A TETRA TECH COMPANY

December 14, 2012

ISSUED FOR USE
EBA FILE: W14103083-01
Via Email: Kirsten.Hulstein@gov.yk.ca

Assessment and Abandoned Mines
Yukon Government
PO Box 2703 (K-419)
Whitehorse, YT Y1A 2C6

Attention: Kirsten Hulstein – Project Manager

Subject: Final Report - Fall 2012 Geotechnical Drilling and Instrumentation Installation Program
Mount Nansen Site, Yukon

1.0 INTRODUCTION

1.1 General

Yukon Government Assessment and Abandoned Mines (AAM) retained EBA Engineering Consultants Ltd. operating as EBA, A Tetra Tech Company (EBA), to supply and install PVC standpipes, ground temperature cables, and pneumatic piezometers to monitor groundwater flow and permafrost conditions at the Mount Nansen Site, located approximately 60 km west of Carmacks, Yukon. This report includes a summary of the geotechnical drill program, subsurface conditions, and instrumentation installed. It also contains discussion of the drill program findings, the potential impacts on the dam structure, and recommendations for future work.

Authorization to complete this work was received by way of a signed AAM contract dated September 18, 2012. For additional information regarding use of this report, please refer to EBA's General Conditions in Appendix A.

1.2 Project Description

The Mount Nansen Site is located approximately 60 km west of Carmacks, Yukon. Annual geotechnical inspections completed by EBA, as well as recent seepage observations, have led to the assumption that surface water from Dome Creek may be reporting to the seepage collection pond. Another indication of possible hydraulic connection is the recent increase in reported pumping rates from the seepage collection pond, as compared to historical data. It is possible that water from the Dome Creek diversion spillway may be travelling underground along the top of permafrost, through the sand terrace below the north tailings dam abutment, and daylighting in the seepage collection pond. It is also possible that a hydraulic connection exists between the original Dome Creek channel and the seepage collection pond through a subsurface flow path into or under the tailings impoundment. The geotechnical drill and instrumentation installation program was undertaken to investigate the possibility of a hydraulic connection between Dome Creek and the seepage collection pond by way of the two scenarios described above.

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1.3 Scope of Services

The scope of services for this project was detailed in the contract signed by AAM and EBA on September 18, 2012 titled "Drilling and Site Instrumentation Installation at Tailings Facility". The scope of services for this project is summarized below:

- Drill three holes between the Dome Creek diversion spillway and the seepage collection pond to assess the subsurface soil conditions and install instrumentation;
- Drill one hole in the upper portion of the tailings pond to determine if there is any seepage into the pond along the original Dome Creek channel;
- Complete laboratory analysis on select soil samples collected during the drill program;
- Prepare a memo summarizing field activities; and
- Prepare a final report summarizing the drill program findings, subsurface conditions, instrumentation details, potential impacts on the dam structure, and recommendations for future work.

2.0 GEOTECHNICAL DRILL PROGRAM

The geotechnical drill program was conducted between October 1 and October 3, 2012 and consisted of four boreholes advanced to varying depths with a Nodwell mounted CME75 auger drill rig equipped with hollow stem augers. The drill was operated by Don Pillsworth of Donjeck Drilling in Whitehorse, Yukon. EBA's site representative was Justin Pigage, P. Eng. Details of the geotechnical drill program are summarized in the following sections.

2.1 Borehole Locations

The approximate location of each borehole was determined prior to the geotechnical drill program based on investigating the assumption that Dome Creek and the seepage collection pond are hydraulically connected by water flowing along the top of permafrost or under the tailings pond. Prior to beginning the geotechnical drill program the locations of each borehole were identified by EBA and AAM site personnel. The final borehole locations are shown on Figure 1 and summarized below in Table 1. The borehole coordinates were obtained using a handheld GPS unit and the elevations were measured off of the benchmark "Dam127" using a rod and level. The elevation of BH03 was estimated from contour maps.

Table 1: Borehole Locations

Borehole	Northing[1] (m)	Easting[1] (m)	Elevation[2] (m)
W14103083-BH01	6,880,668	389,526	1,094.8
W14103083-BH02	6,880,668	389,561	1,091.6
W14103083-BH03	6,880,732	389,132	1,099
W14103083-BH04	6,880,666	389,543	1,092.8

1) Coordinates are UTM Zone 8 (NAD83 datum)

2) Elevations for BH01, BH02, and BH04 surveyed (0.1 m accuracy) Elevation for BH03 estimated from contour maps (1 m accuracy)

Borehole W14103083-BH01 was located approximately half way between the Dome Creek diversion spillway and seepage collection pond on the upper (west) limit of where the subsurface flow might be located based on information from other monitoring wells in the area and the location of observed seepage into the seepage collection pond.

Borehole W14103083-BH02 was located approximately half way between the Dome Creek diversion spillway and seepage collection pond on the lower (east) limit of where the subsurface flow might be located. The lower limit of the assumed subsurface flow was estimated based on the assumption that frozen ground near the seepage collection pond from the dam Thermosyphons prevents subsurface flow downslope of this.

Borehole W14103083-BH03 was located at the upper (west) end of the tailings impoundment where the Dome Creek diversion begins. BH03 was drilled to investigate if Dome Creek is hydraulically connected to the seepage collection pond through a subsurface flow path into or under the tailings impoundment. The ground surface elevation was estimated based on contour maps because the known benchmark on site is too far from the borehole location to easily survey.

Borehole W14103083-BH04 was located approximately half way between BH01 and BH02.

2.2 Subsurface Conditions

The subsurface conditions observed at each borehole location are summarized in this section. BH01, BH02 and BH04 were advanced between the Dome Creek diversion spillway and seepage collection pond. Subsurface conditions for this area are summarized below in Table 2. BH03 was advanced at the upper (west) end of the tailings impoundment where the Dome Creek diversion begins. Subsurface conditions at BH03 are summarized below in Table 3.

Table 2: Subsurface Conditions BH01, BH02, and BH04 – Above Seepage Collection Pond

Soil Type	Strata Depth Range (m)		
	W14103083-BH01	W14103083-BH02	W14103083-BH04
SAND	0.0 – 14.0	0.0 – 14.0	0.0 – 14.3
SILT	14.0 – 14.6	–	14.3 – 18.3
End of Borehole	14.6	14.0	18.3

General subsurface conditions in BH01, BH02, and BH04 consist of 5.2 m of unfrozen sand, over about 8.8 m of frozen sand, over frozen silt. BH04 ended at 18.3 m due to auger refusal on possible bedrock, BH02 ended at the target depth of 14.0 m, and BH01 ended at 14.6 m due to auger refusal in frozen silt. Complete borehole logs and particle size test results are included in Appendix B of this report.

Sand samples recovered from depths of 6.0 to 6.2 m in BH02 and 12.0 to 12.2 m in BH04 were selected for particle size testing to verify field descriptions identifying similar sands over a range of depths in BH01, BH02, and BH04.

Table 3: Subsurface Conditions BH03 – Upper Tailings Pond

Soil Type	Strata Depth Range (m)
	W14103083-BH03
SAND (Fill)	0.0 – 1.0
SAND	1.0 – 3.0
SILT	3.0 – 4.8
SAND	4.8 – 13.0
End of Borehole	13.0

General subsurface conditions in BH03 consist of 1.0 m of sand fill, over 2.0 m of sand, over 1.8 m of frozen silt, over frozen sand. BH03 ended at 13.0 m due to auger refusal on possible bedrock. A complete borehole log for BH03 is included in Appendix B of this report.

2.2.1 Groundwater

Groundwater was noted during the drill program above the surface of the permafrost in BH02 at a depth of around 4.6 m, no groundwater was noted in BH01 or BH04. In BH03, groundwater was noted at the base of the fill layer at a depth of around 1.0 m.

2.2.2 Permafrost

Permafrost was encountered in all boreholes advanced during the drill program. The depths to permafrost are summarized in Table 4.

Table 4: Depths to Permafrost

Borehole ID	Depth to Permafrost (m)
W14103083-BH01	5.2
W14103083-BH02	5.2
W14103083-BH03	3.0
W14103083-BH04	5.2

The organics noted below the surficial sand fill in BH03 provide insulation to the underlying permafrost. No organics were noted in the other boreholes advanced during the geotechnical drill program. Permafrost is likely closer to the surface in BH03 because of this insulating organic layer.

2.2.3 Bedrock

The drill program was conducted using an auger drill rig, making confirmation of bedrock difficult. BH03 and BH04 were terminated due to auger refusal on possible bedrock at depths of 13.0 m and 18.3 m, respectively. A split spoon sampler was driven after auger refusal in BH03 and BH04 to better determine the ground conditions forcing refusal. In both samples, angular rock chips were recovered indicating refusal on bedrock or a large boulder.

3.0 INSTRUMENTATION

Several instruments were installed in each borehole during the geotechnical drill program to monitor the ground temperature and depth to groundwater. The following sections summarize the instrumentation installed.

3.1 Standpipes

A 50 mm PVC standpipe was installed in each borehole during the geotechnical drill program to allow for manual monitoring of the depth to groundwater and water sampling. The standpipes were backfilled to surface with native sand (BH01, BH02, and BH04) and silica sand (BH03). Bentonite plugs to prevent surface water from entering the standpipes were placed about 1.5 m below the ground surface in each borehole. A protective steel cover was placed over each standpipe to prevent damage to the installations. Each steel cover was anchored in place with concrete mixed on site. The standpipes were installed with a slotted section of PVC over the depth range groundwater was encountered during the drill program, or spanning the permafrost surface if no evidence of groundwater was observed. Details of the standpipe installations are summarized in Table 5, and well diagrams are included on the borehole logs in Appendix B.

Table 5: Summary of Standpipe Installations

Borehole ID	Borehole Depth (m)	Standpipe Depth (m)	Slotted Range (m)
W14103083-BH01	14.6	14.6	2.5 – 8.4
W14103083-BH02	14.0	13.7	3.0 – 7.6
W14103083-BH03	13.0	13.0	0.9 – 10.0
W14103083-BH04	18.3	18.3	3.0 – 18.3

3.2 Ground Temperature Cables

Ground temperature cables were installed in each borehole during the geotechnical drill program to monitor the permafrost conditions on site. A summary of the ground temperature cables installed is provided in Table 6, calibration records for each instrument are included in Appendix C of this report. Plots of ground temperature readings taken to date are included in Appendix D of this report.

Table 6: Summary of Ground Temperature Cable Installations

Borehole ID	Ground Temperature Cable	Bead Number	Bead Depth (m)	Bead Elevation[2] (m)
W14103083-BH01	EBA GTC 2364	1	0.6	1094.2
		2	1.6	1093.2
		3	3.6	1091.2
		4	5.6	1089.2
		5	7.6	1087.2
		6	9.6	1085.2
		7	11.6	1083.2
		8	14.6	1080.2
W14103083-BH02	EBA GTC 2365	1	1.7	1089.9
		2	3.7	1087.9
		3	5.7	1085.9
		4	7.7	1083.9
		5	9.7	1081.9
		6	11.7	1079.9
		7	13.7	1077.9
W14103083-BH03	EBA GTC 2362[1]	1	1	1098
		2	3	1096
		3	5	1094
		11	6	1093
		4	7	1092
		10	8	1091
		5	9	1090
		9	10	1089
		6	11	1088
		8	12	1087
		7	13	1086
W14103083-BH04	EBA GTC 2363[1]	1	2.3	1090.5
		2	4.3	1088.5
		3	6.3	1086.5
		4	8.3	1084.5
		5	10.3	1082.5
		6	12.3	1080.5
		7	14.3	1078.5
		11	15.3	1077.5
		8	16.3	1076.5
		10	17.3	1075.5
		9	18.3	1074.5

1) The ground temperature cables were pre-ordered for deeper boreholes, some were folded over to fit the boreholes as drilled. This resulted in 1 m bead spacing in the bottom of some boreholes.

2) Elevations for BH01, BH02, and BH04 surveyed (0.1 m accuracy) Elevation for BH03 estimated from contour maps (1 m accuracy)

3.3 Pneumatic Piezometers

Pneumatic piezometers measure pressure applied by groundwater above the elevation of the instrument. The pressure reading and the piezometer installation depth are used to determine the groundwater elevation at the time of reading. To function properly, they must be installed in unfrozen ground and submerged in groundwater.

Pneumatic piezometers were installed in three of the four boreholes during the geotechnical drill program. The piezometers in BH01, BH02 and BH04 were installed in the permafrost below the groundwater elevation noted during the geotechnical drill program. The piezometers will not function properly until permafrost thaw has advanced below the instrument depths. A pneumatic piezometer was not installed in BH03 because the shallow permafrost depth made it impractical.

A summary of the pneumatic piezometers installed is provided in Table 7, calibration records for each instrument are included in Appendix C of this report. Initial readings taken from the piezometers have been included in Table 7. The initial readings are not representative of the actual groundwater conditions because they were taken immediately after drilling, before any groundwater had a chance to stabilize, and before freeze-back in the permafrost. The initial readings have been included to confirm the piezometers were functioning at the time they were installed.

Table 7: Summary of Pneumatic Piezometer Installations

Borehole ID	Pneumatic Piezometer	Piezometer Elevation (m)	Initial Reading (psi) October 11, 2012
W14103083-BH01	RST 034991	1080.2	0.9
W14103083-BH02	RST 034992	1077.9	14.6
W14103083-BH04	RST 034990	1086.7	1.8
	RST 034989	1074.5	18.3

4.0 DISCUSSION

The purpose of the geotechnical drill and instrumentation program was to investigate the assumption that recent seepage observed on the north side of the seepage collection pond is the result of a hydraulic connection between Dome Creek and the seepage collection pond. Surface water from the Dome Creek diversion spillway may be travelling underground along the top of permafrost through the sand terrace below the tailings dam and/or water from the original Dome Creek channel may be travelling through a subsurface flow path into or under the tailings impoundment. The following sections discuss the findings of the drill program, the potential impacts on the tailings dam structure, and recommendations for future work on the site.

4.1 Drill Program Findings

Groundwater noted in BH02 during the geotechnical investigation supports the assumption that surface water from the Dome Creek diversion spillway may be travelling underground along the top of permafrost and daylighting in the seepage collection pond. During construction of the original spillway in 1996, permafrost was encountered directly below the surficial moss cover (*Klohn-Crippen 1996*). During the

geotechnical drill program, permafrost was noted at a depth of 5.2 m. Initial ground temperature readings also confirm the permafrost has thawed to about 5 m. The subsurface soil conditions downslope of the north abutment consist of sand, underlain by frozen sand, underlain by silt. The unfrozen sand is sufficiently coarse to allow for groundwater flow. It is likely that the increased seepage and glaciation events observed recently in the seepage collection pond are a result of water travelling from the unlined Dome Creek diversion spillway along the top of permafrost through the unfrozen sand terrace.

Borehole W14103083-BH03 was advanced at the upper (west) end of the tailings pond where the Dome Creek diversion begins, to determine if Dome Creek is hydraulically connected to the seepage collection pond through a subsurface flow path into or under the tailings impoundment. Subsurface conditions encountered in BH03 consist of about 3.0 m of wet sand, underlain by 1.8 m of frozen silt, underlain by frozen sand. Permafrost was noted during the geotechnical drill program at a depth of around 3.0 m and initial ground temperature readings confirm the ground is frozen below that depth. Due to the relatively shallow depth of permafrost in the vicinity of BH03, it is unlikely that Dome Creek is hydraulically connected to the seepage collection pond by a subsurface flow path into or under the tailings impoundment.

4.2 Impact on Dam Structure

To date the seepage water observed in the seepage collection pond has been free of sediment, indicating there is no significant particle transport through the sand terrace. Provided the seepage remains clear, there is low probability of negative impact to the overall stability of the tailings dam in the immediate future. If the seepage becomes turbid, sediment transport may be occurring downstream of the north abutment, which could lead to subsurface voids and ultimately overall tailings dam instability.

4.3 Future Work

As permafrost thaw advances, the volume of water travelling through the sand terrace may increase. Increased flow could result in sediment transport, subsurface voids, and ultimately tailings dam instability through erosion of the sand terrace and downslope support of the north abutment. The groundwater elevation and ground temperature should be monitored in the boreholes advanced during the geotechnical drill program. The seepage observed entering the seepage collection pond should also be monitored for signs of increased turbidity.

EBA recommends the ground temperature cables be read monthly. Data sheets that can be used to record ground temperature data have been included in Appendix E of this report.

The pneumatic piezometers installed during the geotechnical investigation will not provide valid data until permafrost thaw has advanced below instrumentation elevations. It is not necessary to read the piezometers until the permafrost has thawed to their elevation. EBA recommends monthly readings of the pneumatic piezometers after the ground temperature data indicates sufficient permafrost thaw has occurred. Data sheets that can be used to record pneumatic piezometer readings have been included in Appendix E of this report.

Depth to water in the standpipes installed during the geotechnical investigation should be recorded at the same frequency as the other instrumentation readings on site. This information can be recorded on the

piezometer data sheets included in Appendix E of this report. In addition, water samples collected from the standpipes should be analyzed and compared to the water in the Dome Creek diversion spillway to determine if they are related.

Finally, EBA recommends onsite staff perform daily visual inspections of the seepage water entering the seepage collection pond from the sand terrace. If increased turbidity is noted during these daily inspections, EBA should be notified immediately. EBA will also visually inspect the seepage twice annually (spring and fall) as part of the ongoing annual geotechnical site inspections.

5.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Yukon Government and their agents. EBA Engineering Consultants Ltd. operating as EBA, A Tetra Tech Company, 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 Yukon Government, 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. EBA's General Conditions are provided in Appendix A of this report.

6.0 CLOSURE

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

Sincerely,
EBA Engineering Consultants Ltd.

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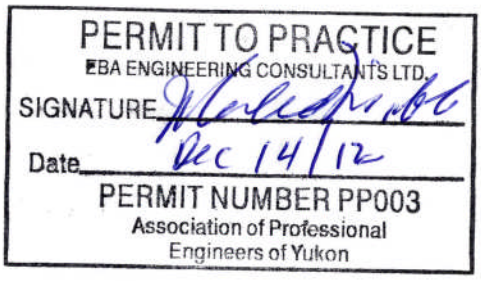


REFERENCES

Klohn-Crippen, 1996. Mount Nansen Tailings Facility Construction Report May to October 1996.

FIGURES

LEGEND:

- NEW INSTRUMENTATION
- EXISTING INSTRUMENTATION
- T - THERMISTOR
- P - PIEZOMETER

0 100

Scale: 1 : 1750 (metres)

CLIENT

Yukon Government
Department of Energy, Mines and Resources
Assessment of Abandoned Mines

eba
A TETRA TECH COMPANY

MOUNT NANSEN SITE
WEST OF CARMACKS, YUKON

SITE PLAN SHOWING BOREHOLE LOCATIONS

PROJECT NO.	DWN	CKD	REV
W14103083-01	CB	JTP	0
OFFICE: EBA-WHSE	DATE: December 13, 2012		

Figure 1

PHOTOGRAPHS

Photo 1: Nodwell mounted CME75 drill rig equipped with hollow stem augers
Facing north (October 2, 2012)

Photo 2: Drilling BH03
Facing south (October 2, 2012)

Photo 3: Frozen silt encountered in BH03
(October 2, 2012)

Photo 4: Drilling BH04
Facing south (October 3, 2012)

Photo 5: Frozen sand encountered in BH01, BH02, and BH04 (October 3, 2012)

Photo 6: Typical completed installation (October 2, 2012)

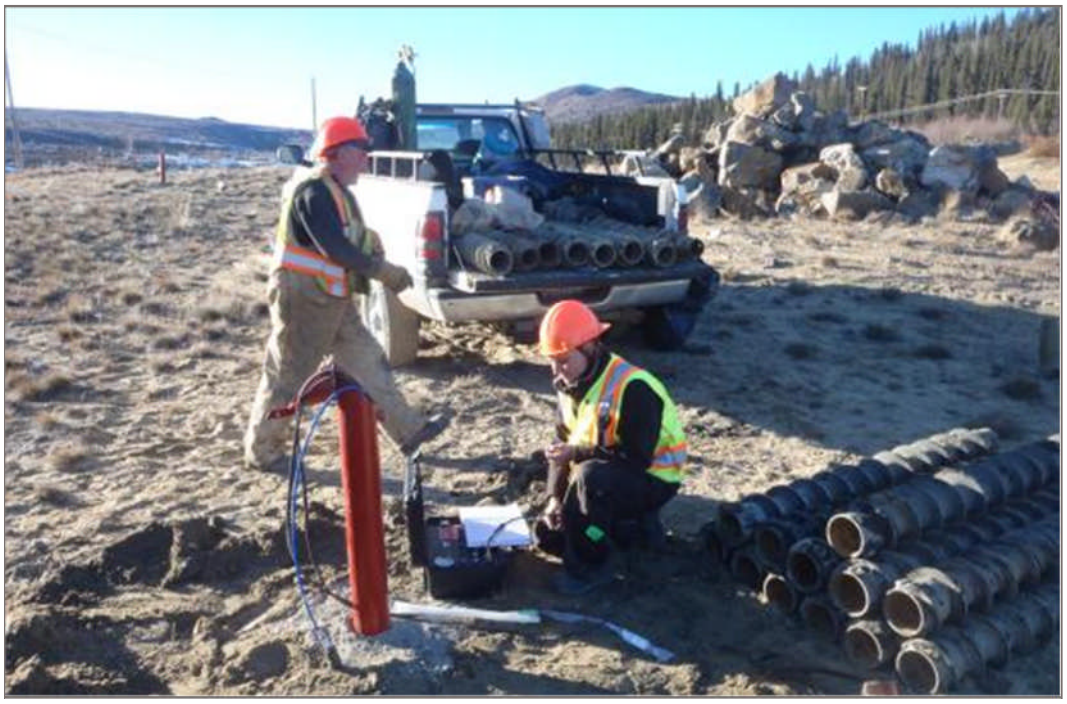


Photo 7: Collecting initial readings from piezometers in BH04
Facing west (October 3, 2012)

Photo 8: Completed BH01, BH04, and BH02 (nearest to furthest)
Facing east (October 3, 2012)

APPENDIX A

EBA'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOTECHNICAL REPORT

This report incorporates and is subject to these “General Conditions”.

1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of EBA’s Client. EBA does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than EBA’s Client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA’s instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of EBA’s instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. EBA’s instruments of professional service will be used only and exactly as submitted by EBA.

Electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client’s current or future software and hardware systems.

3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, EBA 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.

4.0 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. EBA 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.

5.0 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.

6.0 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. EBA 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.

7.0 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.

8.0 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.

9.0 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.

10.0 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.

11.0 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.

12.0 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.

13.0 SAMPLES

EBA 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.

14.0 INFORMATION PROVIDED TO EBA BY OTHERS

During the performance of the work and the preparation of the report, EBA may rely on information provided by persons other than the Client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

APPENDIX B

BOREHOLE LOGS AND LABORATORY TEST RESULTS

MODIFIED UNIFIED SOIL CLASSIFICATION

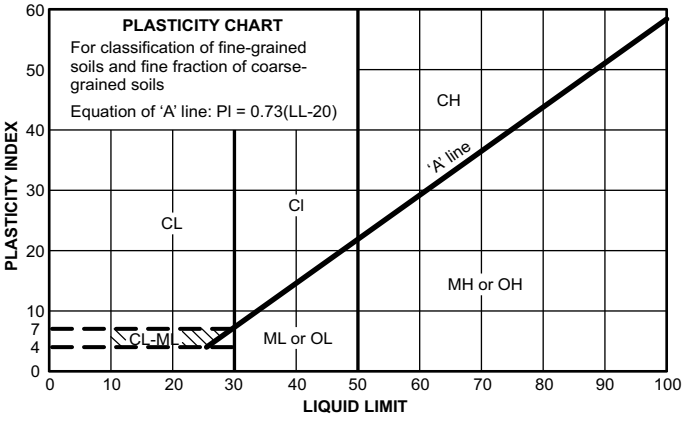
MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE - GRAINED SOILS More than 50% retained on No. 75 µm sieve*	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly-graded gravels and gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly-graded sands and gravelly sands, little or no fines
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (by behavior) 50% or more passes 75 µm sieve*	SILTS	Liquid limit <50	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands of slight plasticity
		Liquid limit >50	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
	CLAYS Above "A" line on plasticity chart negligible organic content	Liquid limit <30	CL	Inorganic clays of low plasticity, gravelly clays, sandy clays, silty clays, lean clays
		Liquid limit 30-50	CI	Inorganic clay of medium plasticity, silty clays
		Liquid limit >50	CH	Inorganic clay of high plasticity, fat clays
	ORGANIC SILTS AND CLAYS	Liquid limit <50	OL	Organic silts and organic silty clays of low plasticity
		Liquid limit >50	OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS			PT	Peat, muck and other highly organic soils

LABORATORY CLASSIFICATION CRITERIA

Classification on basis of percentage of fines
GW, GP, SW, SP
GM, GC, SM, SC
Borderline classification requiring use of dual symbols

$C_U = D_{60} / D_{10}$ Greater than 4 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3		
Not meeting both criteria for GW		
Atterberg limits plot below 'A' line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols	
Atterberg limits plot above 'A' line and plasticity index greater than 7		
$C_U = D_{60} / D_{10}$ Greater than 6 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3		
Not meeting both criteria for SW		
Atterberg limits plot above 'A' line and plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols	
Atterberg limits plot above 'A' line and plasticity index greater than 7		

Less than 5% pass 75 µm sieve
More than 12% pass 75 µm sieve
5% to 12% pass 75 µm sieve



* Based on the material passing the 75 mm sieve

† ASTM Designation D 2487, for identification procedure see D 2488 USC as modified by PFRA

GROUND ICE DESCRIPTION

ICE NOT VISIBLE

GROUP SYMBOL	SYMBOL	SUBGROUP DESCRIPTION	
N	Nf	Poorly-bonded or friable	
	Nbn	No excess ice, well-bonded	
	Nbe	Excess ice, well-bonded	

VISIBLE ICE LESS THAN 50% BY VOLUME

GROUP SYMBOL	SYMBOL	SUBGROUP DESCRIPTION	
V	Vx	Individual ice crystals or inclusions	
	Vc	Ice coatings on particles	
	Vr	Random or irregularly oriented ice formations	
	Vs	Stratified or distinctly oriented ice formations	

VISIBLE ICE GREATER THAN 50% BY VOLUME

ICE	ICE + Soil Type	Ice with soil inclusions	
	ICE	Ice without soil inclusions (greater than 25 mm thick	

NOTES:

1. Dual symbols are used to indicate borderline or mixed ice classifications.
2. Visual estimates of ice contents indicated on borehole logs ± 5%
3. This system of ground ice description has been modified from NRC Technical Memo 79, Guide to the Field Description of Permafrost for Engineering Purposes.

LEGEND: Soil ☐ Ice ■

Fall 2012 Geotechnical	CLIENT: YG - Assessment and Abandoned Mines	BOREHOLE NO: W14103083-BH01
Drilling and Instrumentation	DRILL: CME 75/Hollow Stem Auger	PROJECT NO: W14103083-01
Mt. Nansen Mine Site, YT	6880668N; 389526E; Zone 8	ELEVATION: 1094.83m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

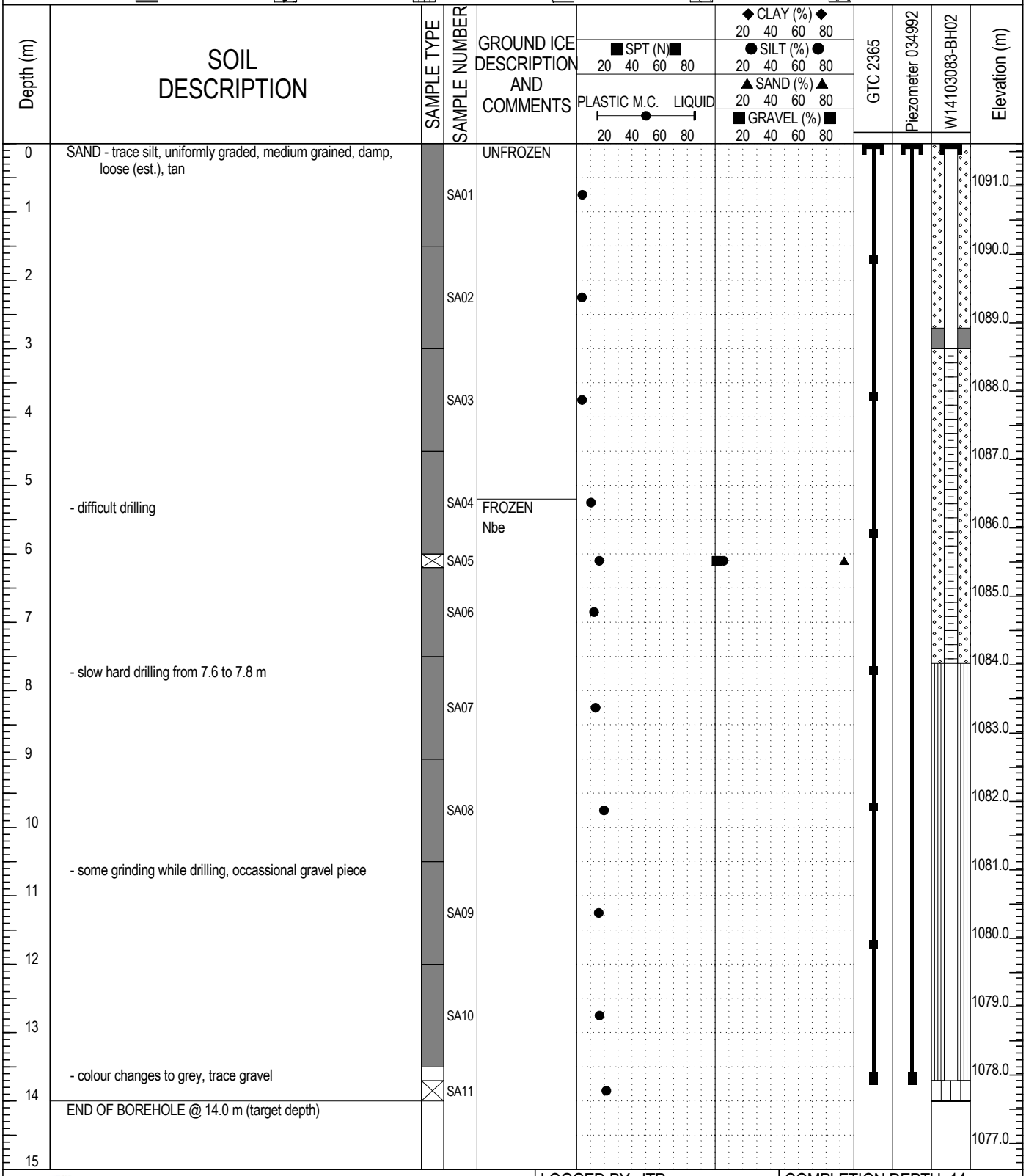
Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	SPT (N) 20 40 60 80	PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80	SILT (%) 20 40 60 80	SAND (%) 20 40 60 80	GRAVEL (%) 20 40 60 80	GTC 2364	Piezometer 034991	W14103083-BH01	Elevation (m)
0	SAND - trace silt, uniformly graded, medium grained, damp, loose (est.), brown			UNFROZEN										
1			SA01											1094.0
2	- colour changes to tan		SA02											1093.0
3														1092.0
4			SA03											1091.0
5														1090.0
6	- difficult drilling		SA04	FROZEN Nbe										1089.0
7			SA05											1088.0
8														1087.0
9			SA06											1086.0
10			SA07											1085.0
11	- some ginding while drilling, occassional gravel piece		SA08											1084.0
12	- becomes trace gravel													1083.0
13			SA09											1082.0
14	SILT - trace sand, dark grey		SA10	Nbn										1081.0
15	END OF BOREHOLE @ 14.6 m (auger refusal in frozen silt)													1080.0

eba A TETRA TECH COMPANY	LOGGED BY: JTP	COMPLETION DEPTH: 14.6m
	REVIEWED BY: JRT	COMPLETE: 10/1/2012
	DRAWING NO:	Page 1 of 1

Fall 2012 Geotechnical	CLIENT: YG - Assessment and Abandoned Mines	BOREHOLE NO: W14103083-BH02
Drilling and Instrumentation	DRILL: CME 75/Hollow Stem Auger	PROJECT NO: W14103083-01
Mt. Nansen Mine Site, YT	6880668N; 389561E; Zone 8	ELEVATION: 1091.62m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



LOGGED BY: JTP	COMPLETION DEPTH: 14m
REVIEWED BY: JRT	COMPLETE: 10/2/2012
DRAWING NO:	Page 1 of 1

eba A TETRA TECH COMPANY

WHITEHORSE W14103083-01.GPJ EBA.GDT 12/12/17

Fall 2012 Geotechnical	CLIENT: YG - Assessment and Abandoned Mines	BOREHOLE NO: W14103083-BH03
Drilling and Instrumentation	DRILL: CME 75/Hollow Stem Auger	PROJECT NO: W14103083-01
Mt. Nansen Mine Site, YT	6880732N; 389132E; Zone 8	

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS
0	SAND (FILL) - silty, some gravel, well graded, medium grained, loose (est.), moist, tan, organics throughout		SA01	UNFROZEN
1	SAND - some silt, uniformly graded, fine grained, wet, loose (est.), grey		SA02	
2			SA03	
3	SILT - black, organics throughout, organic odour			FROZEN Nbe
4			SA04	
5	SAND - silty, some gravel, well graded, medium grained, sub-angular, olive grey		SA05	
6				
7	- grinding, hard drilling - difficult drilling, no sample recovery from 7.0 to 10.0 m			
8				
9	- smooth, hard drilling			
10				
11			SA06	Vx (10%)
12				
13	END OF BOREHOLE @ 13.0 m (auger refusal)			
14	NOTE: possible bedrock, not confirmed			
15				

SPT (N) 20 40 60 80

PLASTIC M.C. LIQUID 20 40 60 80

CLAY (%) 20 40 60 80

SILT (%) 20 40 60 80

SAND (%) 20 40 60 80

GRAVEL (%) 20 40 60 80

GTC 2362

W14103083-BH03

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 49

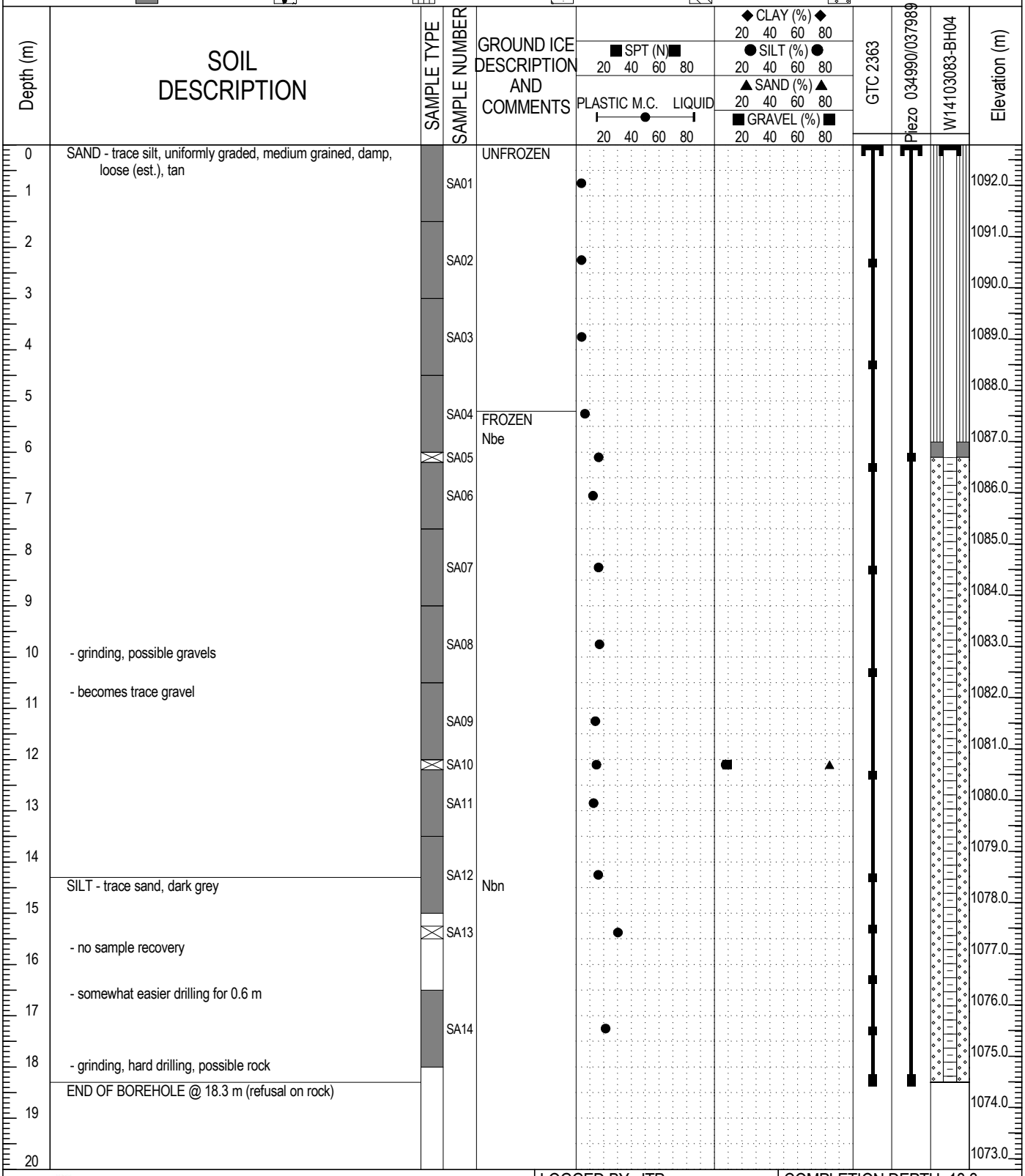
LOGGED BY: JTP	COMPLETION DEPTH: 13m
REVIEWED BY: JRT	COMPLETE: 10/2/2012
DRAWING NO:	Page 1 of 1

eba A TETRA TECH COMPANY

Fall 2012 Geotechnical	CLIENT: YG - Assessment and Abandoned Mines	BOREHOLE NO: W14103083-BH04
Drilling and Instrumentation	DRILL: CME 75/Hollow Stem Auger	PROJECT NO: W14103083-01
Mt. Nansen Mine Site, YT	6880666N; 389543E; Zone 8	ELEVATION: 1092.79m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



eba A TETRA TECH COMPANY	LOGGED BY: JTP	COMPLETION DEPTH: 18.3m
	REVIEWED BY: JRT	COMPLETE: 10/3/2012
	DRAWING NO:	Page 1 of 1

APPENDIX C
INSTRUMENT CALIBRATION RECORDS

THERMISTOR STRING CALIBRATION

Project: Mt. Nansen
Project No.: W14103083-01
Client:
Attention:
Email:

Thermistor String No.: 2362
Client String No.:
Location of Installation: BH1
Calibration Temp.: 0.02
Date of Calibration: September 27, 2012

Depth of Thermistor ☐ feet ☐ meters	Colour of Wire	Plug Letter	Calibration Resistance (kΩ)			Temperature (°C)	Calibration Factor (°C)
			Trial 1	Trial 2	Trial 3		
2.0	Black	A	16.27	16.28	16.28	0.05	-0.03
4.0	Purple	B	16.27	16.28	16.28	0.05	-0.03
6.0	Tan	C	16.29	16.30	16.30	0.03	-0.01
8.0	Grey	D	16.27	16.28	16.28	0.05	-0.03
10.0	Red	E	16.32	16.32	16.32	0.00	0.02
12.0	Brown	F	16.28	16.28	16.28	0.05	-0.03
14.0	Pink	G	16.31	16.32	16.32	0.00	0.02
16.0	Blue	H	16.31	16.32	16.32	0.00	0.02
18.0	Green	J	16.28	16.29	16.29	0.04	-0.02
20.0	Yellow	K	16.29	16.29	16.29	0.04	-0.02
22.0	Silver	L	16.31	16.31	16.31	0.02	0.00
	Orange	N					
	Orange/White	P					
	Black/White	R					
	Brown/White	S					
	Red/White	T					
	White	M					

Lead Length: 2m

Carrier: _____ Date Shipped: _____

W/B Number: _____ Shipped by: _____

eba
A TETRA TECH COMPANY

THERMISTOR STRING CALIBRATION

Project: Mt. Nansen
Project No.: W14103083-01
Client:
Attention:
Email:

Thermistor String No.: 2363
Client String No.:
Location of Installation: BH4
Calibration Temp.: 0.02
Date of Calibration: September 27, 2012

Depth of Thermistor ☐ feet ☐ meters	Colour of Wire	Plug Letter	Calibration Resistance (kΩ)			Temperature (°C)	Calibration Factor (°C)
			Trial 1	Trial 2	Trial 3		
2.0	Black	A	16.29	16.29	16.29	0.04	-0.02
4.0	Purple	B	16.26	16.26	16.26	0.08	-0.06
6.0	Tan	C	16.29	16.29	16.29	0.04	-0.02
8.0	Grey	D	16.27	16.28	16.28	0.05	-0.03
10.0	Red	E	16.25	16.25	16.25	0.09	-0.07
12.0	Brown	F	16.32	16.33	16.33	-0.01	0.03
14.0	Pink	G	16.28	16.28	16.28	0.05	-0.03
16.0	Blue	H	16.23	16.24	16.24	0.10	-0.08
18.0	Green	J	16.28	16.28	16.28	0.05	-0.03
20.0	Yellow	K	16.27	16.27	16.27	0.06	-0.04
22.0	Silver	L	16.30	16.30	16.30	0.03	-0.01
	Orange	N					
	Orange/White	P					
	Black/White	R					
	Brown/White	S					
	Red/White	T					
	White	M					

Lead Length: 2m

Carrier: _____ Date Shipped: _____

W/B Number: _____ Shipped by: _____

THERMISTOR STRING CALIBRATION

Project: Mt. Nansen
Project No.: W14103083-01
Client:
Attention:
Email:

Thermistor String No.: 2364
Client String No.:
Location of Installation: BH2
Calibration Temp.: 0.02
Date of Calibration: September 27, 2012

Depth of Thermistor ☐ feet ☐ meters	Colour of Wire	Plug Letter	Calibration Resistance (kΩ)			Temperature (°C)	Calibration Factor (°C)
			Trial 1	Trial 2	Trial 3		
2.0	Black	A	16.25	16.26	16.26	0.08	-0.06
4.0	Purple	B	16.27	16.27	16.27	0.06	-0.04
6.0	Tan	C	16.26	16.26	16.26	0.08	-0.06
8.0	Grey	D	16.29	16.29	16.29	0.04	-0.02
10.0	Red	E	16.25	16.26	16.26	0.08	-0.06
12.0	Brown	F	16.30	16.30	16.30	0.03	-0.01
14.0	Pink	G	16.27	16.27	16.27	0.06	-0.04
17.0	Blue	H	16.30	16.30	16.30	0.03	-0.01
	Green	J					
	Yellow	K					
	Silver	L					
	Orange	N					
	Orange/White	P					
	Black/White	R					
	Brown/White	S					
	Red/White	T					
	White	M					

Lead Length: 2m

Carrier: _____ Date Shipped: _____

W/B Number: _____ Shipped by: _____

THERMISTOR STRING CALIBRATION

Project: Mt. Nansen
Project No.: W14103083-01
Client:
Attention:
Email:

Thermistor String No.: 2365
Client String No.:
Location of Installation: BH3
Calibration Temp.: 0.02
Date of Calibration: September 27, 2012

Depth of Thermistor ☐ feet ☐ meters	Colour of Wire	Plug Letter	Calibration Resistance (kΩ)			Temperature (°C)	Calibration Factor (°C)
			Trial 1	Trial 2	Trial 3		
2.0	Black	A	16.30	16.31	16.31	0.02	0.00
4.0	Purple	B	16.27	16.28	16.28	0.05	-0.03
6.0	Tan	C	16.29	16.29	16.29	0.04	-0.02
8.0	Grey	D	16.31	16.32	16.32	0.00	0.02
10.0	Red	E	16.32	16.32	16.32	0.00	0.02
12.0	Brown	F	16.23	16.24	16.24	0.10	-0.08
14.0	Pink	G	16.28	16.29	16.29	0.04	-0.02
	Blue	H					
	Green	J					
	Yellow	K					
	Silver	L					
	Orange	N					
	Orange/White	P					
	Black/White	R					
	Brown/White	S					
	Red/White	T					
	White	M					

Lead Length: 2m

Carrier: _____ Date Shipped: _____

W/B Number: _____ Shipped by: _____

innovation in geotechnical instrumentation

RST Instruments Ltd., 11545 Kingston St., Maple Ridge, British Columbia, Canada V2X 0Z5
Tel: 604 540 1100 • Fax: 604 540 1005 • Toll Free: 1 800 665 5599 (North America only)
e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

Calibration Record

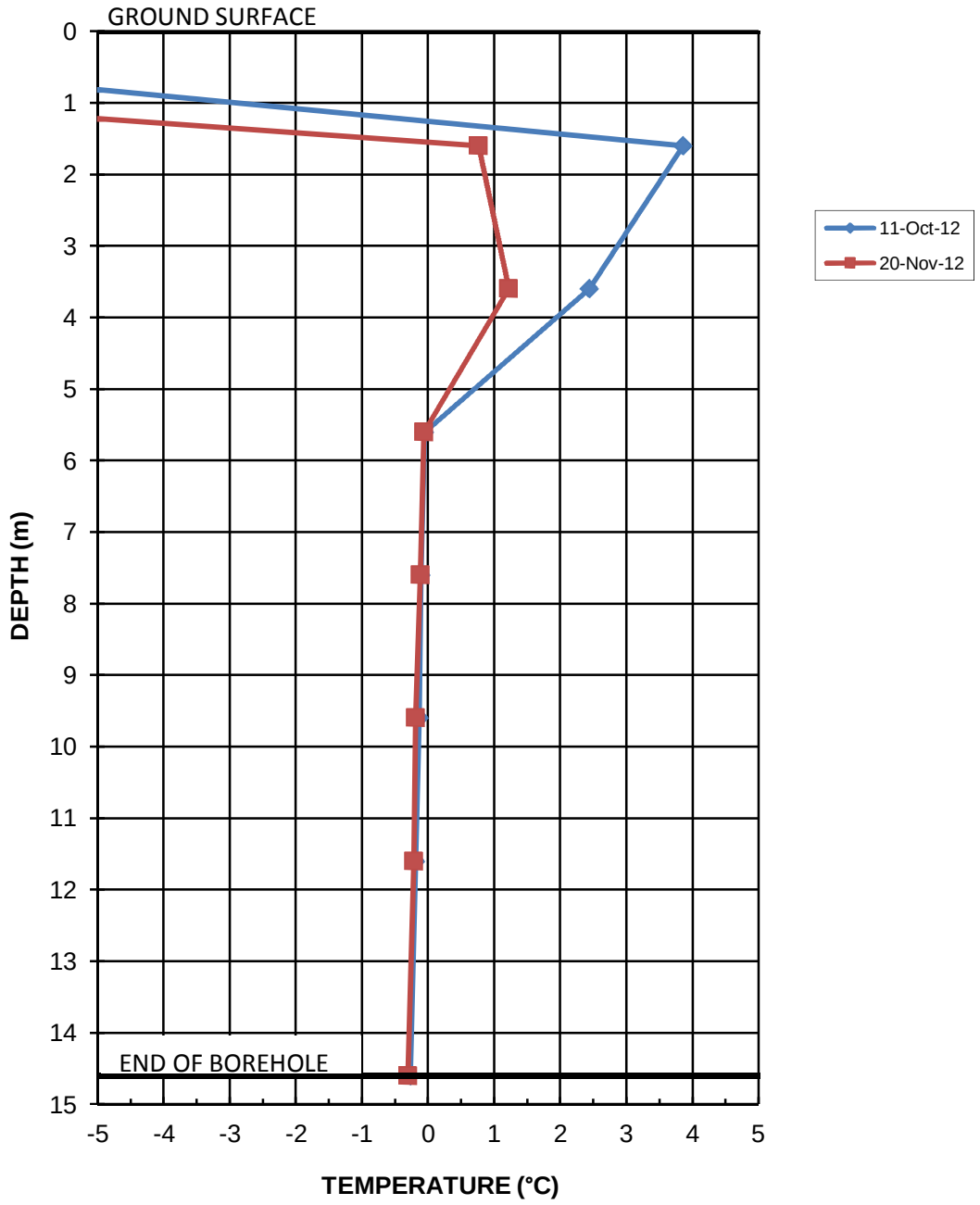
PNEUMATIC PIEZOMETER CALIBRATIONS

CLIENT: EBA ENGINEERING
MODEL: P-100
DATE: SEP 25/12
ORDER NO: Q024496

		APPLIED PRESSSURE (PSI)						
Length	SN	0.00	10.00	20.00	30.00	40.00	50.00	60.00
MEASURED PRESSURE (PSI)								
23m	034989	0.76	10.65	20.42	30.24	40.12	50.03	59.95
23m	034990	0.53	10.56	20.33	30.16	40.20	50.33	60.50
18m	034991	0.79	10.70	20.75	30.60	40.86	50.88	60.95
15m	034992	0.58	10.40	20.49	30.54	40.65	50.73	60.81

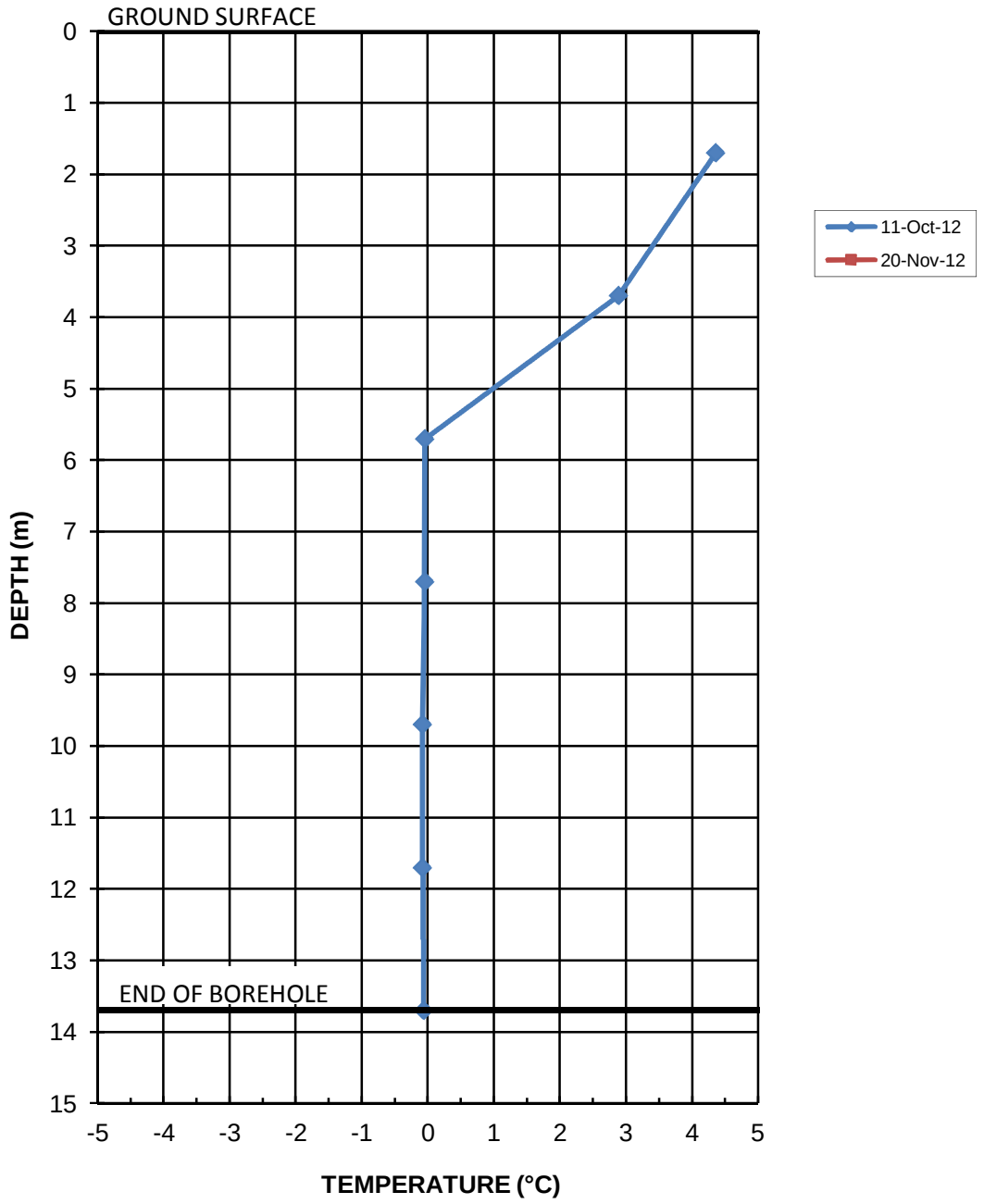
CALIBRATED BY : Mark Peters

APPENDIX D
GROUND TEMPERATURE PLOTS



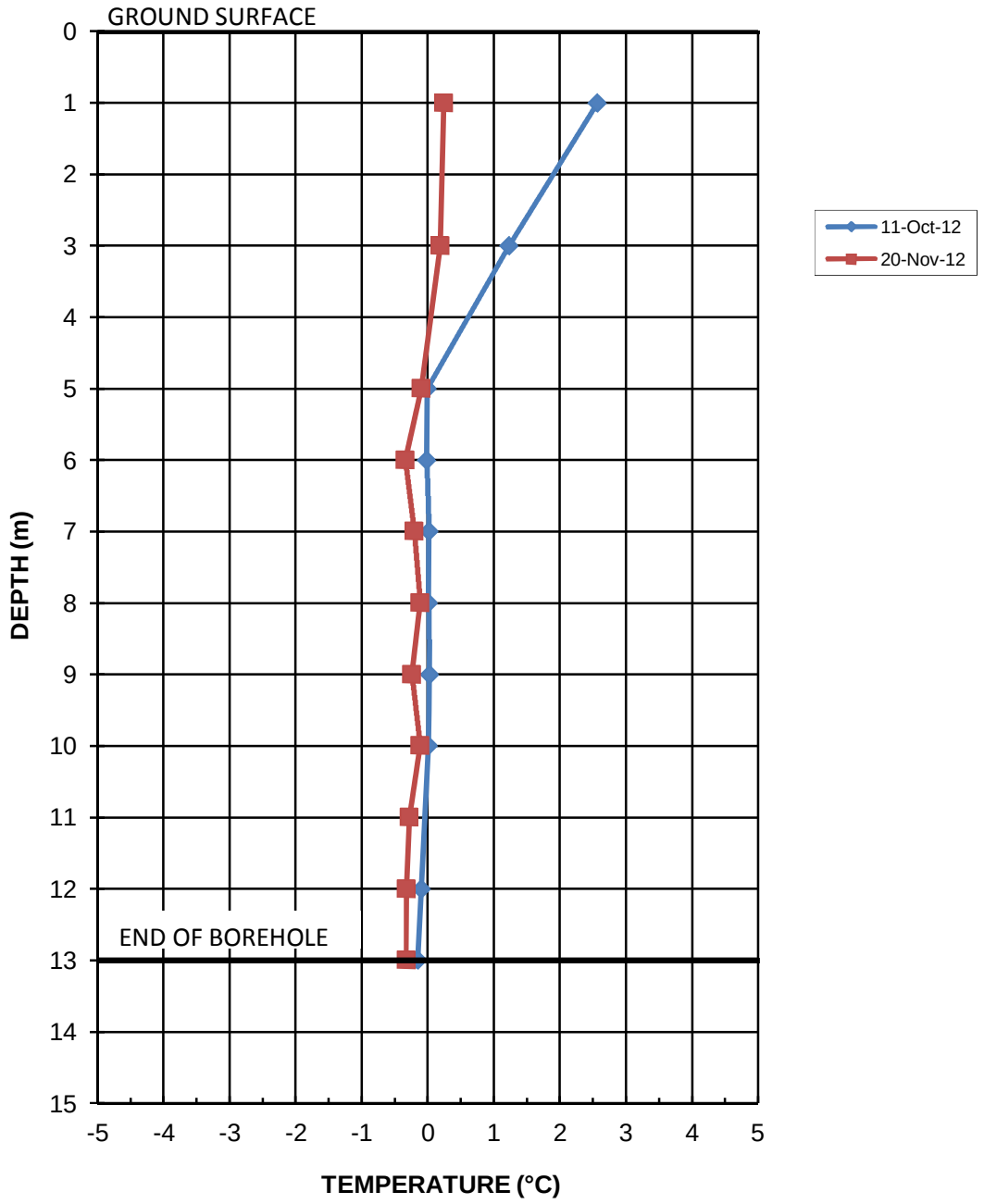
Notes:
-Ground temperature readings provided by client

GTC 2364
Ground Temperature Profile
W14103083-BH01
Mount Nansen Mine Site



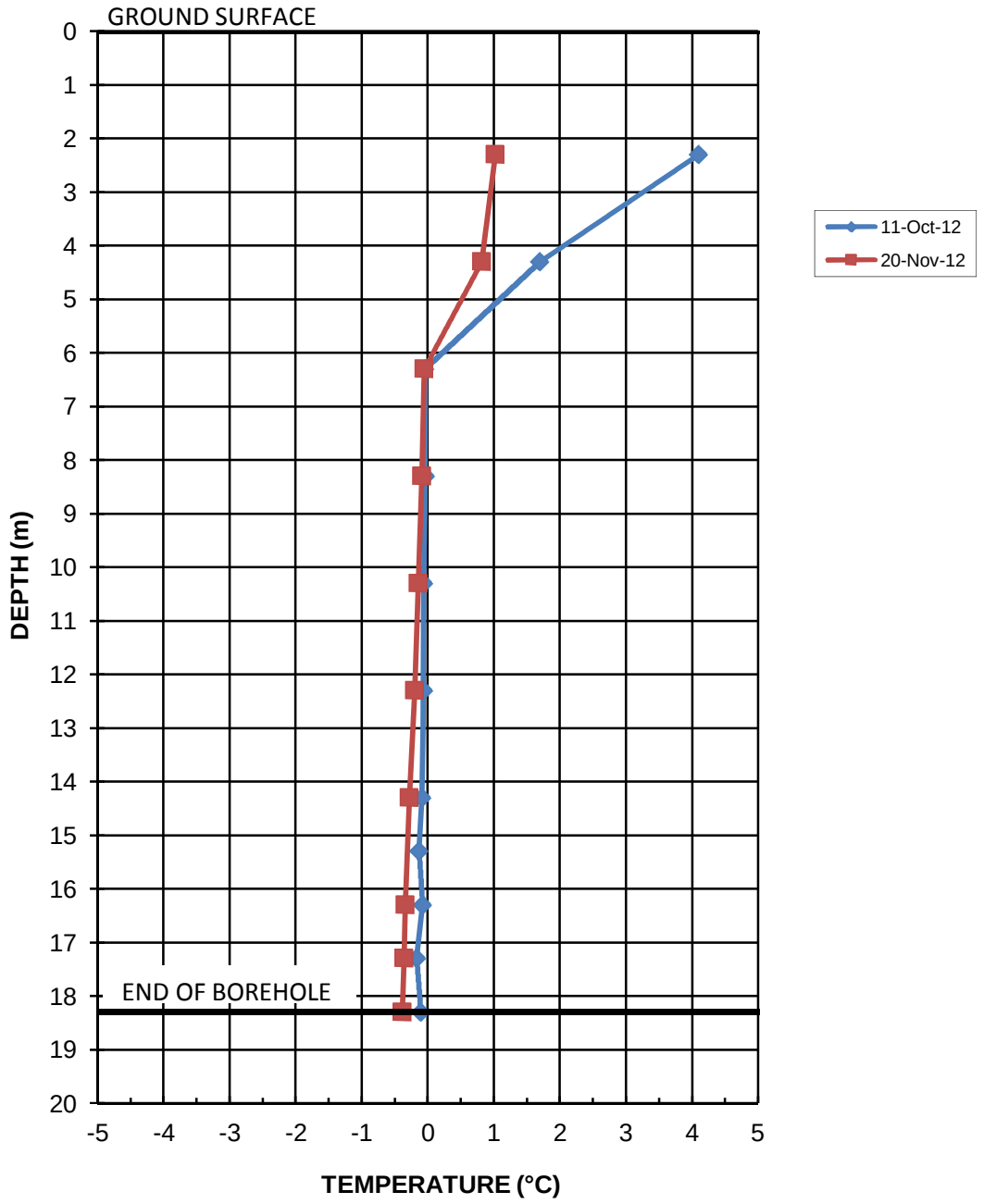
Notes:
-Ground temperature readings provided by client
-Data for 20-Nov-12 not provided

GTC 2365
Ground Temperature Profile
W14103083-BH02
Mount Nansen Mine Site



Notes:
-Ground temperature readings provided by client

GTC 2362
Ground Temperature Profile
W14103083-BH03
Mount Nansen Mine Site



Notes:
-Ground temperature readings provided by client
-Data for 15m bead on 20-Nov-12 not provided

GTC 2363
Ground Temperature Profile
W14103083-BH04
Mount Nansen Mine Site

APPENDIX E
DATA COLLECTION SHEETS

MT. NANSEN THERMISTOR FIELD DATA SHEET

DATE _____ **TECHNICIAN** _____ **OUTSIDE AIR TEMPERATURE (°Celsius)** _____

BOREHOLE NAME	THERMISTOR CABLE NO.	SWITCH POSITION / THERMISTOR BEAD READINGS (kilo-ohms)																COMMENTS
EBA BH01	1178	1	2	3														
EBA BH02	1179	1	2	3	4	5	6	7	8									
EBA BH03	1180	1	2	3														
EBA BH04	1	1																
EBA BH05	1181	1	2	3														
EBA BH06	1182	1	2	3	4	5	6	7	8	9								
EBA BH07	1183	1	2	3														
EBA BH01-01	1385	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
EBA BH01-03	1383	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
EBA BH01-04	1384	1	2	3	4	5	6	7	8	9								
GT09-01	CABLE 1	1	2	3	4	5	6	7	8	9	10	11	12	13				
GT09-02	CABLE 5	1	2	3	4	5	6	7	8									
GT09-03	CABLE 4	1	2	3	4	5	6	7	8	9	10							

MT. NANSEN THERMISTOR FIELD DATA SHEET

DATE _____ **TECHNICIAN** _____ **OUTSIDE AIR TEMPERATURE (°Celsius)** _____

BOREHOLE NAME	THERMISTOR CABLE NO.	SWITCH POSITION / THERMISTOR BEAD READINGS (kilo-ohms)																COMMENTS
GT09-04	CABLE 3	1	2	3	4	5	6	7	8									
GT09-05	CABLE 2	1	2	3	4	5	6	7	8	9	10							
W14103083-BH01	2364	1	2	3	4	5	6	7	8									
W14103083-BH02	2365	1	2	3	4	5	6	7										
W14103083-BH03	2362	1	2	3	4	5	6	7	8	9	10	11						
W14103083-BH04	2363	1	2	3	4	5	6	7	8	9	10	11						

MT. NANSEN PIEZOMETER FIELD DATA SHEET

DATE _____ **TECHNICIAN** _____

BOREHOLE NAME	PIEZOMETER NO.	READING (PSI)	BYPASS POSITION	COMMENTS
EBA BH01	22715		BYPASS OPEN	
			BYPASS CLOSED	
EBA BH03	19172		BYPASS OPEN	
			BYPASS CLOSED	
	22592		BYPASS OPEN	
			BYPASS CLOSED	
	22793		BYPASS OPEN	
			BYPASS CLOSED	
EBA BH05	22714		BYPASS OPEN	
			BYPASS CLOSED	
	22716		BYPASS OPEN	
			BYPASS CLOSED	
	22720		BYPASS OPEN	
			BYPASS CLOSED	
EBA BH07	22718		BYPASS OPEN	
			BYPASS CLOSED	
	22719		BYPASS OPEN	
			BYPASS CLOSED	
	22721		BYPASS OPEN	
			BYPASS CLOSED	
DH9601	20383		BYPASS OPEN	Formerly BH9601
			BYPASS CLOSED	
W14103083-BH01	34991		BYPASS OPEN	
			BYPASS CLOSED	
Measured Depth to Water (m)				
W14103083-BH02	34992		BYPASS OPEN	
			BYPASS CLOSED	
Measured Depth to Water (m)				
W14103083-BH04	34990		BYPASS OPEN	
			BYPASS CLOSED	
	34989		BYPASS OPEN	
			BYPASS CLOSED	
Measured Depth to Water (m)				

Seepage pond staff gauge reading (m) _____ **Tailings pond staff gauge reading (m)** _____ **Gauge 1 or 2?** _____