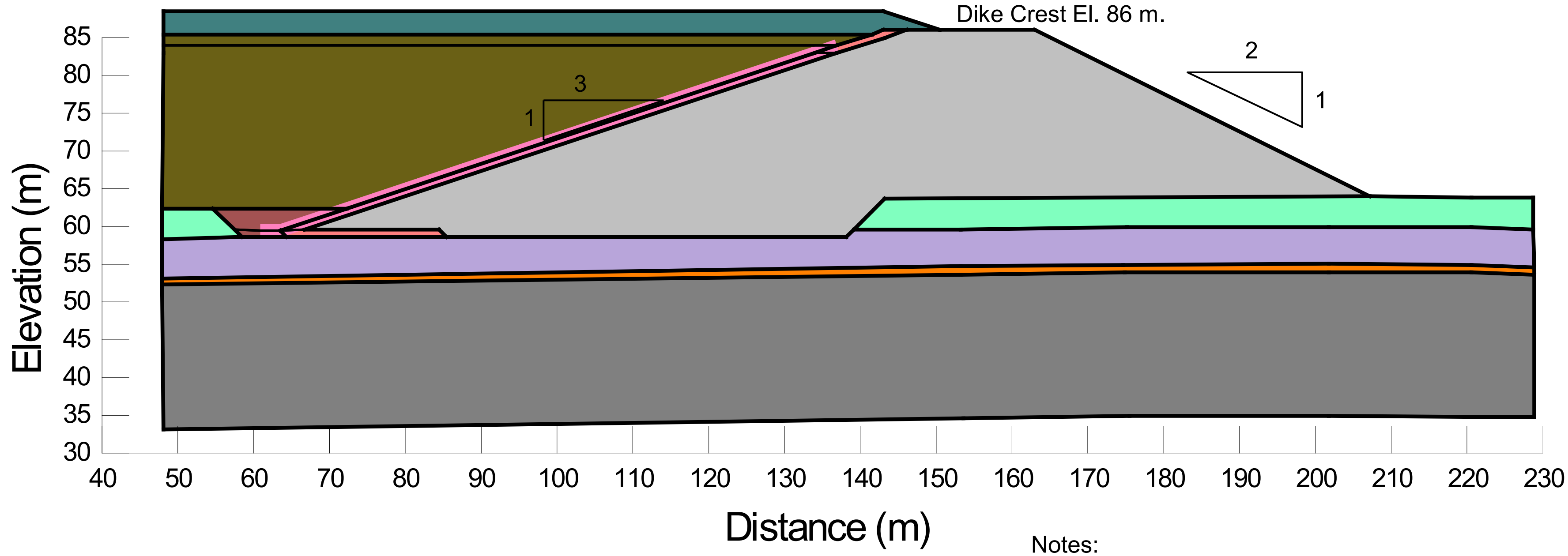
Rockfill Strength Function for Stability Analyses

Golder Associates

PROJECT No.	11-1428-0011	FILE No.	----
DESIGN	LD	20APR12	SCALE NTS	REV. 0
CADD	LD	20APR12	
CHECK	AI	09JAN13	
REVIEW	DRW	09JAN13	

FIGURE B-3

FILE: O:\Active_2011\1428\11-1428-0011_AEMMeliadineTailings\3000_Phase2\3400_TailingsFacilityDesign



Notes:
1. Refer to Figure 1 for location of Section.
2. Phreatic surface generated from seepage model and presented with model results.

Legend	Material	For Slope Stability Analysis		
		Phi (°)	C (kPa)	γ (kN/m^3)
	Rockfill	N/A [1]		20
	Transition	38	0	18
	Cover (rockfill)	38	0	18
	Tailings	35	0	19
	Ice Rich Soil	32, 26(2), 22.5(3)	0	19
	Ice Poor Soil	34, 28(2)	0	20
	Till Trench	32	0	20
	Weathered bedrock	N/A[4]		
	Bedrock	N/A[4]		

Notes:
(1) Obtained from a shear strength function shown in B-3.
(2) Friction angle under pseudo-static conditions (0.5xPGA) reduced by 20%.
(3) Friction angle under undrained conditions.
(4) Slip surfaces through bedrock not considered.

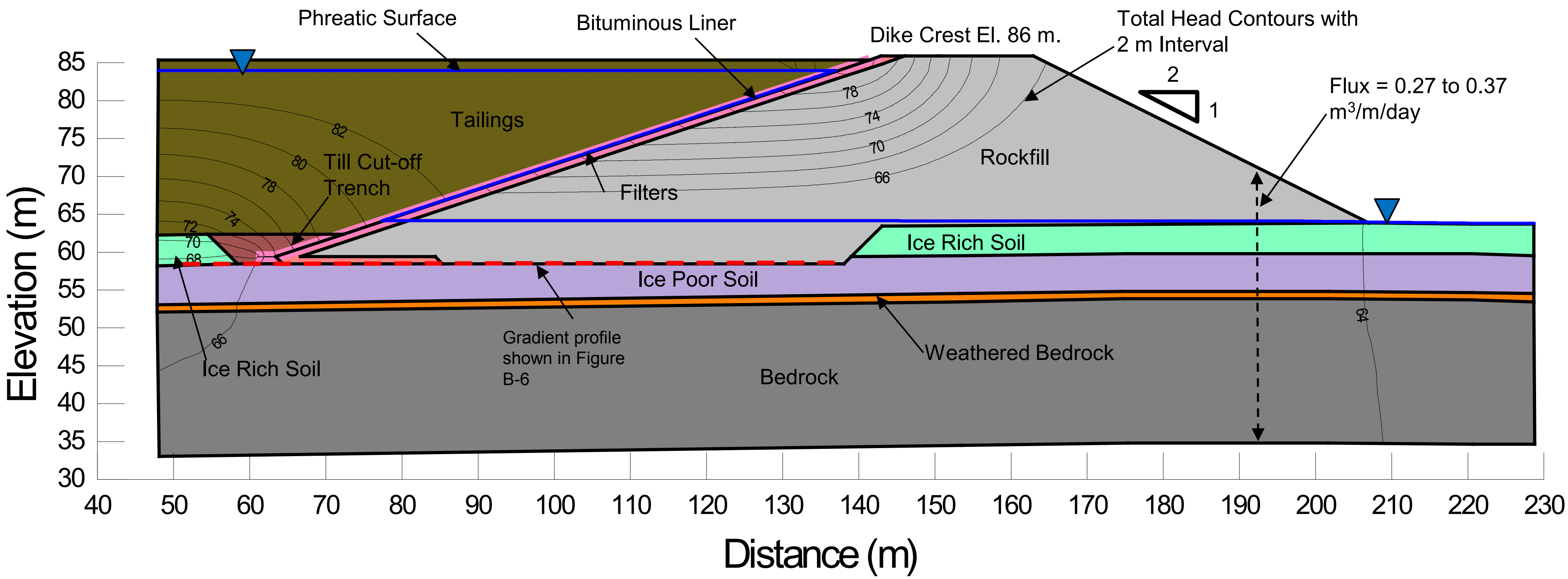
PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE TSF PRELIMINARY DESIGN
NUNAVUT

TITLE
Tailings Dike Typical Closure Geometry and Material Properties for Slope Stability Analyses

Golder Associates

PROJECT No.	11-1428-0011		FILE No. ----	
DESIGN	JV	20APR12	SCALE NTS	REV. 0
CADD	JV	20APR12	**FIGURE B-4**	
CHECK	AI	09JAN13		
REVIEW	DRW	09JAN13		

FILE: O:\Active_2011\1428\11-1428-0011_AEMMeliadineTailings\3000_Phase2\3400_TailingsFacilityDesign



Material	Saturated hydraulic conductivity (m/s)
Rockfill	1×10^{-2}
Transition	1×10^{-3}
Tailings	2×10^{-7}
Ice Rich Soil	2×10^{-7}
Ice Poor Soil	1×10^{-6}
Till Cut-off Trench	1×10^{-7} , 1×10^{-6} (1)
Weathered Bedrock	5×10^{-6}
Bedrock	3×10^{-7}
Liner	1×10^{-12}

(1) Sensitivity Case

Results:

- Flow rate at downstream toe: 0.27 to 0.37 m^3/m/day, depending on till cut-ff trench hydraulic conductivity.

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE TSF PRELIMINARY DESIGN
NUNAVUT

TITLE
Tailings Dike -
Seepage Analysis Results

PROJECT No.	11-1428-0011		FILE No. ----
DESIGN	LD	20APR12	SCALE NTS REV. 0
CADD	LD	20APR12	
CHECK	AI	09JAN13	**FIGURE B-5**
REVIEW	DRW	09JAN13	

Golder Associates

Model Files: *Ktill-10-7ms-Seepage and Stability-BaseCase.gsz; Ktill-10-6ms-Seepage Sensitivity.gsz*
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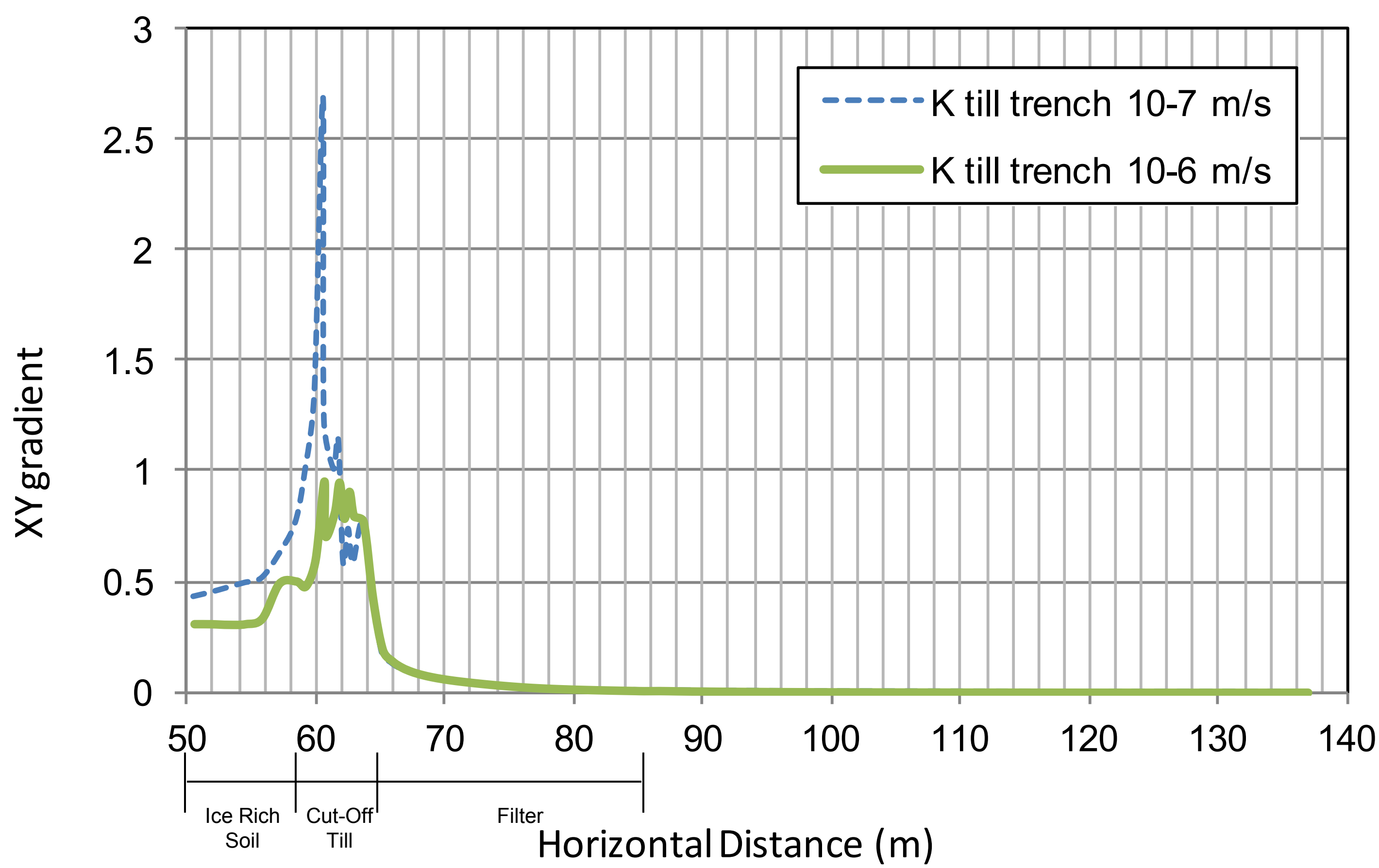
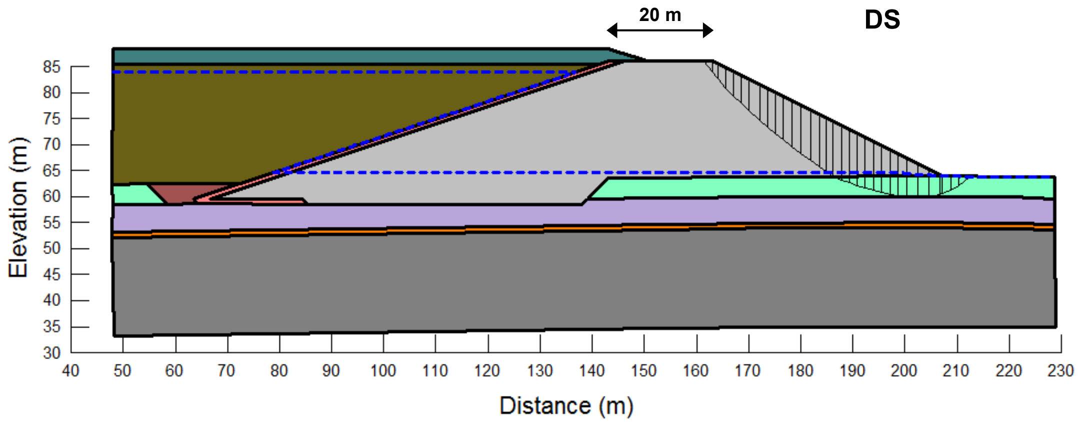
FILE: O:\Active_2011\1428\11-1428-0011_AEMMeliadineTailings\3000_Phase2\3400_TailingsFacilityDesign

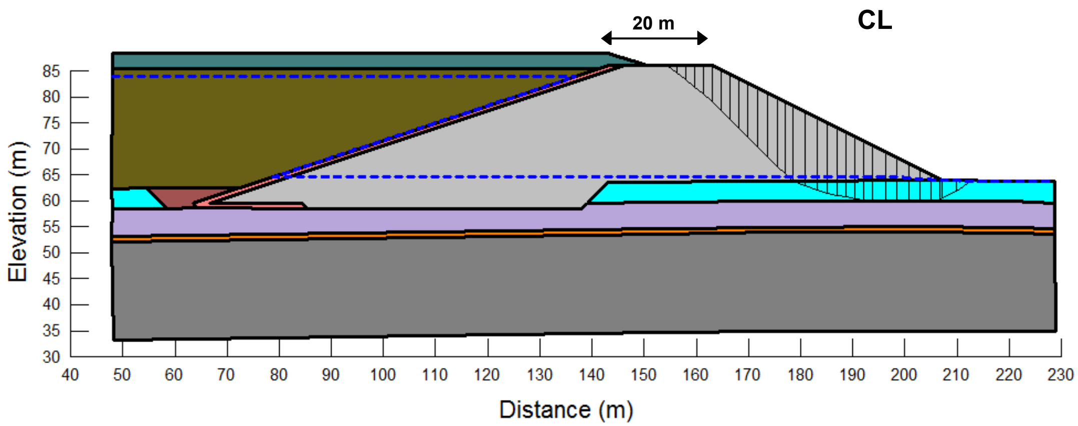


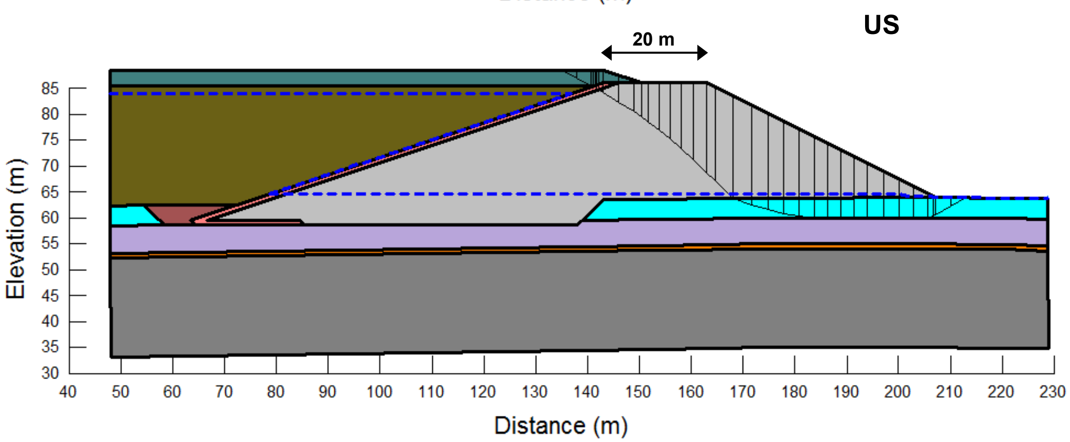
Notes:
k : Hydraulic conductivity
Refer to Figure B-5 for section alignment of graph.

PROJECT	AGNICO EAGLE MINES LIMITED MELIADINE TSF PRELIMINARY DESIGN NUNAVUT				
TITLE	Hydraulic Gradient along TSF Dike Foundation				
Golder Associates	PROJECT No.	11-1428-0011		FILE No. ----	
	DESIGN	LD	20APR12	SCALE NTS	REV. 0
	CADD	LD	20 APR12	FIGURE B-6	
	CHECK	AI	09JAN13		
	REVIEW	DRW	09JAN13		

FILE: O:\Active_2011\1428\11-1428-0011_AEMMeliadineTailings\3000_Phase2\3400_TailingsFacilityDesign







Downstream Face Stability (DS)

Case	Factor of Safety (FoS) under Condition		
	Static	**Pseudo-static**	**Undrained**
FoS Criteria	**1.5**	**1.1**	**1.3**
Operation	1.7	1.4	1.4
Closure	1.7	1.4	1.3

Dike Stability (CL)

Case	Factor of Safety under Condition		
	Static	**Pseudo-static**	**Undrained**
FoS Criteria	**1.5**	**1.1**	**1.3**
Operation	1.7	1.5	1.4
Closure	1.8	1.5	1.4

Slip Surface Close to Upstream Face (US)

Case	Factor of Safety under Condition		
	Static	**Pseudostatic**	**Undrained**
FoS Criteria	**1.5**	**1.1**	**1.3**
Operation	2.0	1.6	1.7
Closure	1.9	1.6	1.6

Model Files: *Ktill-10-7ms-Seepage and Stability-BaseCase.gsz; Ktill-10-7ms-Seepage and Stability-Closure.gsz*
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PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE TSF PRELIMINARY DESIGN
NUNAVUT

TITLE
Tailings Dike - Slope Stability Analyses Results

Golder Associates

PROJECT No.	11-1428-0011		FILE No. ----
DESIGN	LD	20APR12	SCALE NTS REV. 0
CADD	LD	20APR12	
CHECK	AI	09JAN13	**FIGURE B-7**
REVIEW	DRW	09JAN13	

APPENDIX C

Tailings Deposition Plan

TECHNICAL MEMORANDUM

DATE May 22, 2012 **REFERENCE No.** Doc 287-1114280011 Ver. 0

TO Serge Ouellet & Michel Julien
Agnico-Eagle Mines Ltd.

CC Allison Isidoro & Dan R. Walker

FROM Anne-Marie Dagenais & John Cunning **EMAIL** Anne-Marie_Dagenais@golder.com

PROPOSED PARAMETERS AND CRITERIA FOR TAILINGS DEPOSITION MODELLING - MELIADINE GOLD PROJECT, NUNAVUT

Agnico-Eagle Mines Ltd (AEM) is currently in the process of a feasibility study for their Meliadine gold project, located in Nunavut, which includes the conceptual design of the tailings storage facility (TSF). In support of these studies, tailings deposition modelling is being carried out to assist in the storage capacity evaluation, and defining water and tailings management strategies. This document presents the design basis for tailings deposition modelling for AEM review and approval. The information presented herein was provided by e-mail[1] and also discussed with AEM on May 9, 2012 during a conference call. Comments received by AEM were incorporated in the current document.

Operating Criteria

The following information will be used for the tailings deposition modelling:

- A total planned tonnage of 37.7 M t produced over a mine life of 13 years (34.4 M t to be sent to the TSF and 3.3 M t to be sent underground);
- An annual planned production of tailings to be sent to the TSF is presented in Table 1 based on the Life of Mine (LoM) sent on May 8[1];
- Estimated pond volume fixed at a maximum of 2.9 M m^3 during operations, diminishing to 1 M m^3 in the last year of the operation. The 2.9 M m^3 is based on the annual tailings water volume sent to the TSF including the design storm event;
- Site topography provided by AEM; and
- TSF layout as presented in the TSF preliminary design draft report[2].

[1] AEM. May 2012. E-mail communication from serge.ouellet@agnico-eagle.com. ''11-1428-0011 Tailings deposition model – design basis''. E-mail received May 8 2012.

[2] Golder Associates. 2011. Tailings Storage Facility Preliminary Design, Meliadine Project, Nunavut. Draft Report. Project 11-1428-0011/3000, Document 255, Version B. December 23, 2011.

Table 1: Annual Tailings Planned Production

Milling Schedule (Year)	1	2	3	4	5	6	7	8	9	10	11	12	13
Tailings to TSF (1000's tonnes dry)	2,161	2,599	2,843	2,868	2,856	2,842	2,814	2,814	2,814	2,814	2,814	2,724	1,466

Deposition Parameters

The model input parameters proposed for the tailings deposition model are listed below.

- Average settled tailings dry density of 1.14 t/m3;
- Tailings beach slope of 1% above water;
- Tailings beach slope below water of 5.0%; and
- Perimeter discharge points.

Modelling Scenarios

It is proposed to model two scenarios to evaluate the effect of tailings deposition strategy on the dike raise planning, water management, and overall development of the TSF:

- Scenario 1: Start deposition from the lower area in the south to gain initial storage capacity.
- Scenario 2: Start deposition from the eastern perimeter.

The main driver behind the modelling scenarios is progressive site closure. Progressive reclamation will start in the northern sector of the TSF and will progressively move towards the south of the facility. The modeling scenarios will take into account the following operational considerations:

- Maintain the tailings pond away from the perimeter dikes;
- Maintain a tailings pond with minimum water depth of 4 m for pumping purposes (this depth includes an average 2-m ice cap in winter);
- Maintain a 2-m freeboard for water above the operating pond;
- Maintain a minimal elevation of 0.5 m between the tailings and the dike crest (this elevation may be higher with regards to spillway location and closure scenario);
- Gradually move the pond towards the south and center of the facility towards the end of the mine life to facilitate closure;
- Aim for a gently sloping tailings surface towards the south of the TSF at the end of the operation to facilitate closure of the facility; and

- Aim to keep tailings surface below elevation 81 m in spillway area to reduce need to excavate tailings in this area as part of closure.

Deposition will be modelled using discharge points positioned all around the perimeter of the facility. The pipeline will be located at the upstream crest of the dike, and the spigot discharge locations 0.5 m below crest. Tailings will be discharge from the perimeter dike throughout the operation. Towards the end of the operation, discharge points inside the TSF may be required to develop a gently sloping surface towards the south of the facility. It is assumed that access roads or platforms for discharge points inside the facility will be constructed if required.

Table 2 below presents the deposition periods that will be considered in the deposition models, with the corresponding tonnages and volumes of tailings to be modelled as well as the estimated pond volumes.

Table 2: Tailings

Deposition Period	Tailings stored		Tailings stored		Estimated Pond Volume ($M\ m^3$)
	Incremental (M t)	Cumulative (M t)	Incremental ($M\ m^3$)	Cumulative ($M\ m^3$)	
Year 2	4.76	4.76	4.18	4.18	2.9
Year 5	8.57	13.33	7.51	11.69	2.9
Year 9	11.28	24.61	9.90	21.59	2.9
Year 13	9.82	34.43	8.61	30.20	1.0

The modelling will be reviewed to confirm available storage capacity meets the design requirements and that the proposed water management plans are consistent with the modelled tailings deposition surfaces. Location of discharge points and their sequencing for deposition is not developed at this stage of the modelling. This can be developed later on in the project through a more detailed deposition plan, along with the optimization of the tailings surface for the closure scenario, if needed.

Conclusions

Following receipt of your approval of this design basis for tailings deposition modelling, the deposition modelling will be carried out for the proposed deposition periods.

If you have any questions or comments, please do not hesitate to contact us.

GOLDER ASSOCIATES LTD.

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Project Engineer

ORIGINAL SIGNED

John Cunning, P. Eng. (BC, NT/NU)
Associate, Senior Geotechnical Engineer

AMD/JC/lw

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