TECHNICAL MEMO

ISSUED FOR USE-REVISION 1

To:	Lisa Mah, Agnico Eagle	**Date:**	January 23, 2024
c:	Nigel Goldup, Tetra Tech	**Memo No.:**	01
From:	Fai Ndofor, Tetra Tech Hongwei Xia, Tetra Tech	**File:**	ENG.EARC03193-04
Subject:	Stability Analyses for the Proposed Tailings Storage Facility (TSF), Meliadine Mine Water Licence Amendment, NU		

1.0 INTRODUCTION

Agnico Eagle Mines Limited (Agnico Eagle) is currently operating the approved Meliadine Gold Mine (the Meliadine Mine), located approximately 25 km north of Rankin Inlet, Nunavut, by mining the Tiriganiaq (TIR) deposit with two open pits and an underground (UG) operation. The existing Type “A” Water Licence (2AM-MEL-1631) authorized the mining undertaking at TIR open pits and underground. Agnico Eagle is applying for a Type A Water Licence Amendment (WLA) to include future mining of the Wesmeg, Wesmeg North, Pump, F Zone, and Discovery deposits that were included in the 2014 Final Environmental Impact Statement (Agnico Eagle 2014).

Tetra Tech Canada Inc. (Tetra Tech) was retained by Agnico Eagle to carry out a prefeasibility level study of the proposed Tailings Storage Facility (TSF) expansion to facilitate the application for the Type A WLA for the Meliadine Mine. As part of the prefeasibility level study, slope stability analyses were carried out to assist in developing the typical-section and design of the TSF for the Meliadine WLA.

This technical memorandum summarizes the methodology, input parameters, and findings of the slope stability analyses for the proposed TSF.

2.0 GENERAL SITE CONDITIONS

2.1 Climate and Meteorology

The Meliadine Mine 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 per day in summer. The nearest weather station is Rankin Inlet A (Station 2303401), located approximately 25 km south of the mine site. The closest long-term regional evaporation station operated by Environment Canada is in Churchill, Manitoba.

The monthly mean air temperature is typically above 0°C for the months of June to September, and below 0°C between October and May. July is typically the warmest month and January the coldest. Winters are typically long and cold, while summers are short and cool. Spring and fall are short. The mean annual temperature for the period of record from 1981 to 2020 was -10.4°C.

The annual average total precipitation at the mine site is 430 mm/year and falls almost equally as snow and rainfall (Tetra Tech 2021a). Average annual evaporation for small waterbodies in the Project area is estimated to be 323 mm between June and September. The average annual loss of snowpack to sublimation and snow

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redistribution is estimated to vary between 46% and 52% of the total precipitation for the winter period and occurs between October and May (Golder 2013a).

The region is known for high winds, which are due in part to the broad, flat, uninterrupted expanses offered to moving air masses. The wind blows generally from the northwest and north-northwest direction. The mean values for wind speed show that the north-northwest, together with northwest winds, have the highest speeds and tend to be the strongest. Mean monthly wind speeds are typically between 19 km/hour and 29 km/hour, with an average of 22.3 km/hour.

The representative concentration pathway scenario 4.5 (RCP4.5) under the Intergovernmental Panel on Climate Change was adopted for the projection of climate at the Meliadine Mine. It is anticipated that the mean temperature in the mine region will increase approximately 0.06 °C/year relative to historical means over the period from 2020 to 2120. Precipitation at the Project region is also predicted to increase by 0.7 mm/year on average.

2.2 Environmental Setting

The dominant terrain in the Meliadine Mine 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, which control the regional surface drainage patterns. The property is about 60 metres above sea level (masl) in low-lying topography with numerous lakes. Surface waters are usually frozen by early October and remain frozen until early June.

The surveyed lake surface elevations in the Meliadine Mine area range from about 51 masl at Meliadine Lake to about 74 masl for local small, perched lakes. Lakes formed by glaciofluvial processes or glacial processes, are common throughout the Project area. Most of the perched lakes at the Project site are relatively shallow (less than 2 m water depths). 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. Ice covers usually appear by the end of October and are completely formed in early November. The spring freshet typically begins in mid-June and is complete by early July (Golder 2012a).

2.3 Permafrost

The Meliadine Mine site is located within the Southern Arctic terrestrial eco-zone which is one of the coldest and driest regions of Canada, in a zone of continuous permafrost. Continuous permafrost to depths of between 285 m to 430 m is expected based on ground temperature data from thermistors installed near Tiriganiaq, FZone, and Discovery deposits. The measured ground temperature data indicates that the active layer ranges from 1.0 m to 3.0 m in areas of shallow soils and areas 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 could be deeper. The typical permafrost ground temperatures at the depths of zero annual amplitude (typically at the depth of below 18 m) are in the range of -5.9°C to -7.0°C in the areas away from lakes and streams. The geothermal gradient ranges from 0.016°C/m to 0.02°C/m (Golder 2012a).

The formation of an open-talik, which penetrates through the permafrost, would be expected for lakes that exceed a critical depth and size. Thermal modelling was conducted by Golder to assess the extent of lake taliks. It is anticipated that open-taliks exist below portions of Lake B4, Lake B5, Lake B7, Lake A6, Lake A8, Lake CH6, and Lake D4 (Golder 2012a). The salinity of groundwater also influences the temperature at which the groundwater will freeze.

2.4 Groundwater

In areas of continuous permafrost, there are generally two groundwater flow regimes: a shallow groundwater flow regime located in the active layer near the ground surface, and a deep groundwater flow regime located beneath permafrost. From late spring to early autumn, when temperatures are above 0°C, the active layer thaws. Within the active layer, the water table is expected to be a subdued replica of topography and is expected to parallel the topographic surface. Groundwater in the active layer flows to local depressions and ponds that drain to larger lakes in the Meliadine Mine.

The permafrost in the rock in the Meliadine Mine area would be virtually impermeable to groundwater flow. The shallow groundwater flow regime, therefore, has little to no hydraulic connection with the deep groundwater regime. A numerical hydrogeological model for the deep groundwater flow regime was developed in 2012 and updated several times in 2016, 2019, and 2021. It was reported that the elevations of the larger lakes with taliks extending down to the deep groundwater regime (referred to as open taliks) provide the principal driving force for deep groundwater flow. Through thermal modelling, open-taliks were suggested to exist beneath Lake B4, Lake B5, Lake B7, Lake A6, Lake A8, Lake CH6, and Lake D4. Hydrogeological testing conducted at the Project site indicated that the bulk bedrock is generally of low hydraulic conductivity, ranged from 1×10^{-10} m/s to 6×10^{-9} m/s (Golder 2012a). Groundwater velocities in the deep groundwater regime are very low and on the order of 0.2 m/year to 0.3 m/year.

To a lesser degree, groundwater beneath the permafrost is influenced by density differences due to the upward diffusion of deep-seated brines (density-driven flow). In the Canadian Shield, concentrations of Total Dissolved Solids (TDS) in groundwater increase with depth, primarily in response to upward diffusion of deep-seated brines. A “West Bay”-type well was installed in 2011 at the site near the proposed Tiriganiaq UG infrastructure to establish a baseline for deep groundwater quality. A second “West Bay”-type well was installed in 2020 near the Discovery deposit to collect more baseline data. Mean salinity of groundwater below the permafrost has been estimated at approximately 61,000 mg/L. Salinity can induce a freezing point depression, creating a cryopeg in permafrost where water can be unfrozen even though the temperature is below 0°C. The freezing point depression was calculated to be equivalent to -3.3°C in the Meliadine Mine area (Golder 2012b). The portion of the permafrost, where groundwater may be partially or wholly unfrozen due to the freezing point depression, has been estimated to be at a depth of 280 m to 290 m (Golder 2012a).

2.5 Seismic Zone

The Meliadine Mine site is in an area of low seismic risk. The site classification for seismic response is “Class C” based on the determined ground conditions. The Peak Ground Acceleration (PGA) for a reference “Class C” site under various Annual Exceedance Probability (AEP) was estimated using the 2020 National Building Code of Canada Seismic Hazard Tool. The estimated PGA is 0.0285 g for a 5% in 50-year probability of exceedance (0.001 per annum or 1 in 1,000 year return) and 0.0498 g for a 2% in 50-year probability of exceedance (0.000404 per annum or 1 in 2,475 year return) for the Meliadine Mine site.

3.0 SUBSURFACE CONDITIONS

Various geotechnical investigation programs have been conducted at the Meliadine Mine site since 2009, with a total of 22 boreholes drilled within the approved and proposed TSF expansion footprint. In general, a thin layer of organic material overlying ice-rich silty sand, gravelly silt, and sand, with traces of clay and shells with cobbles constitute the overburden material underneath the TSF area. Excess ice was observed in most of the boreholes drilled within the area. The depth to bedrock ranges from 1.3 m on the eastern side of the TSF to 8.3 m at the southeastern side. Table 1 summarizes the key geotechnical information of the overburden soils within the approved and proposed TSF expansion footprint based on findings from past drilling programs (Golder 2009, 2012c, 2012d, EBA 2013, Tetra Tech EBA 2014b, Tetra Tech 2018).

Table 1: Summary of Overburden Soils in the Proposed TSF Expansion Area

Borehole No.	Organic Layer Thickness (m)	Major Overburden Soil Types	Ice Conditions	Depth to Bedrock (m)
GT07-11	~0.20	Sand, ice-rich fine-grained materials (not logged in detail)	~2.25 m (from 0.75 m to 2.0 m) ice-rich fine-grained materials with up to 75% Ice	~5.5
GT09-16	-	Gravel, sand and silt, cobbles	n/a	~5.9
GT09-17	0.3	Peat, silt, sand, and gravel	Vr, Vx from 0.3 m to 1.7 m	~2.8
GT09-15	0.30	Low recovery, gravel, silty sand	Thawed during drilling	3.5
GT11-10	0.75	Silty peat, ice and silt, gravelly sandy silt	1.75 m ice and silt from 0.75 m to 2.5 m	6.3
GT12-18	-	Gravelly silty sand, gravelly sandy silt, gravelly silt and sand	Vs from 1 m to 2 m	7.3
GT12-19	-	Gravelly silty sand, sandy silt, silty sand	Vs to Vc, Vr from 2 m to 2.7 m	3.1
GT13-07	0.10	Boulders, sand and silt	Thawed during drilling	1.3
GT14-13	0.10	Silty gravelly sand, sand and silt	Up to 10% Vx, Vc, 5% Vs from 1.8 m to 3.2 m	3.2
GT11-02	0.4	Sandy peat, gravelly sand and silty sand, and silt	Up to 12% Vr from 3.7 m to 5.4 m 7.3% Vs from 5.4 m to 7.1 m	7.1
GT11-03	1.10	Silty peat, ice, and silt	Moisture content 458% between 1.5 m to 3.1 m	3.1
GT12-20	0.07	Peat, sand and gravel, cobbles, silty sand, and silt	Nf between 6.6 m to 8.3 m	8.3
GT12-21	-	Gravel, silty sand, and silt	n/a	6.24
GT12-22	0.05	Peat, silty sand, cobbles	n/a	3.67
GT12-23	0.1	Peat, Silty gravel, gravel	n/a	4.72
GT12-25	-	Gravel, boulder, silty sand, and gravel	Nbn between 3.75 m and 4.75 m	4.75
GT13-06	0.01	Peat, sand and silt, gravel	Vx up to 20% from 1.0 m to 2.0 m Vx 5% from 3.0 m to 6.5 m	3.62
GT14-12	-	Gravel, gravelly sand, and silt	Up to 30% Vx, Vc	2.55
GT17-17	0.16	Peat, sand, some gravel and boulders and cobbles	Nbe from 1.25 m to 1.5 m, Nbn from 1.5 m to 3.0 m	3.0
GT17-18	0.26	Peat, sand, and boulder	Vr 90% ice from 2.37 m to 2.51 m	4.94
GT17-19	0.17	Peat, sand, gravel, boulder, and cobble	Nbn	1.8
GT17-20	0.1	Peat, sand and gravel	Nbn	1.48

4.0 ANALYSIS METHODOLOGY AND DESIGN CRITERIA

4.1 General

Limit equilibrium analyses were conducted to determine the factor of safety (FoS) against slope failure in short term during construction and long term after the closure of the TSF. SLOPE/W, a two-dimensional, limit equilibrium software from GeoSlope International Ltd., was utilized to analyze slope stability of the proposed TSF for the Meliadine WLA. The principles underlying the method of limit equilibrium analyses of slope stability are as follows:

- A slip mechanism is postulated;
- The shear resistance required to equilibrate the assumed slip mechanism is calculated by means of statics;
- The calculated shear resistance required for equilibrium is compared with the available shear strength in terms of FoS; and
- The slip surface with the lowest FoS is determined through iteration.

A design FoS is used to account for the uncertainty and variability in the strength and pore water pressure parameters, and to limit deformations. In addition, earthquake loading has been modeled using pseudo-static peak horizontal ground acceleration.

4.2 Design Criteria for Factor of Safety

The British Columbia Mine Waste Rock Pile Research Committee publication - Mined Rock and Overburden Piles, Investigation and Design Manual, Interim Guidelines, May 1991 provides accepted minimum stability FoS for various conditions based on the importance of the structure, potential failure consequences, uncertainties involved in design loads, and soil parameters, especially shear strength parameters (PAE 1991). The additional cost associated with a higher FoS, and the risk that the owner of the structure is willing to take are presented in Table 2.

Table 2: Suggested Minimum Design Values for Factor of Safety (PAE 1991)

Stability Condition	Suggested Minimum Design Values for Factor of Safety[1)]	
	Case A	Case B
Stability of Dump Surface (Shallow Seated Stability)		
▪ Short Term (During Construction)	1.0	1.0
▪ Long Term (Reclamation – Abandonment)	1.2	1.1
Overall Stability (Deep Seated Stability)		
▪ Short Term (Static)	1.3 - 1.5	1.1 - 1.3
▪ Long Term (Static)	1.5	1.3
▪ Pseudo-Static (Earthquake)[2]	1.1 - 1.3	1.0
Case A: ▪ Low level of confidence in critical analysis parameters ▪ Possibly unconservative interpretation of conditions, assumptions ▪ Severe consequences of failure ▪ Simplified stability analysis method (charts, simplified method of slices) ▪ Stability analysis method poorly simulates physical conditions ▪ Poor understanding of potential failure mechanism(s)		
Case B: ▪ High level of confidence in critical analysis parameters ▪ Conservative interpretation of conditions, assumptions ▪ Minimal consequences of failure ▪ Rigorous stability analysis method ▪ Stability analysis method simulates physical conditions well ▪ High level of confidence in critical failure mechanism(s)		

1. A range of suggested minimum design values are given to reflect different levels of confidence in understanding site conditions, material properties, consequences of instability, and other factors.
2. Where pseudo-static analyses, based on peak ground accelerations which have a 10% probability of exceedance in 50 years, yield a FoS < 1.0, dynamic analyses of stress-strain response, and comparison of results with stress-strain characteristics of dump material is recommended.

Generally, the selection of a design FoS for an earth structure depends on the importance of the structure, potential failure consequences, and uncertainties involved in design loads and soil parameters. Considering these subjects, the minimum design FoS adopted for the proposed TSF stability analyses and representative of Case A (more conservative factor of safety) are presented in Table 3.

Table 3: Design Factors of Safety for TSF Stability

Surface or Potential Shallow Slip Surfaces	Design Factor of Safety Adopted
Short-term, during construction	1.0
Long-term static loading	1.2
Long–term seismic (pseudo-static) loading	1.0
Potential Deep Seated Slip Surfaces	
Short-term, during construction	1.3
Long-term static loading	1.5
Long–term seismic (pseudo-static) loading	1.1

The estimated PGA is 0.0498 g for a 1 in 2,475 year return for the site area (Class “C”) based on the 2020 National Building Code of Canada and was adopted in the TSF stability analyses.

5.0 STABILITY ANALYSIS INPUT DATA AND CASES

5.1 Foundation Soil Profile and TSF Section

The original ground geotechnical conditions in the TSF area are summarized in Section 3.0. For stability analyses in this study, a relatively conservative soil profile for the TSF foundation was adopted to consist of 1.5 m sand and silt, 1 m ice-rich silt, 2 m ice-poor silt/sand overlying bedrock.

A typical section of the proposed TSF design was evaluated in the stability analyses. The analyses considered the following key design parameters of the TSF:

- An average final TSF height of approximately 64 m with a side slope of 4% on the plateau, 3(H):1(V) above Elevation 100 m, and 4(H):1(V) below Elevation 100 m;
- A waste rock fill thickness of 3.7 m over the upper side slopes of the final tailings surfaces;
- A waste rock fill thickness of 4.2 m over the lower toe of the side slopes of the final tailings surfaces; and
- Top covers of 2.5 m waste rock fill over 0.5 m overburden till fill overlying the top final tailings surfaces.

The plan view of the proposed TSF and sections for the Meliadine WLA are presented in Figures 1 to 3.

5.2 Material Properties

The material properties adopted for the “dry” stack tailings and foundation materials in the stability analyses are presented in Table 4. Laboratory direct shear tests on the tailings (Tetra Tech EBA 2014a) indicated that the tailings had an inferred peak internal angle of friction of 33.5° for the tailings sample with a dry density of 1,708 kg/m^3. In consideration of the large-strain shear stress softening behaviour observed in the direct shear tests and possible lower dry density in the field conditions, a relative conservative internal angle of friction of 30° was adopted for the dry stack tailings. A laboratory consolidated-undrained triaxial test on a silty sand overburden sample was conducted (EBA 2013). The sample was taken from a borehole drilled in the area more than 700 m south of the TSF. The test indicated the soil had an inferred peak internal angle of friction of 36°. In the stability analyses for the TSF, most of input parameters for the overburden soils and closure cover fills were assumed based on experience and engineering judgement. These parameters are relatively conservative and reasonable for the prefeasibility study. The long-term cohesion of the frozen ice rich silt was adopted based on the suggestions presented in Weaver and Morgenstern (1981). It is anticipated that the tailings will freeze back based on the monitoring data from the approved TSF. The tailings was assumed in an unfrozen condition in this study, which is on conservative side.

Table 4: Material Parameters Used in TSF Stability Analyses

Material	Thickness (m)	Angle of Internal Friction, Ø (º)	Cohesion, *c* (kPa)	Unit Weight, γ (kN/m^3)
Waste Rock for Closure Cover	2.5 (top); 3.7 to 4.2 (side slopes)	42	0	19
Overburden Till Fill for Closure Cover	0.5 (top only)	30	0	18
Dry Stack Tailings	Up to 65	30	0	19.4
Sand and Silt	1.5	31	0	20
Unfrozen Ice rich Silt	1	28	0	17
Long-term Frozen Ice rich Silt (*c*=70 kPa)		0	70	17
Long-term Frozen Ice rich Silt (*c*=160 kPa)		0	160	17
Ice-poor Sand/Silt	2.5	32	0	20

$\bar{B}$ = 0.1 for sand and silt during construction period. $\bar{B}$ = 0.2 for unfrozen ice rich silt during construction period. $\bar{B}$ = 0 for long term after construction.

An assumed piezometric line, together with a pore pressure coefficient, $\bar{B}$ was used in the analyses to simulate potential pore water conditions. A $\bar{B}$ was applied in modeling the excess pore-pressure that can be potentially generated during construction under loading. The $\bar{B}$ is defined as a ratio of the excess pore-pressure generated in each soil to the change in vertical stress in the soil due to fill placement above the original ground surface. For long-term static and seismic loading conditions, $\bar{B}$ was set to zero.

5.3 Cases Evaluated

The slope stability analyses were conducted at typical cross section A, in Figure 2 and considers the following various design scenarios:

- TSF slope stability under static loading during short-term stage construction;
- TSF slope stability under static loading under long-term post-construction conditions;
- TSF slope stability under seismic (pseudo-static) loading during long term after construction; and
- Other parametric sensitivity analysis cases.

6.0 STABILITY ANALYSIS RESULTS

The calculated minimum FoS in the slope stability analyses for the proposed TSF are summarized in Table 5 and illustrated in Figures 4 to 13.

Table 5: Summary of Slope Stability Analysis Results for the Proposed TSF

Figure	Loading	Condition	Calculated Minimum Factor of Safety	Comments
Figure 4	Static	Short term - during construction	2.3	Considering potential excess pore water pressure generated in sand and silt, and unfrozen ice rich silt due to placement of the tailings; unsaturated tailings with a water table on the original ground surface
Figure 5	Static		2.0	Considering potential excess pore water pressure generated in sand and silt, and unfrozen ice rich silt due to placement of the upper tailings; unsaturated tailings with a water table on the original ground surface
Figure 6	Static	TSF during long term after construction	1.7	No potential excess pore water pressure; Ice rich silt has three zones (unfrozen ice rich silt, frozen ice rich silt (c=70 kPa) and frozen ice rich silt (c=160 kPa)), according to corresponding thermal analysis results
Figure 7	Seismic		1.4	In addition to the case in Figure 8, a PGA of 0.0498 g was used for seismic loading
Figure 8	Static	TSF during long term after construction, with thawing ice rich Silt	2.0	Considering unfrozen ice rich silt and potential excess pore water pressure generated in thawing ice rich silt when the ice rich silt is thawed under remotely extreme case; unsaturated tailings with a water table on the original ground surface
Figure 9	Seismic		1.6	In addition to the case in Figure 10, a PGA of 0.0498 g was used for seismic loading
Figure 10	Static	TSF during long term after construction, with saturated tailings	1.4	This analysis simulated a sensitivity case to evaluate the long-term stability with a very conservative assumption of saturated tailings with a water table at elevation 100 m., The tailings will be placed in an unsaturated condition. The probability of having high phreatic surface in the tailings is low. In this analysis, the ice rich silt has three zones: unfrozen ice rich silt, frozen ice rich silt (c=70 kPa) and frozen ice rich silt (c=160 kPa)
Figure 11	Seismic		1.2	In addition to the case in Figure 12, a PGA of 0.0498 g was used for seismic loading
Figure 12	Static	TSF during long term after construction, with saturated tailings and thawed Ice rich Silt	1.4	This analysis simulated a sensitivity case to evaluate the long-term stability with conservative assumptions of saturated tailings with a water table at elevation 100 m. Considering thawed ice rich silt when the ice rich silt is thawed under extreme case
Figure 13	Seismic		1.2	In addition to the case in Figure 14, a PGA of 0.0498 g was used for seismic loading

7.0 DISCUSSION AND CONCLUSIONS

A series of slope stability analyses were carried out to evaluate the TSF stability during construction and in the long term after closure for the proposed typical design section used in this study. The analyses results indicate that the calculated minimum FoS for the proposed TSF meets or exceed the factors of safety adopted under various loading conditions, except for two parametric sensitivity analyses cases with an assumed phreatic surface at Elevation 100 m. The calculated minimum FoS for the sensitivity analyses are 1.4 under static loading conditions. Given the conservative assumptions on the material properties and thermal conditions, and the low probability of having a high phreatic surface, the FoS under long-term static loading are slightly lower than the design factor of safety adopted and considered to be acceptable for this study.

The tailings was assumed in an unfrozen condition in this study, which is on conservative side. The measured ground temperature data at the approved TSF indicates that the tailings will freeze back in the long term. The freeze-back of the TSF will provide additional benefits such as increasing stability and minimizing seepage during the operation and closure.

8.0 LIMITATIONS OF REPORT

This technical memo and its contents are intended for the sole use of Agnico Eagle Mines Limited (Agnico Eagle) and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Agnico Eagle, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on Use of this Document attached in Appendix A or Contractual Terms and Conditions executed by both parties.

9.0 CLOSURE

We trust this technical memo meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

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PERMIT TO PRACTICE
TETRA TECH CANADA INC.

Signature ____________________

Date ____________________ 2024-01-23

PERMIT NUMBER: P 018
NT/NU Association of Professional Engineers and Geoscientists

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FIGURES

NO. DESSIN
DRAWING NO.

FORMAT ANSI B–11x17

LEGEND

CATCHMENT BOUNDARY

AGNICO EAGLE

TETRA TECH

TITRE / TITLE	# DWG
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DESSINS EN RÉFÉRENCE/REFERENCE DRAWINGS

REV	DESCRIPTION	DATE	PAR BY
A	ISSUED FOR USE	2024–01–23	HX

REVISIONS

DESSINÉ PAR / DRAWN BY	EL	DATE	2024–01–23
VÉRIFIÉ PAR / CHECKED BY	HX		2024–01–23
APPROUVÉ PAR / APPROVED BY	HX		2024–01–23
No. PROJET / PROJECT NO.	ENG.EARC03193–04		
DATE	2024–01–23		

TITRE / TITLE
AGNICO EAGLE – MELIADINE MINE

TSF PLAN VIEW

ÉCHELLE/SCALE 1:10,000 FICHIER/FILE –

No. DESSIN/DRAWING NO. FIGURE 1 REVISION A FEUILLE/SHT 1 / 3

AE–CART–ANSI B

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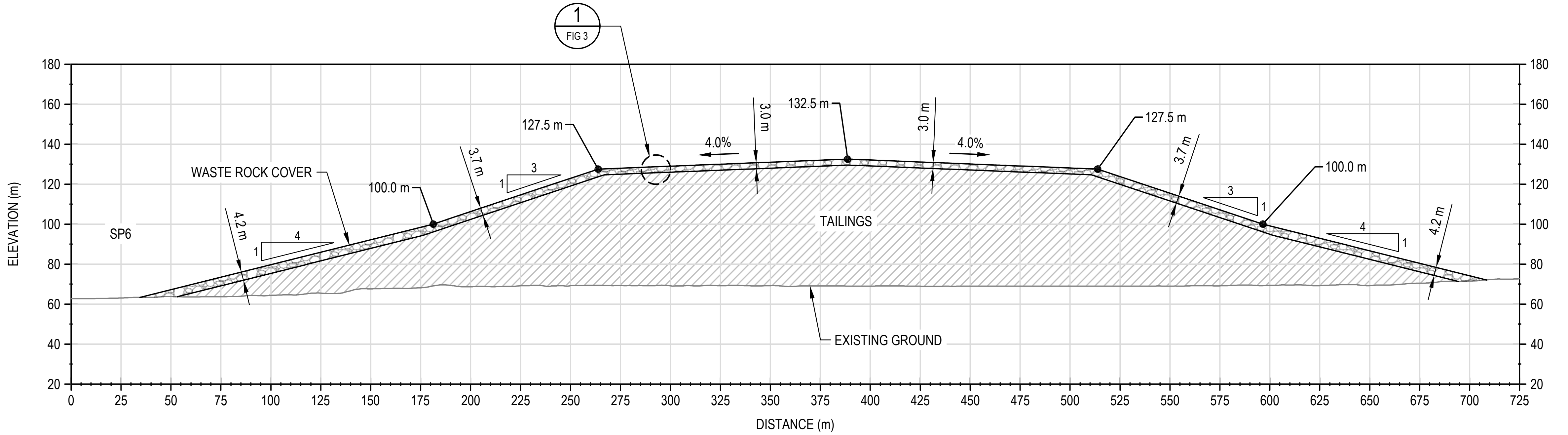
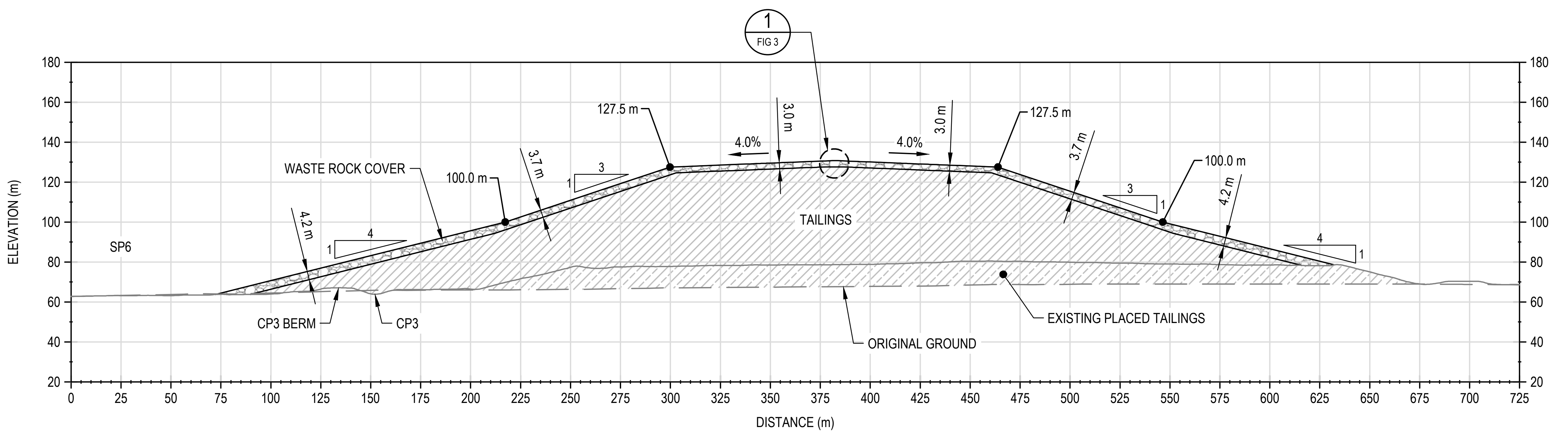
NO. DESSIN
DRAWING NO.

FORMAT ANSI B–11x17



A
FIG 1
TYPICAL SECTION
SCALE: 1:1000



B
FIG 1
TYPICAL SECTION
SCALE: 1:1000

LEGEND

- WASTE ROCK
- TAILINGS
- EXISTING TAILINGS

AGNICO EAGLE

TETRA TECH

TITRE / TITLE	# DWG
–	–
–	–
–	–
–	–
–	–

DESSINS EN RÉFÉRENCE/REFERENCE DRAWINGS

REV	DESCRIPTION	DATE	PAR BY
	ISSUED FOR USE	2024–01–23	HX

REVISIONS

DESSINÉ PAR DRAWN BY	EL	DATE	2024–01–23
VÉRIFIÉ PAR CHECKED BY	HX		2024–01–23
APPROUVÉ PAR APPROVED BY	HX		2024–01–23
No. PROJET PROJECT NO.	ENG.EARC03193–04		
DATE	2024–01–23		

TITRE / TITLE
AGNICO EAGLE – MELIADINE MINE

TSF CROSS–SECTIONS

ÉCHELLE/ SCALE	1:2,500	FICHIER FILE	–
No. DESSIN/ DRAWING NO.	FIGURE 2	REVISION A	FEUILLE/SHT 2 / 3

AE–CART–ANSI B

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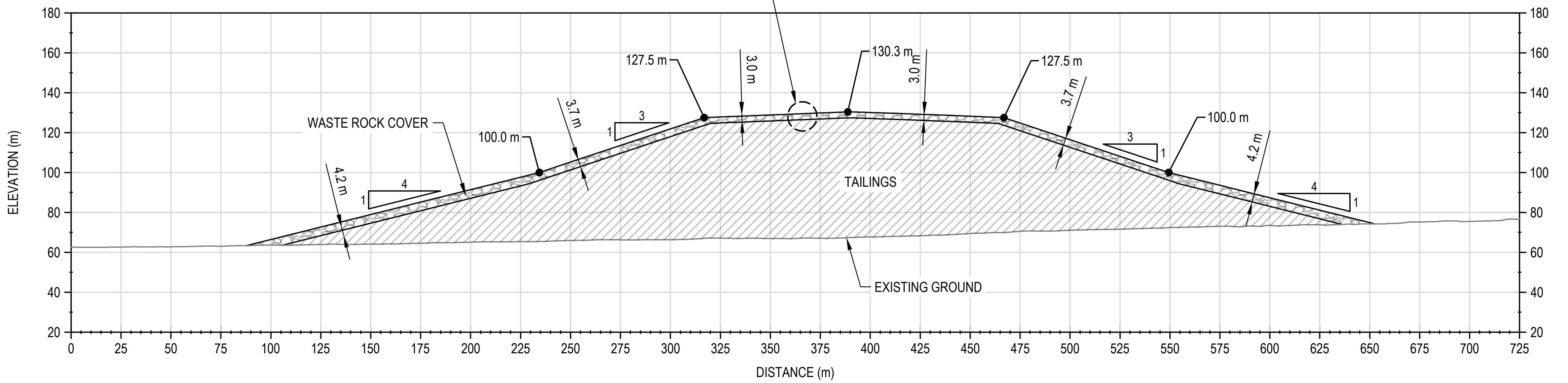
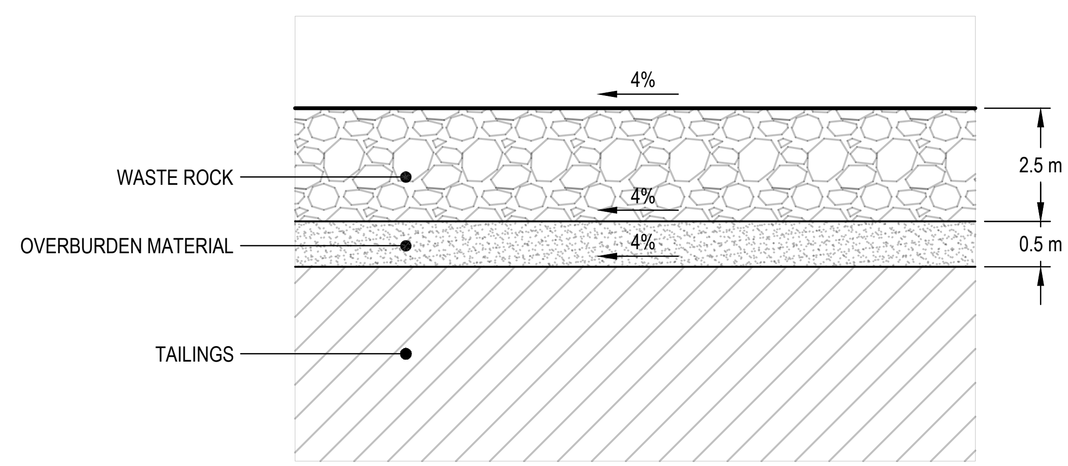
NO. DESSIN
DRAWING NO.

FORMAT ANSI B–11x17



C TYPICAL SECTION

FIG 1 SCALE: 1:1000



1 TYPICAL COVER DETAIL AT PLATEAU

FIG 2, 3 SCALE: NTS

LEGEND

- WASTE ROCK
- TAILINGS
- OVERBURDEN

AGNICO EAGLE

TETRA TECH

TITRE / TITLE	# DWG
–	–
–	–
–	–
–	–
–	–

DESSINS EN RÉFÉRENCE/REFERENCE DRAWINGS

REV	DESCRIPTION	DATE	PAR BY
	ISSUED FOR USE	2024–01–23	HX

REVISIONS

		DATE
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VÉRIFIÉ PAR / CHECKED BY	HX	2024–01–23
APPROUVÉ PAR / APPROVED BY	HX	2024–01–23

No. PROJET / PROJECT NO.: ENG.EARC03193–04

DATE: 2024–01–23

TITRE / TITLE: AGNICO EAGLE – MELIADINE MINE

TSF CROSS–SECTIONS

ÉCHELLE/SCALE: 1:2,500 FICHIER/FILE: –

No. DESSIN/DRAWING NO.: FIGURE 3 REVISION: A FEUILLE/SHT: 3 / 3

AE–CART–ANSI B

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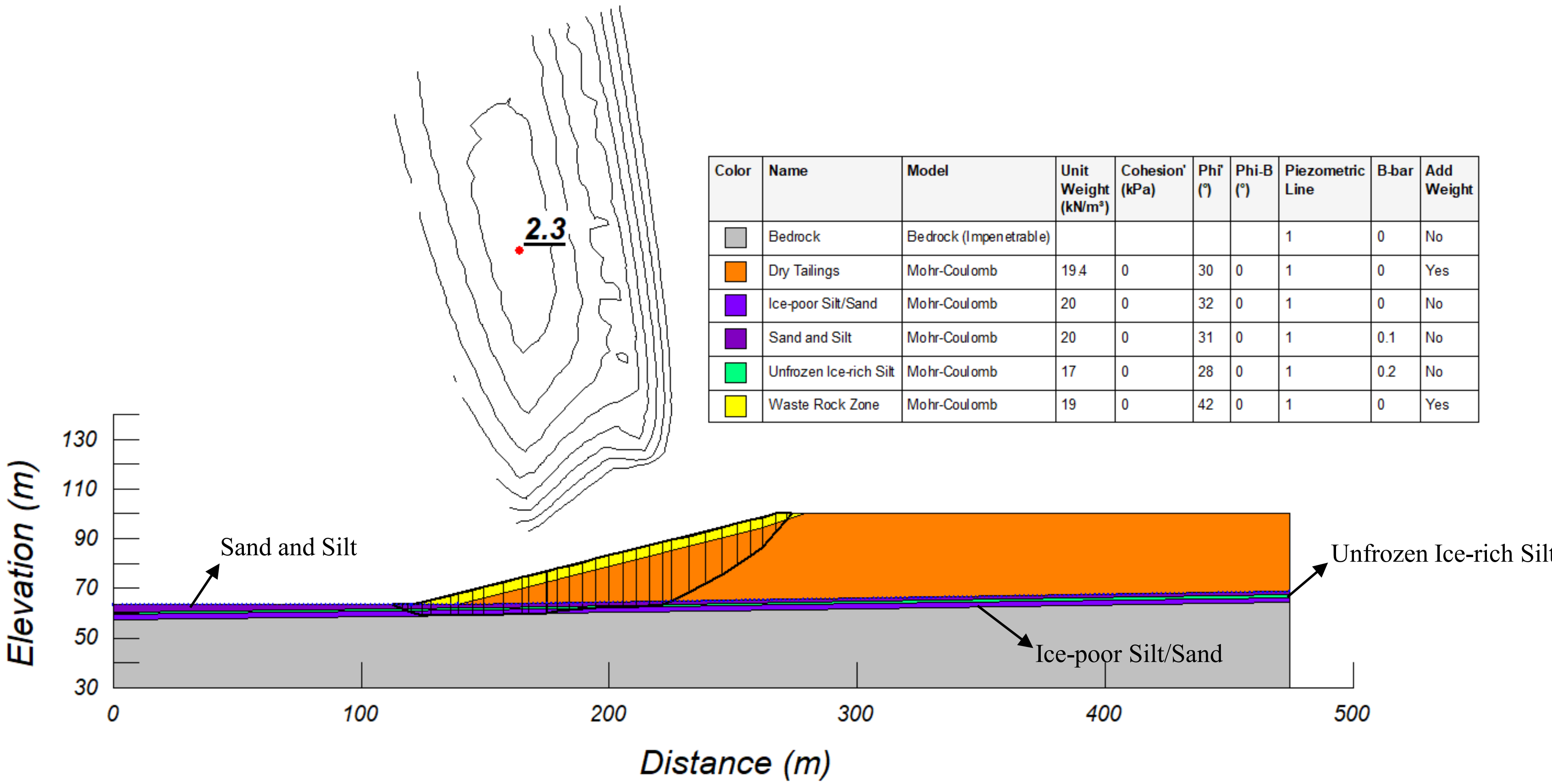
Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Bedrock	Bedrock (Impenetrable)					1	0	No
	Dry Tailings	Mohr-Coulomb	19.4	0	30	0	1	0	Yes
	Ice-poor Silt/Sand	Mohr-Coulomb	20	0	32	0	1	0	No
	Sand and Silt	Mohr-Coulomb	20	0	31	0	1	0.1	No
	Unfrozen Ice-rich Silt	Mohr-Coulomb	17	0	28	0	1	0.2	No
	Waste Rock Zone	Mohr-Coulomb	19	0	42	0	1	0	Yes



LEGEND

NOTES

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STABILITY ANALYSES FOR TAILINGS STORAGE FACILITY MELIADINE MINE, NU

Static, Short-term Analysis during Construction for Stage 1 (Elevation :100 m)

PROJECT NO.	DWN	CKD	APVD	REV
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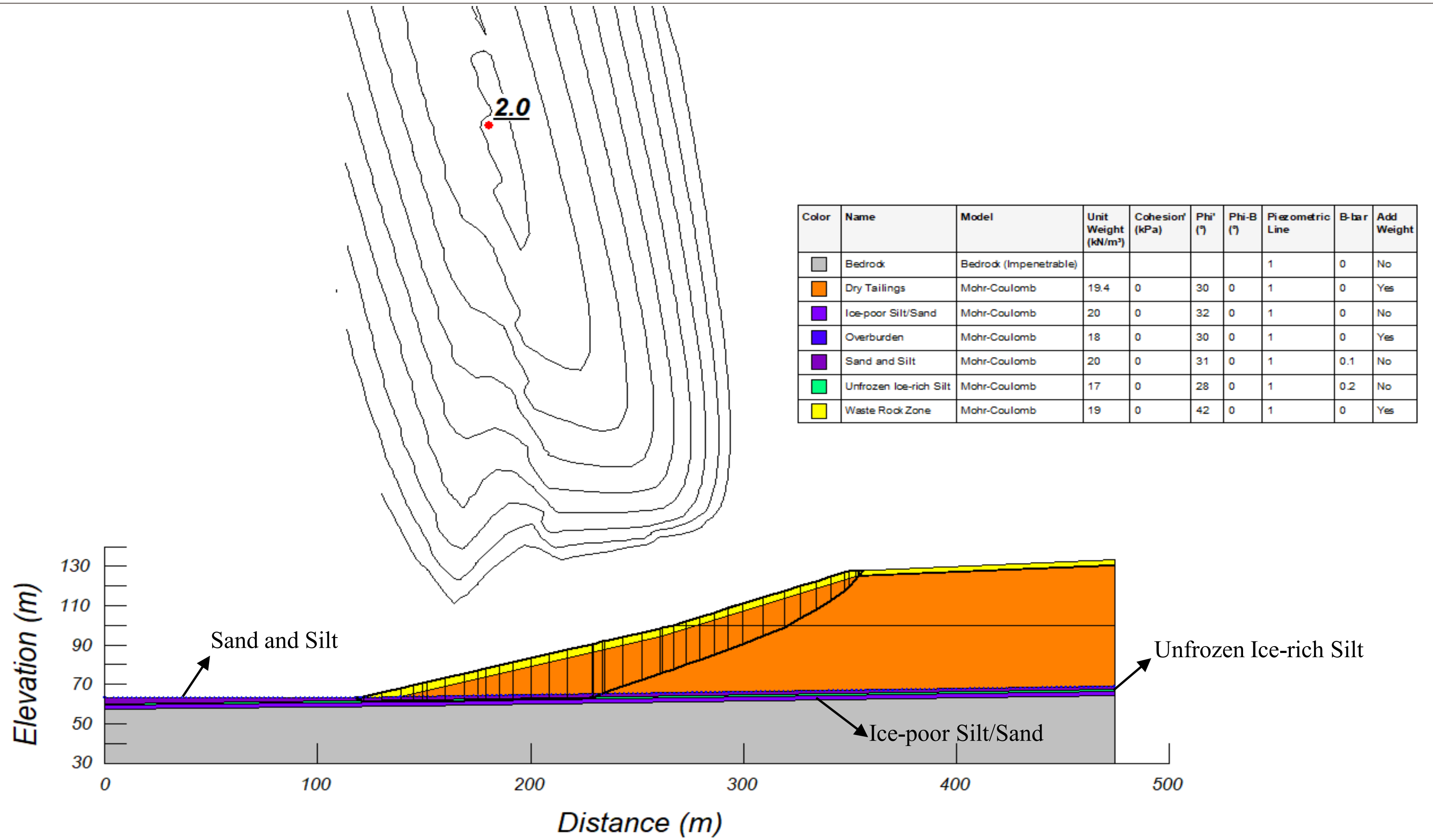
Edmonton	January 2023			

Figure 4



Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Bedrock	Bedrock (Impenetrable)					1	0	No
	Dry Tailings	Mohr-Coulomb	19.4	0	30	0	1	0	Yes
	Ice-poor Silt/Sand	Mohr-Coulomb	20	0	32	0	1	0	No
	Overburden	Mohr-Coulomb	18	0	30	0	1	0	Yes
	Sand and Silt	Mohr-Coulomb	20	0	31	0	1	0.1	No
	Unfrozen Ice-rich Silt	Mohr-Coulomb	17	0	28	0	1	0.2	No
	Waste Rock Zone	Mohr-Coulomb	19	0	42	0	1	0	Yes

LEGEND

NOTES

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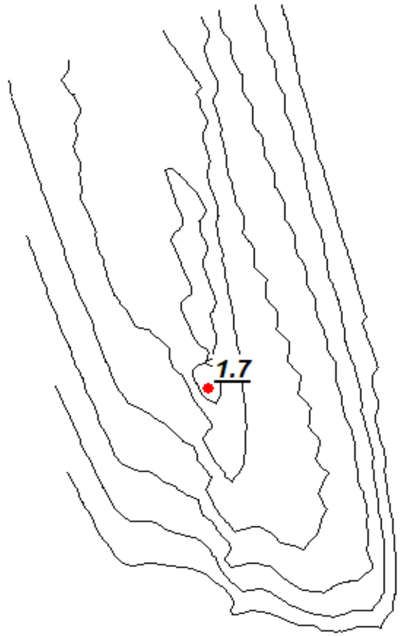
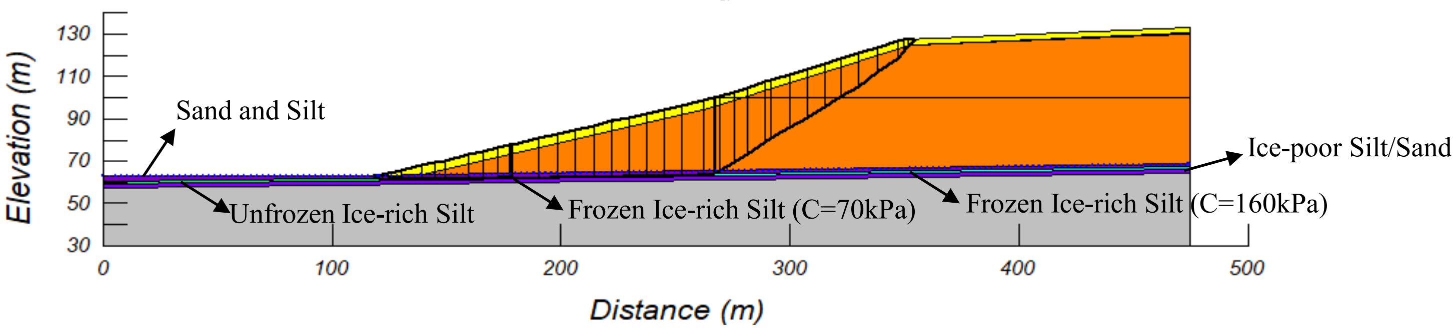
STABILITY ANALYSES FOR TAILINGS STORAGE FACILITY MELIADINE MINE, NU

Static, Short-term Analysis during Construction

PROJECT NO.	DWN	CKD	APVD	REV	
ENG.EARC03193-04	AK			A	**Figure 5**
OFFICE	DATE				
Edmonton	January 2023				



Color	Name	Model	Unit Weight (kN/m³)	Cohesion (kPa)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Bedrock	Bedrock (Impenetrable)						1		No
	Dry Tailings	Mohr-Coulomb	19.4		0	30	0	1		Yes
	Frozen Ice-rich SiltC160	Undrained (Phi=0)	17	160				1		No
	Frozen Ice-rich SiltC70	Undrained (Phi=0)	17	70				1		No
	Ice-poor Silt/Sand	Mohr-Coulomb	20		0	32	0	1		No
	Overburden	Mohr-Coulomb	18		0	30	0	1		Yes
	Sand and Silt	Mohr-Coulomb	20		0	31	0	1	0	No
	Unfrozen Ice-rich Silt	Mohr-Coulomb	17		0	28	0	1	0	No
	Waste Rock Zone	Mohr-Coulomb	19		0	42	0	1		Yes



LEGEND

NOTES

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STABILITY ANALYSES FOR TAILINGS STORAGE FACILITY MELIADINE MINE, NU

Static, Long-term Analysis after Construction, Frozen Ice-rich Silt

PROJECT NO.	DWN	CKD	APVD	REV	
ENG.EARC03193-04	AK			A	**Figure 6**
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Edmonton	January 2023				

STATUS
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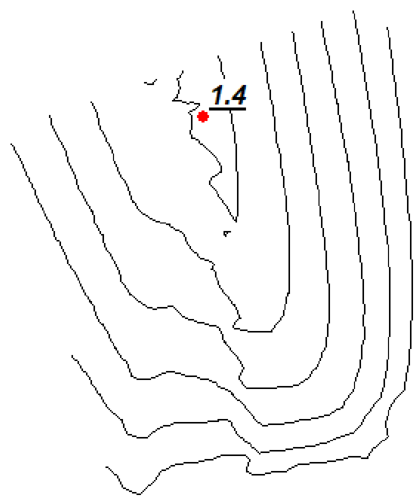
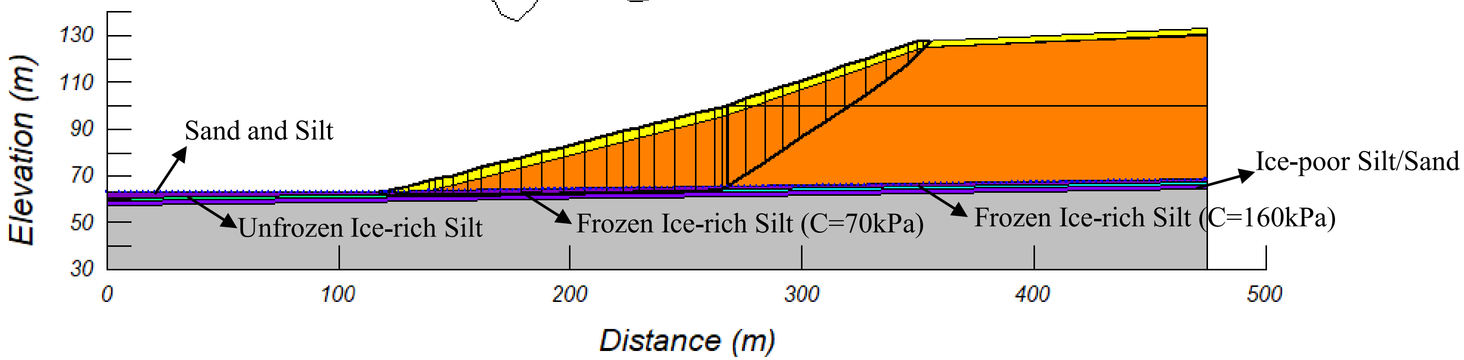


Color	Name	Model	Unit Weight (kN/m³)	Cohesion (kPa)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Bedrock	Bedrock (Impenetrable)						1	0	No
	Dry Tailings	Mohr-Coulomb	19.4		0	30	0	1	0	Yes
	Frozen Ice-rich SiltC160	Undrained (Phi=0)	17	160				1	0	No
	Frozen Ice-rich SiltC70	Undrained (Phi=0)	17	70				1	0	No
	Ice-poor Silt/Sand	Mohr-Coulomb	20		0	32	0	1	0	No
	Overburden	Mohr-Coulomb	18		0	30	0	1	0	Yes
	Sand and Silt	Mohr-Coulomb	20		0	31	0	1	0	No
	Unfrozen Ice-rich Silt	Mohr-Coulomb	17		0	28	0	1	0	No
	Waste Rock Zone	Mohr-Coulomb	19		0	42	0	1	0	Yes



LEGEND

NOTES

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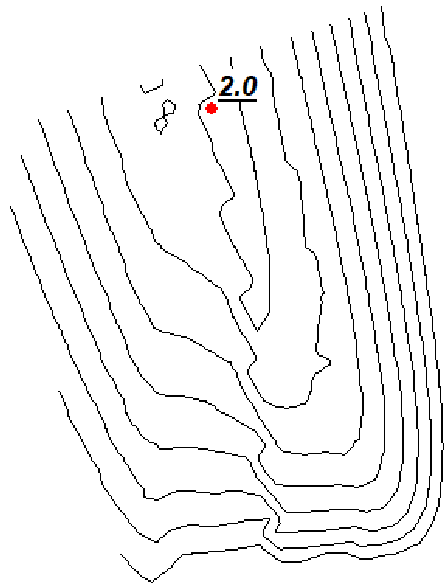
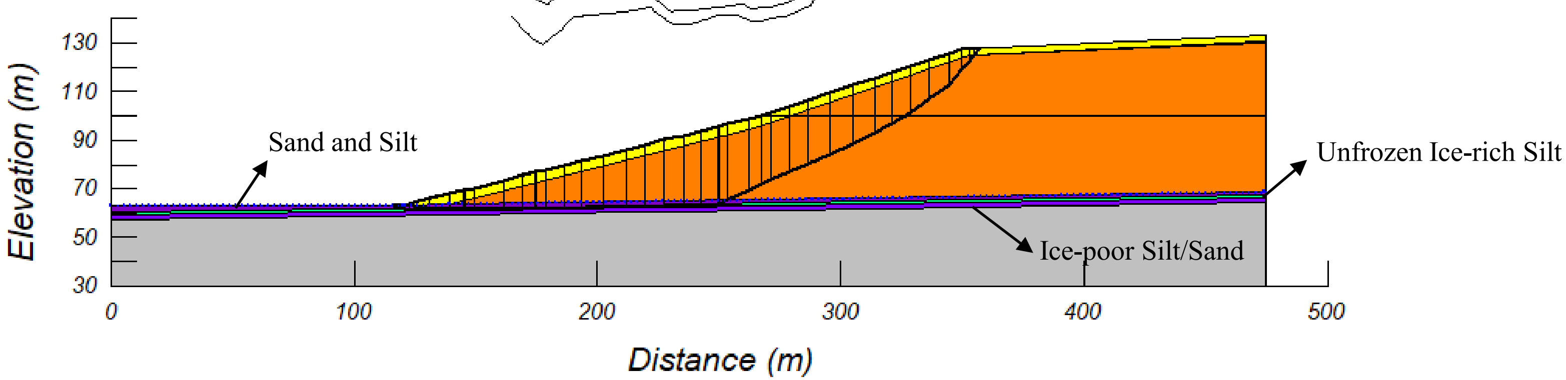
STABILITY ANALYSES FOR TAILINGS STORAGE FACILITY MELIADINE MINE, NU

Seismic, Long-term Analysis after Construction, Frozen Ice-rich Silt

PROJECT NO.	DWN	CKD	APVD	REV	
ENG.EARC03193-04	AK			A	**Figure 7**
OFFICE	DATE				
Edmonton	January 2023				



Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Bedrock	Bedrock (Impenetrable)					1	0	No
	Dry Tailings	Mohr-Coulomb	19.4	0	30	0	1	0	Yes
	Ice-poor Silt/Sand	Mohr-Coulomb	20	0	32	0	1	0	No
	Overburden	Mohr-Coulomb	18	0	30	0	1	0	Yes
	Sand and Silt	Mohr-Coulomb	20	0	31	0	1	0	No
	Unfrozen Ice-rich Silt	Mohr-Coulomb	17	0	28	0	1	0.2	No
	Waste Rock Zone	Mohr-Coulomb	19	0	42	0	1	0	Yes



LEGEND

NOTES

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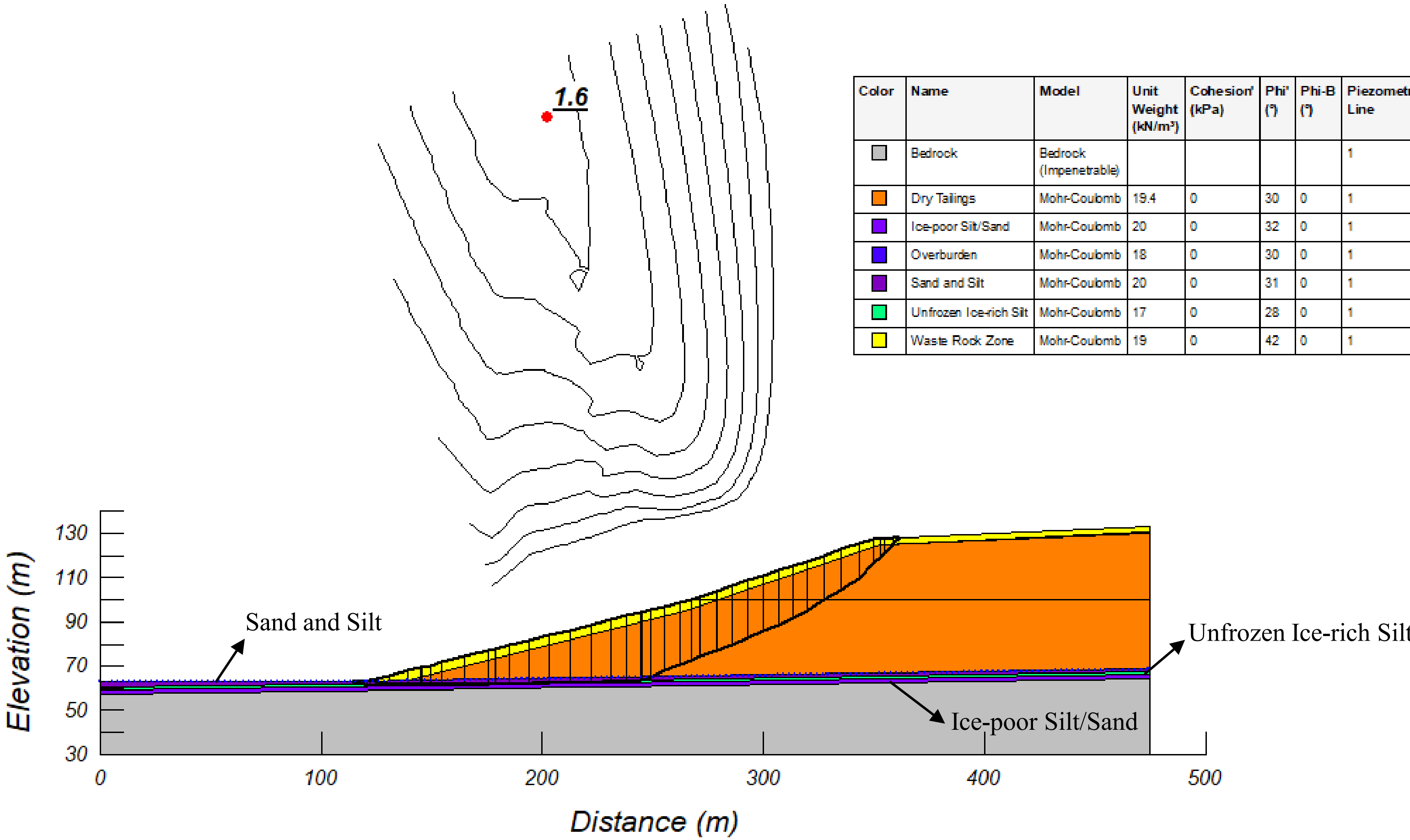
STABILITY ANALYSES FOR TAILINGS STORAGE FACILITY MELIADINE MINE, NU

Static, Long-term Analysis after Construction with Thawing Ice-rich Silt

PROJECT NO.	DWN	CKD	APVD	REV
ENG.EARC03193-04	AK			A
OFFICE	DATE			
Edmonton	January 2023			

Figure 8



Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Bedrock	Bedrock (Impenetrable)					1	0	No
	Dry Tailings	Mohr-Coulomb	19.4	0	30	0	1	0	Yes
	Ice-poor Silt/Sand	Mohr-Coulomb	20	0	32	0	1	0	No
	Overburden	Mohr-Coulomb	18	0	30	0	1	0	Yes
	Sand and Silt	Mohr-Coulomb	20	0	31	0	1	0	No
	Unfrozen Ice-rich Silt	Mohr-Coulomb	17	0	28	0	1	0.2	No
	Waste Rock Zone	Mohr-Coulomb	19	0	42	0	1	0	Yes

LEGEND

NOTES

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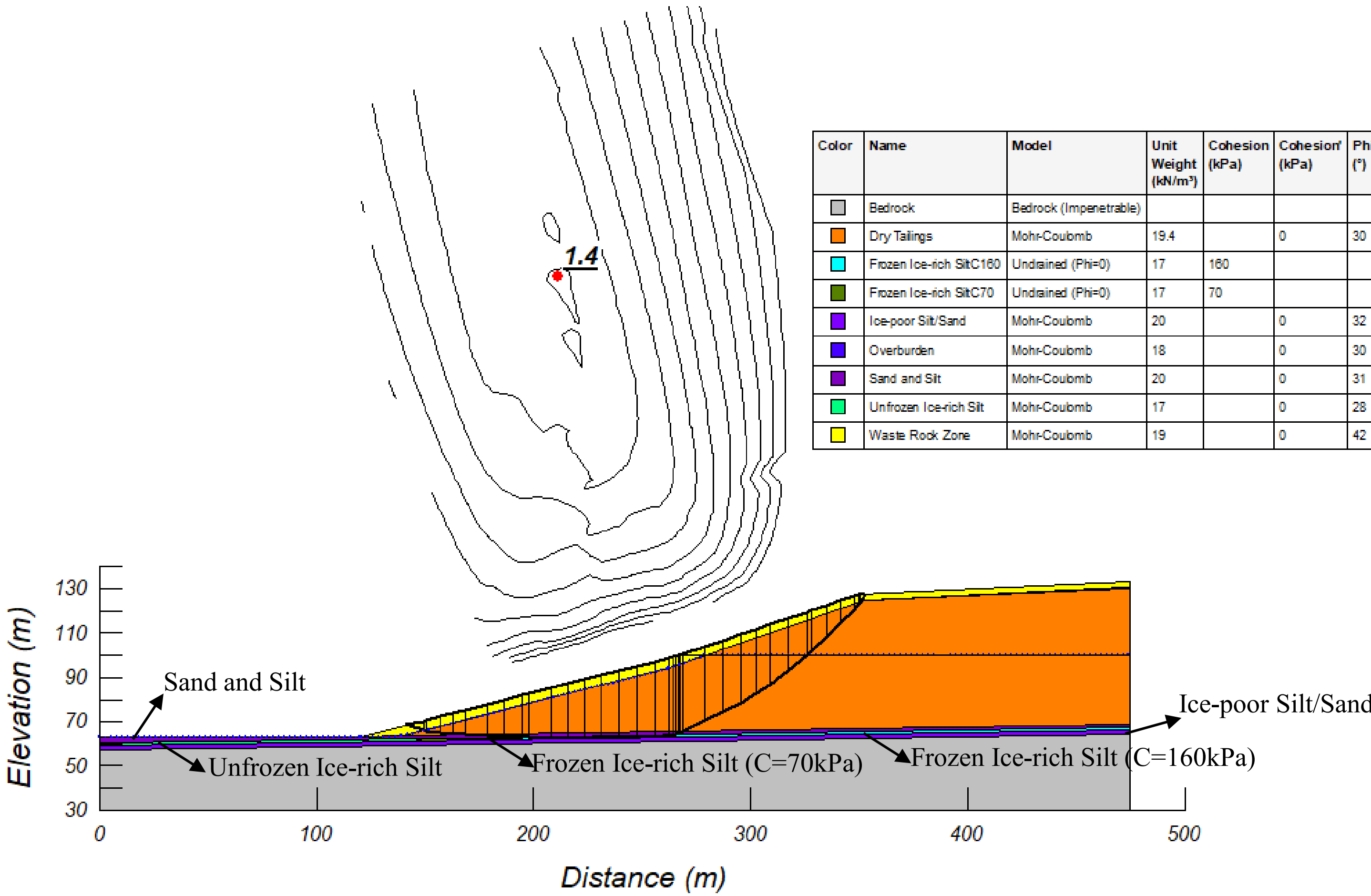
STABILITY ANALYSES FOR TAILINGS STORAGE FACILITY MELIADINE MINE, NU

Seismic, Long-term Analysis after Construction with Thawing Ice-rich Silt

PROJECT NO.	DWN	CKD	APVD	REV
ENG.EARC03193-04	AK			A
OFFICE	DATE			
Edmonton	January 2023			

Figure 9



Color	Name	Model	Unit Weight (kN/m³)	Cohesion (kPa)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Bedrock	Bedrock (Impenetrable)						1	0	No
	Dry Tailings	Mohr-Coulomb	19.4		0	30	0	1	0	Yes
	Frozen Ice-rich SiltC160	Undrained (Phi=0)	17	160				1	0	No
	Frozen Ice-rich SiltC70	Undrained (Phi=0)	17	70				1	0	No
	Ice-poor Silt/Sand	Mohr-Coulomb	20		0	32	0	1	0	No
	Overburden	Mohr-Coulomb	18		0	30	0	1	0	Yes
	Sand and Silt	Mohr-Coulomb	20		0	31	0	1	0	No
	Unfrozen Ice-rich Silt	Mohr-Coulomb	17		0	28	0	1	0	No
	Waste Rock Zone	Mohr-Coulomb	19		0	42	0	1	0	Yes

LEGEND

NOTES

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STABILITY ANALYSES FOR TAILINGS STORAGE FACILITY MELIADINE MINE, NU

Static, Long-term Analysis after Construction, Frozen Ice-rich Silt and Saturated Tailing at 100 m

PROJECT NO.	DWN	CKD	APVD	REV
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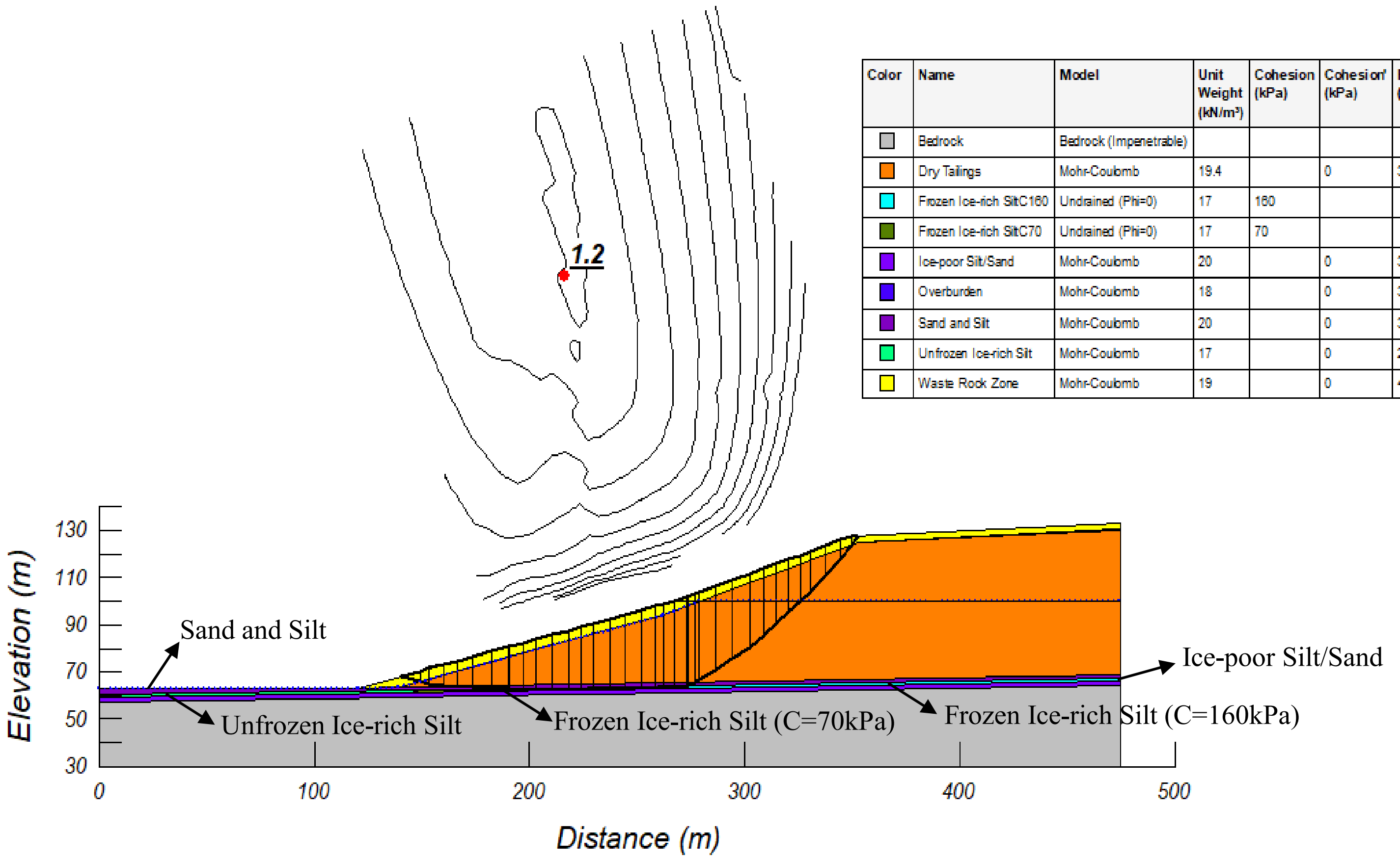
OFFICE	DATE			
Edmonton	January 2023			

Figure 10



Color	Name	Model	Unit Weight (kN/m³)	Cohesion (kPa)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Bedrock	Bedrock (Impenetrable)						1	0	No
	Dry Tailings	Mohr-Coulomb	19.4		0	30	0	1	0	Yes
	Frozen Ice-rich SiltC160	Undrained (Phi=0)	17	160				1	0	No
	Frozen Ice-rich SiltC70	Undrained (Phi=0)	17	70				1	0	No
	Ice-poor Silt/Sand	Mohr-Coulomb	20		0	32	0	1	0	No
	Overburden	Mohr-Coulomb	18		0	30	0	1	0	Yes
	Sand and Silt	Mohr-Coulomb	20		0	31	0	1	0	No
	Unfrozen Ice-rich Silt	Mohr-Coulomb	17		0	28	0	1	0	No
	Waste Rock Zone	Mohr-Coulomb	19		0	42	0	1	0	Yes

LEGEND

NOTES

PGA: 0.0498 g

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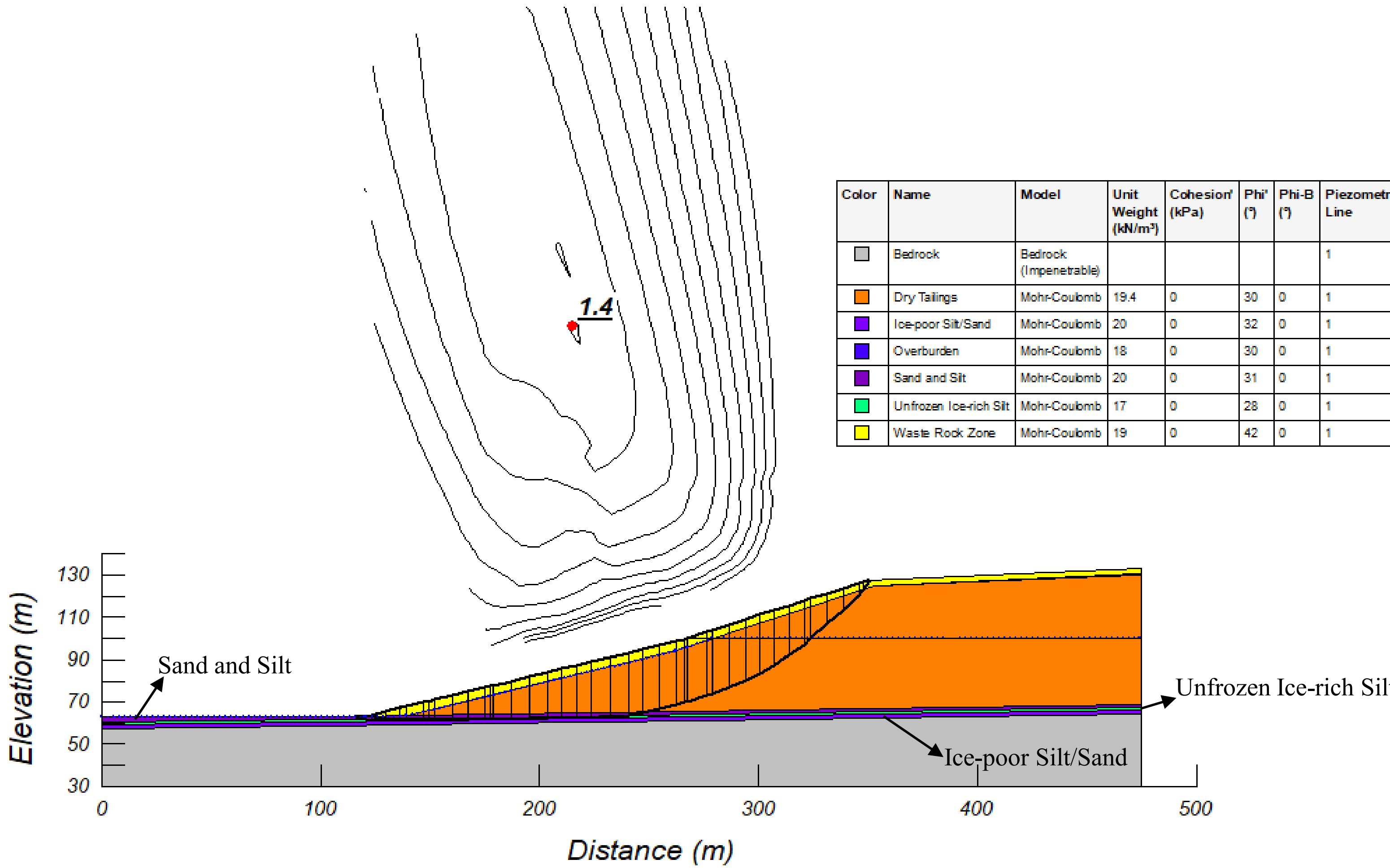
STABILITY ANALYSES FOR TAILINGS STORAGE FACILITY MELIADINE MINE, NU

Seismic, Long-term Analysis after Construction, Frozen Ice-rich Silt and Saturated Tailing at 100 m

PROJECT NO.	DWN	CKD	APVD	REV
ENG.EARC03193-04	AK			A
OFFICE	DATE			
Edmonton	January 2023			

Figure 11



Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Bedrock	Bedrock (Impenetrable)					1	0	No
	Dry Tailings	Mohr-Coulomb	19.4	0	30	0	1	0	Yes
	Ice-poor Silt/Sand	Mohr-Coulomb	20	0	32	0	1	0	No
	Overburden	Mohr-Coulomb	18	0	30	0	1	0	Yes
	Sand and Silt	Mohr-Coulomb	20	0	31	0	1	0	No
	Unfrozen Ice-rich Silt	Mohr-Coulomb	17	0	28	0	1	0	No
	Waste Rock Zone	Mohr-Coulomb	19	0	42	0	1	0	Yes

LEGEND

NOTES

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STABILITY ANALYSES FOR TAILINGS STORAGE FACILITY MELIADINE MINE, NU

Static, Long-term Analysis after Construction, Unfrozen Ice-rich Silt and Saturated Tailing at 100 m

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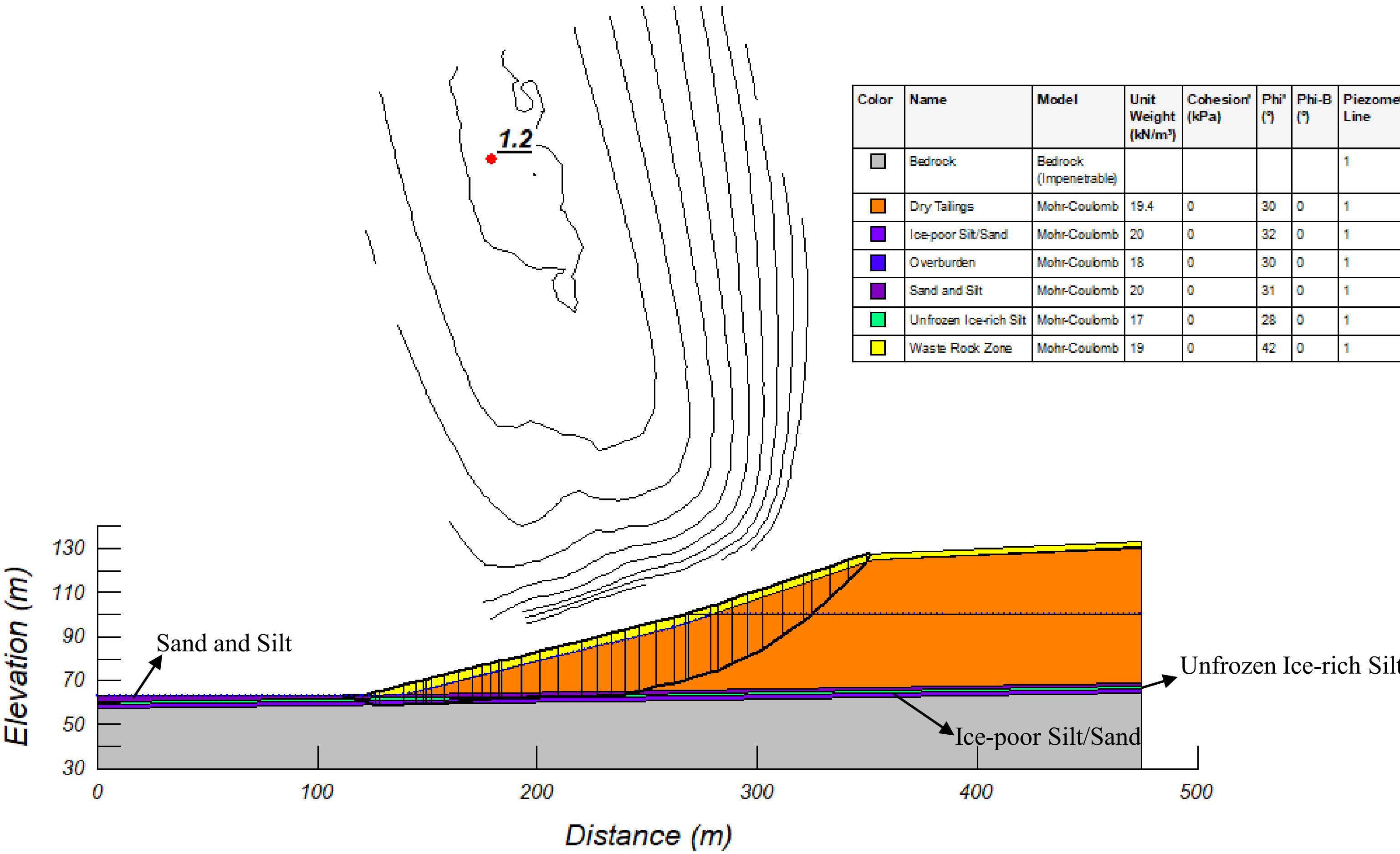
OFFICE	DATE			
Edmonton	January 2023			

Figure 12



Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Bedrock	Bedrock (Impenetrable)					1		No
	Dry Tailings	Mohr-Coulomb	19.4	0	30	0	1		Yes
	Ice-poor Silt/Sand	Mohr-Coulomb	20	0	32	0	1		No
	Overburden	Mohr-Coulomb	18	0	30	0	1		Yes
	Sand and Silt	Mohr-Coulomb	20	0	31	0	1	0	No
	Unfrozen Ice-rich Silt	Mohr-Coulomb	17	0	28	0	1	0	No
	Waste Rock Zone	Mohr-Coulomb	19	0	42	0	1		Yes

LEGEND

NOTES

PGA: 0.0498 g

STATUS
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STABILITY ANALYSES FOR TAILINGS STORAGE FACILITY MELIADINE MINE, NU

Seismic, Long-term Analysis after Construction, Unfrozen Ice-rich Silt and Saturated Tailing at 100 m

PROJECT NO.	DWN	CKD	APVD	REV
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Figure 13

APPENDIX A

LIMITATIONS ON USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL

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The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

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While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary investigation and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.8 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.9 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.10 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

1.11 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.12 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.13 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

1.14 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.15 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

1.16 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

1.17 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.