Groundwater Monitoring Plan, Version 2.1

WHALE TAIL PIT PROJECT

Groundwater Monitoring Plan

In Accordance with:
Project Certificate No. 008, T&C 15 and 16

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 2

Revision 1
February 2019

EXECUTIVE SUMMARY

Agnico Eagle Mines Limited – Meadowbank Division (Agnico Eagle) received a Project Certificate No.008 from the Nunavut Impact Review Board for the development of the Whale Tail Pit, a satellite deposit located on the Amaruq Exploration property.

The deposit will be mined as an open pit (i.e., Whale Tail Pit), and ore will be hauled by truck to the approved infrastructure at Meadowbank Mine for milling. Approximately 8.3 million tonnes (Mt) of ore will be mined from the open pit and processed over a three to four-year mine life. Ore from Whale Tail Pit will be crushed on site after which it will be transported to Meadowbank Mine for milling. The mill rate will be approximately 9,000 to 12,000 tonnes per day.

During mining, groundwater will flow into the open pit. This water is naturally high in total dissolved solids and will not be directly discharged out of the active mine site without treatment. Water management during mine operations will involve a variety of activities, described in detail in the Water Management Plan (WMP) developed for the Project (Agnico Eagle 2018a).

This Groundwater Management Plan (GWMP) reflects the commitments made with respect to submissions provided during the technical review of the FEIS, to comply with Terms and Conditions No. 15 and 16 included in the Project Certificate. This version of the plan includes:

1. Sampling results of the multi-level Westbay well system, that were completed in November 2018;
2. Thermal analyses completed in 2018;
3. Groundwater monitoring plan for horizontal and vertical groundwater flow; and,
4. Threshold and adaptive management plan related to the groundwater management.

Additional modelling efforts were completed in support of the water quality predictions at closure and post-closure. The additional modelling that were completed are: post-closure hydrogeological modelling in combination with the diffusion model; and, the pit lake hydrodynamic model and receiving lake (Mammoth Lake) hydrodynamic model.

The results of these studies indicated that arsenic release from the submerged pit wall (arsenic diffusion) will not affect water quality in the pit lake; and, mass transfer to water is very low even under the conservative assumptions of the calculations. Results from these studies further indicate that the seepage into and out of the pit lake are negligible in volume, particularly compared to surface water exchanged annually during post-closure when flows are re-established based on average climate year watershed runoff. The combination of results corroborates to support that the hydrogeological regime around the pit lake is not critical to pit lake water quality.

Agnico Eagle considers that the uncertainty related to the arsenic-related water quality issues emanate from the Water Rock Storage Facility and the fill water in the proposed pit lake created after the excavation of the ore body, are addressed, and the NIRB Project Certificate No. 008 terms and conditions No. 15 and 16 has been fulfilled.

The GWMP was updated to include additional monitoring of the horizontal and vertical groundwater flow to validate the prediction of these studies during the operation of the Whale Tail pit.

Agnico Eagle would like to clarify the monitoring requirements related to the Waste Rock Storage Facility (WRSF) are addressed in the approved ARD-ML monitoring plan, Water Quality and Flow Monitoring Plan, Water Management Plan and Waste Management Plan, as any seepage emanating from the WRSF is considered as a surface water management issue. The groundwater monitoring plan focus on the definition of the groundwater quality and flow reporting to the pit lake created before, during and after the excavation of the ore body.

DISTRIBUTION LIST

AEM – Geology Superintendent

AEM – Engineering Superintendent

AEM – Geotechnical Coordinator

AEM – Environment Superintendent

AEM – Environmental Coordinator

DOCUMENT CONTROL

Version	Date (YMD)	Section	Revision
1	2018-05-30	All	To address Project Certificate No. 008. T&C 15 and 16
2	2018/11/8	1.1, 2.4, 2.5	To address ECCC and CIRNAC recommendations issued in October 2018
2 Rev. 1	2019/02/19	All	To address NWB and CIRNAC comments discussed on February 13, 2019

Prepared by:
Golder Associates & Agnico Eagle Mines Limited - Meadowbank Division

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1 INTRODUCTION

Agnico Eagle Mines Limited – Meadowbank Division (Agnico Eagle) received Project Certificate No.008 from the Nunavut Impact Review Board (NIRB) for the development of the Whale Tail Pit (the Project), a satellite deposit located on the Amaruq Exploration property. The Amaruq Exploration property is a 408 square kilometre (km^2) site located on Inuit Owned Land approximately 150 kilometres (km) north of the hamlet of Baker Lake and approximately 50 km northwest of the Meadowbank Mine in the Kivalliq region of Nunavut (Figure 1). The deposit will be mined as an open pit, and ore will be hauled by truck to the approved infrastructure at Meadowbank Mine for milling.

This document presents Groundwater Monitoring Plan (GWMP) for the Whale Tail Pit. Overall water management for operations, closure, and post-closure is described in the Agnico Eagle Water Management Plan (WMP) (Agnico Eagle 2018a). The WMP provides descriptions of the water control structures and associated design criteria.

1.1 CONCORDANCE

Meadowbank Mine is an approved mining operation and Agnico Eagle is planning to extend the life of the mine by constructing and operating the Project. The Project was subject to an environmental review established by Article 12, Part 5 of the Nunavut Agreement. In June 2016, Agnico Eagle submitted a Final Environmental Impact Statement (FEIS) seeking a reconsideration of the Meadowbank Mine Project Certificate (No. 004/File No. 03MN107) and Type A Water Licence Amendment (No. 2AM-MEA1525) from the NIRB.

On July 2016, the NIRB determined that the proposed Project required a separate screening assessment under the Nunavut Agreement and the *Nunavut Planning and Project Assessment Act* (NuPPAA). A separate Project Certificate (NIRB Project Certificate No. 008) was issued for the Project on March 15, 2018 by the NIRB. This GWMP reflects the commitments made with respect to submissions provided during the technical review of the FEIS, to comply with Terms and Conditions No. 15 and 16 included in the Project Certificate.

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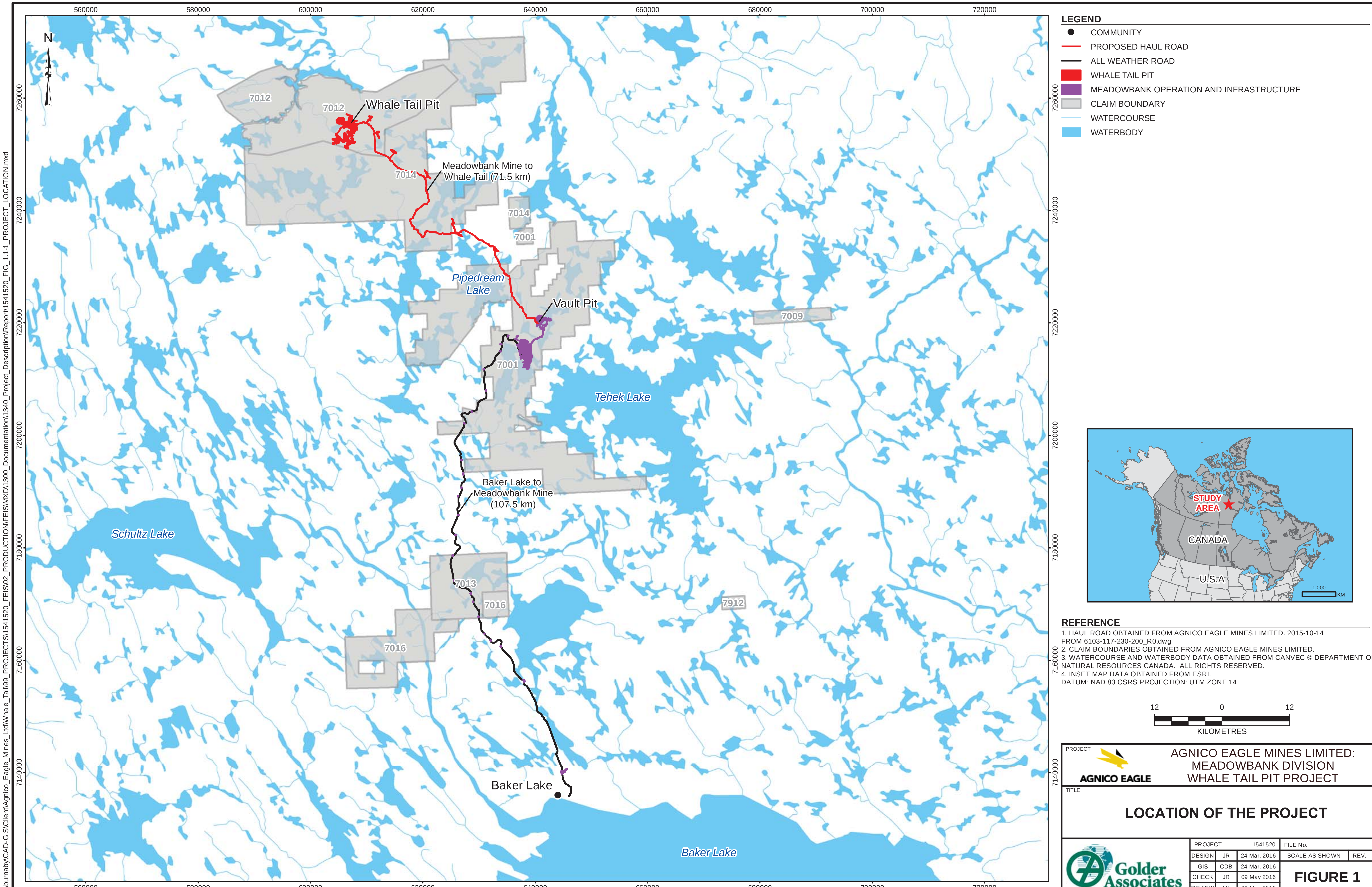
1.2 OBJECTIVES

The objective of the GWMP is to provide consolidated information on groundwater management for the Project. The GWMP is divided into the following components:

- Introductory section (Section 1)
- A brief summary of the physical and hydrogeological setting at the mine site, the mine development plan and FEIS pit inflow predictions (Section 2)
- A description of the groundwater monitoring program (Section 3)
- A summary of procedures for quality assurance and quality control (QA/QC) (Section 4)



Whale Tail Pit
7012
7014
7001
7009
7013
7016
7912
Meadowbank Mine to Whale Tail (71.5 km)
Pipedream Lake
Vault Pit
Tehek Lake
Baker Lake to Meadowbank Mine (107.5 km)
Schultz Lake
Baker Lake
N
LEGEND
COMMUNITY
PROPOSED HAUL ROAD
ALL WEATHER ROAD
WHALE TAIL PIT
MEADOWBANK OPERATION AND INFRASTRUCTURE
CLAIM BOUNDARY
WATERCOURSE
WATERBODY
STUDY AREA
CANADA
U.S.A
1,000 KM
REFERENCE
1. HAUL ROAD OBTAINED FROM AGNICO EAGLE MINES LIMITED. 2015-10-14 FROM 6103-117-230-200_R0.dwg
2. CLAIM BOUNDARIES OBTAINED FROM AGNICO EAGLE MINES LIMITED.
3. WATERCOURSE AND WATERBODY DATA OBTAINED FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
4. INSET MAP DATA OBTAINED FROM ESRI.
DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14
12 0 12
KILOMETRES
PROJECT
AGNICO EAGLE
AGNICO EAGLE MINES LIMITED: MEADOWBANK DIVISION WHALE TAIL PIT PROJECT
TITLE
LOCATION OF THE PROJECT
Golder Associates
PROJECT 1541520 FILE No.
DESIGN JR 24 Mar. 2016 SCALE AS SHOWN REV. 0
GIS CDB 24 Mar. 2016
CHECK JR 09 May 2016
REVIEW LY 09 May 2016
FIGURE 1
Y:\burnaby\CAD-GIS\Client\Agnico_Eagle_Mines_Ltd\Whale_Tail\99_PROJECTS\1541520_FEIS\02_PRODUCTION\FEIS\MXD\1300_Documentation\1340_Project_Description\Report\1541520_FIG_1.1-1_PROJECT_LOCATION.mxd

2 BACKGROUND

2.1 SITE CONDITIONS

The Project is located in Canada's Northern Arctic ecozone. This region includes most of Canada's Arctic Archipelago and northern regions of continental Nunavut and the Northwest Territories. This ecoregion is classified as a polar desert and is characterized by long cold winters and short cool summers. The mean air temperatures in June to September is approximately 7 degrees Celsius (°C) and -20.6 °C in October to May.

Average annual precipitation at Meadowbank Mine is 142.6 mm (1998 to 2004). The annual precipitation at site generally falls as rain between June and September, and snow between October and May. However, snowfall can occur at any time of the year.

Based on data for Baker Lake (120 km to the south), and from experience ice auguring within the Meadowbank Mine lakes in the winter, the mean maximum lake ice thickness over Whale Tail Lake is expected to be 2.25 m. During the winter collection of water quality baseline data in Whale Tail Lake in April 2016, ice thickness was confirmed to be 2 m.

The surficial geology of the Project area shows strong evidence of glacial activity and is dominated by veneers and blankets of till overlying undulating bedrock. Bedrock frequently outcrops in isolated exposures, elevated plateaus and elongated ridges. Lakes and ponds are abundant, occupying approximately 16% of the area.

The local overburden consists of till with a silty sand matrix and clasts that range from granule gravel to large boulders in size. Glaciofluvial deposits in the form of eskers and terraces are found in the northeast section of the satellite deposit and they continue in a southeast direction intersecting the haul road in several locations.

The bedrock geology in the Project area consists of Archean and Proterozoic supercrustal sequences and plutonic rocks.

2.2 HYDROGEOLOGY SETTING

2.2.1 Conceptual Model

The Project is in an area of continuous permafrost. In this region, the layer of permanently frozen subsoil and rock is generally deep and overlain by an active layer that thaws during summer. The depth of the active layer is typically expected to range between one and three metres. Depending on lake size, depth, and thermal storage capacity, the talik (unfrozen ground surrounded by permafrost) beneath lakes may fully penetrate the permafrost layer resulting in an open talik. Circular lakes with a radius greater than 300 m, or elongated lakes with a half-width of at least 150 m, are assumed to be connected to the deep groundwater flow regime through open taliks. The thickness of the permanently frozen permafrost was estimated to be on the order of 427 to 495 m.

In areas of continuous permafrost, there are two groundwater flow regimes: a deep groundwater flow regime beneath permafrost, and a shallow groundwater flow regime located in the active (seasonally thawed) layer near the ground surface. With the exception of areas of taliks beneath lakes, the two groundwater regimes are isolated from one another by thick permafrost.

The shallow groundwater regime is active only seasonally during the summer months, and the magnitude of the flow in this layer is expected to be several times less than runoff from snowmelt. Groundwater in the active layer primarily flows to local depressions and ponds that drain to larger lakes; therefore, the total travel distance would generally extend only to the nearest pond, lake, or stream. Water in the active layer is stored in ground ice during the cold season and is then released with the ice thaws in late spring or early summer, thus providing flow to surface. During the warm season, groundwater in the active layer is recharged primarily by precipitation.

Permafrost reduces the hydraulic conductivity of the bedrock by several orders of magnitude (Burt and Williams 1976; McCauley et al. 2002). Consequently, the permafrost in the rock would be virtually impermeable to groundwater flow. The shallow groundwater flow regime, therefore, has little to no hydraulic connection with the deep groundwater regime which is overlain by massive and continuous permafrost.

Groundwater flow within the deep groundwater flow regime is limited to the sub-permafrost zone. This deep groundwater flow regime is connected to the ground surface by open taliks underlying larger lakes. Talik exist beneath lakes that have enough depth so that they do not freeze to the bottom over the winter. If the lake is sufficiently large and deep, the talik can extend down to the deep groundwater regime. These taliks are referred to as open talik. If the talik does not extend down to the deep groundwater, it is referred to as a closed or an isolated talik. The width and shape of lakes in the Hydrogeology Baseline Study area were reviewed to estimate if open taliks could be present below the lakes (FEIS Volume 6 Appendix 6.A). Based on 1-D analytical solutions presented in Burn (2002), Golder estimated that open taliks could be present for circular lakes with a radius of approximately 300 m and for elongated lakes with a half-width of approximately 150 m. Beneath smaller lakes that do not free to the bottom over the winter, a talik bulb may form; however, the talik bulb is not expected to extend to the deep groundwater flow system.

Generally, deep groundwater will flow from higher elevation lakes with open taliks to lower elevation lakes with open taliks. To a lesser degree, groundwater beneath the permafrost is influenced by density differences due to saline water conditions (density driven flow).

Below the active layer, permafrost underlies the land surrounding the lakes, which restricts the lateral or horizontal flow of groundwater and restricts the recharge of the sub-permafrost groundwater flow system by precipitation. Multiple thermistors in the land surrounding Whale Tail Lake, in combination with thermal modelling, indicate the permafrost extends to 425 m to 495 m below ground surface. In particular, thermistor data recorded at AMQ15-452, AMQ17-1233, AMQ17-1337 and AMQ17-1277A (Golder 2018b) indicates the presence of permafrost between Whale Tail Lake and Nemo lake, and therefore the absence of horizontal groundwater flow in the upper 425 to 495 m of bedrock.

Groundwater flow is controlled by surface water elevations in lakes with open talik; water moves vertically through the open talik to the underlying sub-permafrost groundwater flow system. The elevations of the lakes with expected talik in the baseline study area indicate that Whale Tail Lake is likely a groundwater discharge zone at the south end of the Lake (upward vertical hydraulic gradient), with flow from Lake A60 to Whale Tail Lake, and a groundwater recharge zone at the north end of the Lake (downward hydraulic gradient), with groundwater flow from Whale Tail Lake to Lake DS1 as presented on the Figure 2 showing the hydrogeology baseline study area. Whale Tail Pit is located in the north basin and therefore a downward vertical hydraulic gradient is expected (Figure 3). This was verified by hydraulic head monitoring at the Westbay Well system, which had a measured downward hydraulic gradient of 0.008 m/m, which is equivalent to what would be expected based on the relative lake elevation of Whale Tail Lake and Lake DS1 (Golder 2019).

Figure 2: Hydrogeology Baseline Study Area

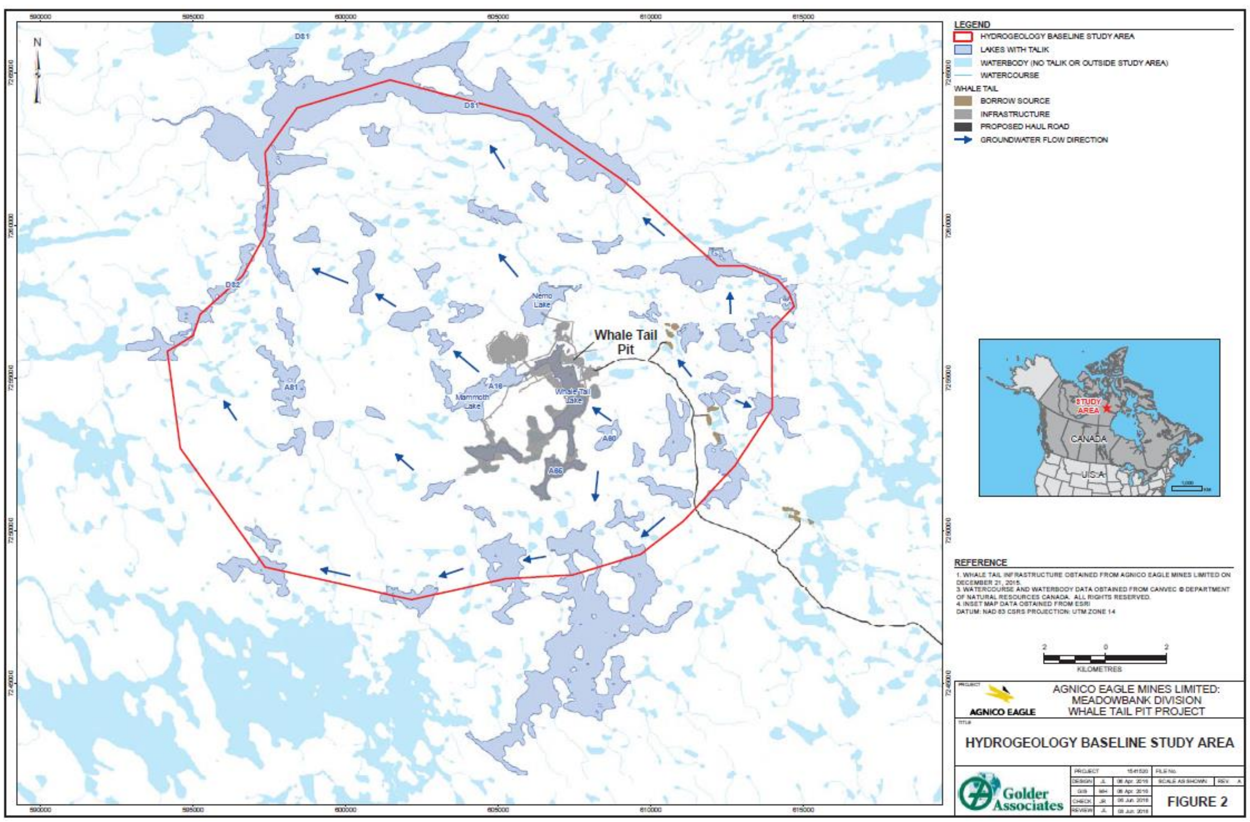
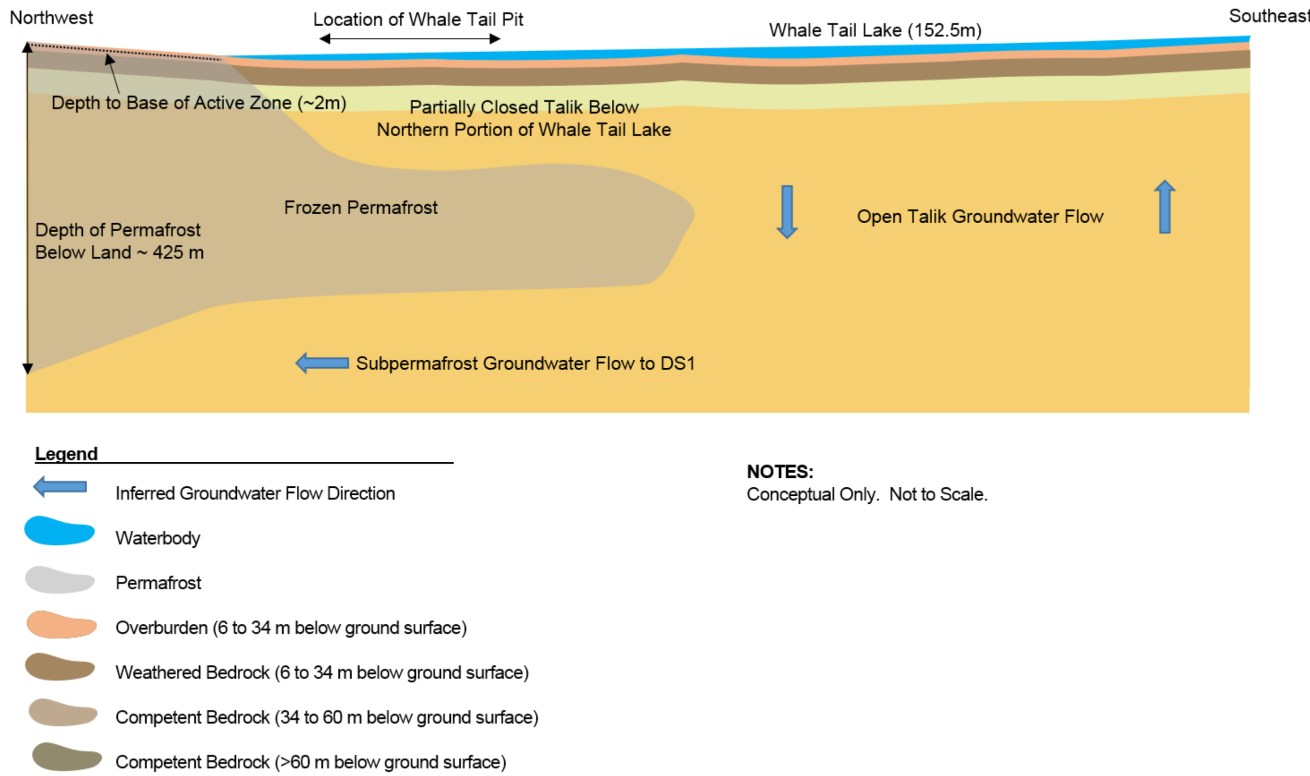
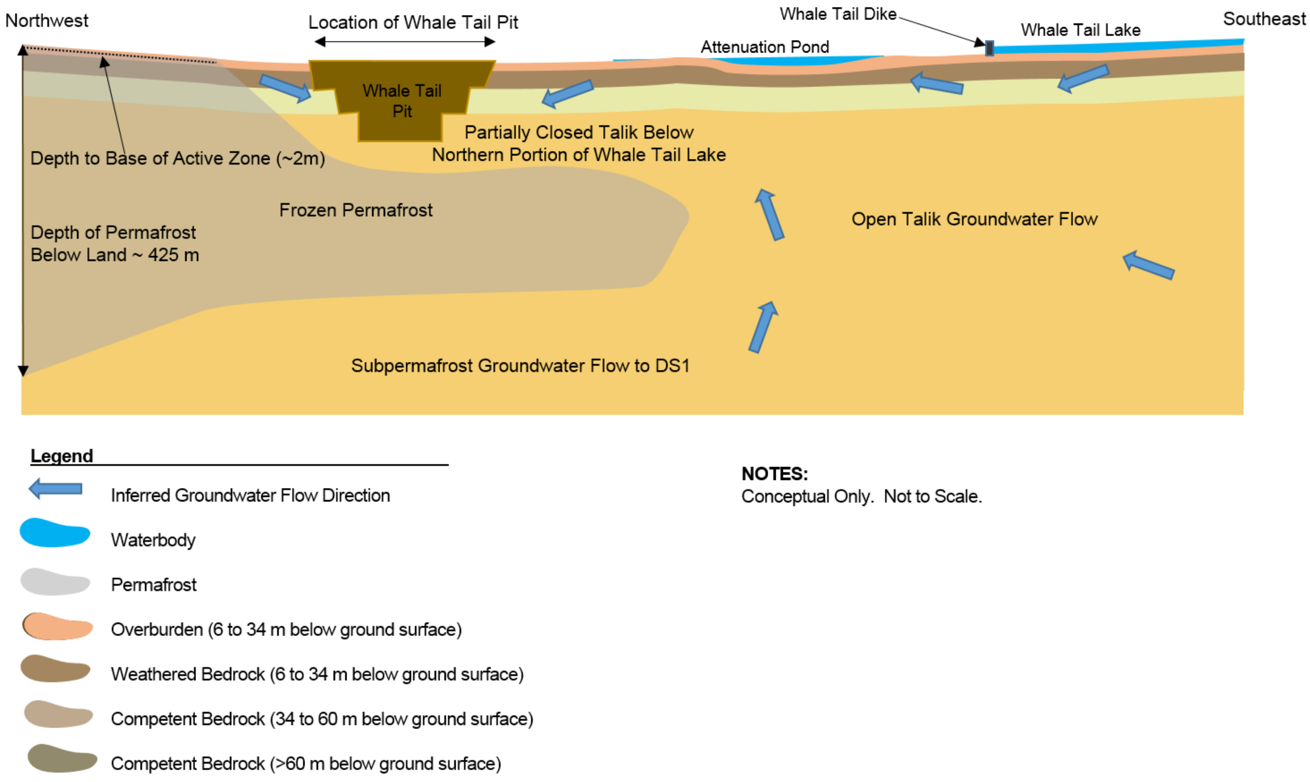


Figure 3: Conceptual Model of Pre-Mining Deep Groundwater Flow Regime - Cross-Section View



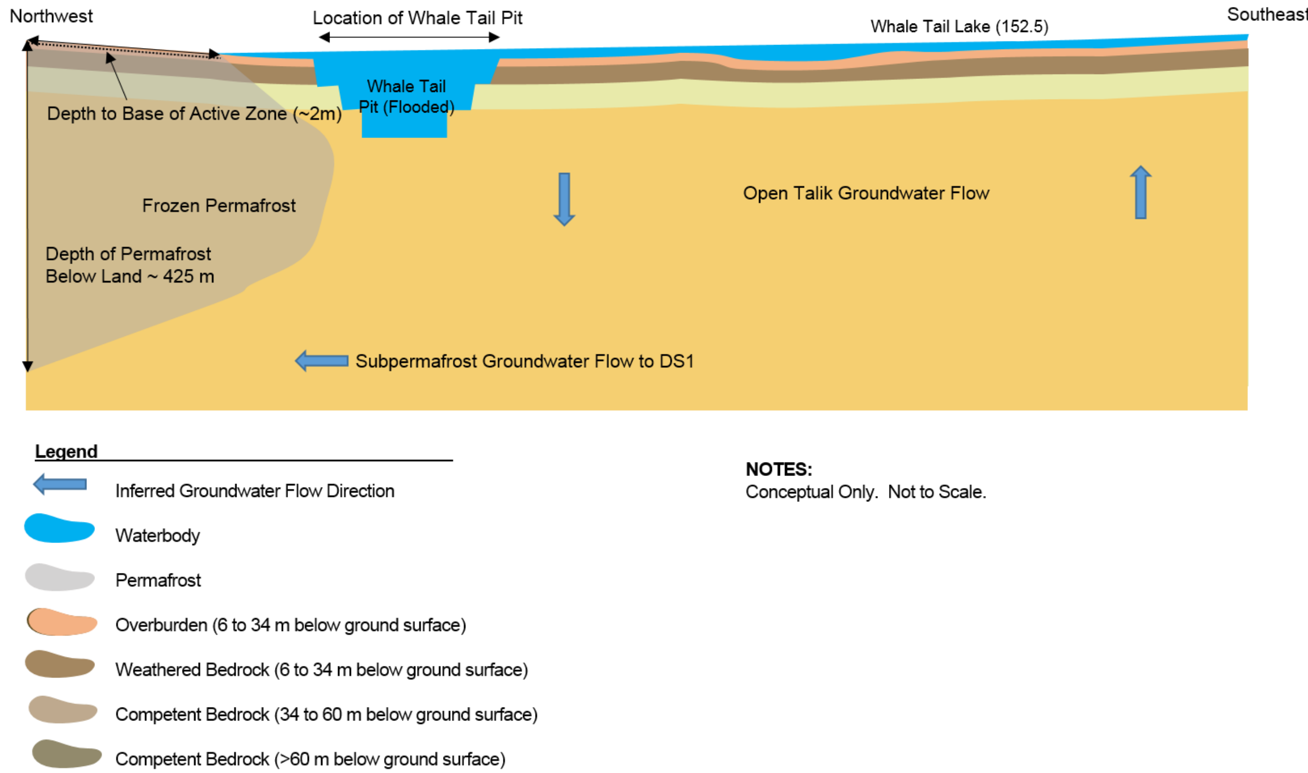
Below Whale Tail Lake, a talik is expected to form a continuous channel that is closed in the northern portion of Whale Tail Lake below the open pit and becomes open towards the south and central portion of the lake. As shown in Figure 4, during mining the open pit will act as a sink for groundwater flow, with seepage faces developing along the pit walls. In response to mining of the open pit, groundwater will be induced to flow through bedrock to the open pit. Mine inflow will primarily originate from Whale Tail Lake, the attenuation pond between the pit and Whale Tail dike, and deep bedrock. The quality of mine inflow will be a result of the mixing from each of these sources.

Figure 4: Conceptual Model of Deep Groundwater Flow Regime during Mining - Cross-Section View



During closure (Figure 5), the open pit will be flooded with water from a variety of sources including: water pumped from the flooded South Whale Tail watershed until the original Whale Tail Lake level is reached (152.5 m), the north-east watershed following the breach of the North-East dike, groundwater originating from nearby lakes underlain by open taliks, connate water and water pumped from the attenuation pond. This process will dissipate the large hydraulic head differences established during mine operations in the vicinity of the mine workings. The rate of groundwater inflow will decrease as the water level in the open pit rises. From the start of closure and following the formation of the pit lake in post-closure, permafrost below the pit is expected to thaw slowly. The thermal regime in the vicinity of the pit will be monitored, as outlined in the Thermal Monitoring Plan for the Project (Agnico Eagle 2018b).

Figure 5: Conceptual Model of Deep Groundwater Flow Regime in Long-Term Post-Closure - Cross-Section View



2.2.2 Post-Closure Hydrogeological and Thermal Analysis

Hydrogeological analysis was conducted to assess the post-closure groundwater regime in the vicinity of the Whale Tail Pit (Golder 2018a). The intent of the study was to consider post-closure changes in the groundwater regime once the pit lake reaches its ultimate elevation and the influence, if any, that these changes may have on water quality in the flooded pit. As part of the analysis, the predicted changes in the permafrost regime, based on a post-closure thermal assessment, were incorporated in to the hydrogeological model. The results of the hydrogeological assessment provided input into a concurrent study that assessed water quality in the flooded pit (Golder 2018c). Overall, groundwater was found to be a minor component of the flooded pit lake water quality due to the small predicted seepage rates from the pit in relation to typical surface water exchanges.

Results of the post-closure thermal assessment (Golder, 2018b) included:

- During pit flooding, the warm pit lake temperature impacts mostly the upper portion of the permafrost under the pit, and a talik starts to form around the pit wall and floor.

- The permafrost under the pit lake continues to thaw during the long-term post-closure stage, and the open talik expands towards the northern edge of the pit lake (land side). The majority of the permafrost under the pit lake is thawed 300 years after closure.

- The steady-state model indicates the pit lake would thaw the permafrost in the long-term, and eventually somewhat reduce the permafrost depth to the northwest of the pit. A significantly longer time (in the order of 10,000 years) is likely required for the pit lake to reach the steady-state thermal conditions. Permafrost is still predicted to the north of the pit, restricting the horizontal flow of groundwater to towards Nemo Lake where the permafrost is present.

Result of the Post-closure hydrogeological model (Golder, 2018a) included:

- Initially, once the hydraulic heads return to near equilibrium shortly after mine flooding, groundwater inflow into the pit is greater than pit lake discharge into surrounding bedrock. This groundwater discharge to the pit lake decrease gradually over 100 years, at which time it reverses and the pit lake discharge into the bedrock is greater than the groundwater inflow. The relative difference in flow increases with time and as the permafrost layer beneath the pit lake thaws.

- Long-term, the pit lake establishes as a source of groundwater recharge, which is consistent with the current pre-development groundwater flow condition.

As summarized above, with the exception of deep sub-permafrost groundwater flow, groundwater flow during closure will be similar to pre-development conditions and limited to the area of talik below Whale Tail Lake and the developed pit lake during closure. Horizontal flow beneath land will be restricted by the presence of permafrost below the active layer. Thermal analysis indicates that although permafrost degradation below the pit footprint will occur, permafrost will be present below the land outside of the pit lake and other lakes with talik (i.e., including between the pit and Nemo Lake).

Predictions from the hydrogeological modelling were an input into a concurrent study that assesses overall water quality in the flooded pit (Golder, 2018c). Arsenic loading rate from the Whale Tail pit north wall has been determined from the completion of the Arsenic diffusion model (Golder, 2018d) and integrated to the Whale Tail Pit hydrodynamic model (Golder, 2018c). Result of the hydrodynamic model are:

- The concentration of TDS will remain below site specific water quality objectives at all times. TDS will peak at just below 25mg/L in year 2025, and thereafter decrease over time. Concentration of TDS will stabilize at approximately 11mg/L by 2055.

- The concentration of arsenic will remain below site specific water quality objectives at all times. Arsenic will peak at just below 0.025mg/L in year 2025, and thereafter decrease over time. Concentration of arsenic will stabilize at approximately 0.0025mg/L by 2055.

- The concentration of total phosphorous will remain below site specific water quality objectives at all times. Total phosphorus will peak at just above 0.007mg/L in year 2025, and thereafter decrease over time. Concentration of total phosphorus will stabilize at approximately 0.0025 mg/L by 2055.

The pit lake in the long-term is expected to be a source of groundwater recharge, with a seepage loss rates to groundwater of approximately 1.7 m^3/day (620 m^3/year), which is negligible relative to the 3,000,000+ m^3 of surface water exchanged annually post-closure when surface water flows are re-established, based on average climate year watershed runoff. This groundwater loss rate is representing 0.02% of the total surface water exchanged annually. This indicates that uncertainty in the hydraulic gradient and groundwater flow is not critical to the long-term assessment of pit lake water quality. As presented in Golder (2018) recent monitoring of the hydraulic gradient, and calculated fluxes based on this gradient suggest that the predicted post-closure seepage rates are reasonable based on the measured data.

2.2.3 Groundwater Volumes and Quality

Potential groundwater inflow quantity and quality with respect to total dissolved solids was predicted in the FEIS using a groundwater numerical model (FEIS Volume 6, Appendix 6.B). A summary of these predictions is presented on Table 1 and Table 2.

Table 1: 2015 Predicted Groundwater Inflow to the Open Pit during Operations and Closure

Phase	Period	Groundwater Inflow (m^3/day)	TDS Concentration (mg/L)
Dewatering	Mar 2019 to Oct 2019	-	-
Mining	Q4 2019 to 2020	275	415
	2021	100	410
Filling	2022	65	370
	2023	55	365
	2024	30	370
	Jan to Oct 2025	15	370
	Nov 2025 to Oct 2028	1	370

Note: Mining prior to Q4 2019 is within permafrost and groundwater inflow will be negligible.

TDS = total dissolved solids; m^3/day = cubic metres per day; mg/L = milligrams per litre

Table 2: 2015 Predicted Groundwater Inflow to the Attenuation Pond during Operations and Closure

Phase	Period	Net Groundwater Inflow (m^3/day)	TDS Concentration (mg/L)
Dewatering	Mar 2019 to Oct 2019	-	-
Mining	Q4 2019 to 2020	2	160
	2021	1	170
Filling	2022	1	195
	2023	1	175
	2024	1	175
	Jan to Oct 2025	1	175
	Nov 2025 to Oct 2028	-	-

TDS = total dissolved solids; m^3/day = cubic metres per day; mg/L = milligrams per litre

In accordance with Project Certificate Term and Condition No. 16b and 16c, Golder conducted a supplemental hydrogeological assessment to predict the post-closure groundwater regime in the vicinity of the Whale Tail Pit (Golder 2018a). The purpose of the model simulations was to evaluate the effects of higher TDS groundwater beneath the open pit on the groundwater flow system after closure and to evaluate the influence of solute transport by density–driven flow on the movement of solutes from the bedrock into the flooded pit.

Table 3 presents the predicted groundwater inflow quantity and quality to the Whale Tail Pit during post-closure. The results of the post-closure hydrogeological assessment provided input into a concurrent study that was assessing overall water quality in the flooded pit (Golder 2018b). The post-closure model results show that, initially, once the hydraulic heads return to near equilibrium shortly after mine flooding, groundwater inflow into the pit lake is greater than pit lake discharge into surrounding bedrock. Over time, pit lake water is drawn downwards from the bottom part of the flooded pit into bedrock. Approximately 100 years after closure, pit lake water discharge into bedrock becomes greater than groundwater inflow into the pit lake. The relative difference in flow increases with time and as the permafrost layer beneath the pit lake is predicted to thaw.

Table 3: Predicted Groundwater Inflow and Groundwater Quality – Post-Closure

Years Following Closure	Groundwater Inflow to Pit Lake (m^3/day)	Average TDS Concentration into pit (mg/l)	Pit Lake Outflow to Groundwater (m^3/day)
1	2.2	650	1.1
10	1.1	540	0.8
100	0.2	440	0.8
500	0.1	77	1.7

2.3 ADDITIONAL DATA COLLECTION

Project Certificate Term and Condition No. 15 indicates the need to collect additional site-specific hydraulic data in key areas of the Project during the pre-development, construction and operational phases. Agnico Eagle has commenced with the collection and documentation of this data, and a summary of the results is presented below.

2.3.1 Groundwater Quality

At the time of the FEIS, a representative sample of deep groundwater had not been collected and data collected at the Meadowbank Mine was used to infer the TDS profile at the project. A Westbay well system was installed on site between March and April in 2016. The borehole was drilled to a depth of 499 m. The well was installed to monitor hydraulic heads, test hydraulic conductivity, and collect groundwater samples from multiple intervals (Golder 2016c). The groundwater samples collected from the Westbay system at depths from 276 m to 392 m indicate that the TDS content in the groundwater was between 3,198 mg/L and 4,042 mg/L. This range is slightly higher than the groundwater TDS measured at Meadowbank from shallower depths (less than 200m vertical depth).

Groundwater samples were also collected from the Westbay in November 2018, along with the measurement of vertical hydraulic gradient (Golder 2018). The 2018 program estimated groundwater quality were in the same range as previously estimated. The calculated groundwater TDS were slightly higher in 2018 which was attributed to the higher proportion of residual drilling water in the sample. The concentrations of metals and arsenic were low. Given that the arsenic concentrations are similar to the assumptions adopted in the geochemical models (low arsenic in formation groundwater), groundwater arsenic content is still not likely to have a significant effect on mine surface water quality.

Data collected from the Westbay will be used in future updates to the water quality forecast in support of the Project. At this time, it is expected that the water treatment system planned for the project can handle groundwater with the measured water quality observed in 2016 and 2018.

2.3.2 Hydraulic Conductivity Testing

Supplemental hydrogeological investigations have been undertaken between 2015 and 2017 to further characterize the hydraulic conductivity of the bedrock in the vicinity of the Whale Tail Pit. These investigations have been documented in reports by Knight Piesold (2016), Golder (2016a, 2017), and SNC (2017). These investigations included the completion of 49 packer tests in unfrozen areas of bedrock (i.e., within the talik or below the regional permafrost).

Data collected from these four supplemental investigations indicate the bulk hydraulic conductivity of the bedrock ranges on the order of 1×10^{-5} m/s near surface (i.e., up to depths of 40 m) to approximately 1×10^{-9} m/s at greater depths. As part of the FEIS, the hydraulic conductivity was estimated to be between 1×10^{-8} and 2×10^{-7} m/s. Evaluation of the refined estimates of hydraulic conductivity from the supplemental testing with respect to groundwater flows indicate that the inflow to the pit could be up to five times higher (up to 1,400 m^3/day) during mining due to the groundwater flow rates to the pit being controlled by the shallow bedrock hydraulic conductivity (connection of the pit to the south whale tail basin). This higher flow rate is within the limits of the water treatment system and water management infrastructure and adaptive management of these flows is not required at this time.

The lower hydraulic conductivity of the bedrock at depth indicate that the seepage rates from the pit are likely to be lower than predicted in the post closure hydrogeological assessment. This indicates that the predicted seepage rates were conservatively high, and that actual seepage rates from the pit lake will be slightly lower due to the lower bedrock hydraulic conductivity expected to be present near the base of the pit. Based on the lower estimated hydraulic conductivity near the base of the pit (1 x 10^{-9} m/s), the measured vertical hydraulic gradient in the Westbay (0.008 m/m), and an approximately flooded pit lake area of approximately 0.5 Km3, the long-term predicted discharge from the pit lake at post-closure would be approximately 0.3 m^3/day). Overall, the estimated flux is similar to the long-term predicted discharge from the pit lake at post-closure (1.7 m^3/day) and supports the conclusion in the FEIS that long-term predicted flows from the pit lake to the groundwater flow system will be negligible relative to the surface water exchange into the pit lake (Golder 2018c).

2.3.3 Verification of Horizontal and Vertical Groundwater Flow Direction

Thermal data continues to be collected at the Project to verify assumptions in the permafrost conditions. Thermistors have been installed at ten locations, of which four are located to the north of the Whale Tail Pit, between Nemo Lake and Whale Tail Pit (Golder 2018b). These thermistors verify the presence of permafrost below the active layer and that the deep-sub permafrost groundwater flow system will only be connected/recharged by vertical flow through talik present below lakes of sufficient size, such as Whale Tail lake. The four thermistors between Nemo Lake and Whale Tail Pit (AMQ17-1337, AMQ17-1233, AMQ17-1277A and AMQ15-452) each indicate permafrost below the land and that horizontal flow below the active layer is restricted by permafrost in the upper 425 to 495 m of bedrock.

The vertical movement of groundwater flow through the open talik is being monitored using the Westbay Well system (AMQ16-626) to measure the vertical hydraulic gradient. This monitoring verified the direction of groundwater flow and can be used in combination with the measured bedrock hydraulic conductivity to estimate the groundwater flux near Whale Tail Pit.

The data collected at AMQ16-626 (Golder 2018), indicates the presence of a downward hydraulic gradient. Assuming the measured hydraulic head is representative of the midpoint of the measurement interval, the downward gradient is 0.008 m/m. This gradient is consistent with the estimated gradient derived from looking at the relative elevation of Whale Tail Lake and DS1 (0.008 m/m), as reported in Agnico Eagles response to TC15 (Agnico Eagle 2018). DS1 is the predicted receptor from water in the area of Whale Tail Pit and Underground (Golder 2016c). Figure 2 is presenting location of Whale Tail Lake and DS1 Lake.

For the depth interval over which the hydraulic head was measured (326 to 456 mbgs), the estimated hydraulic conductivity of the bedrock for the FEIS for the Whale Tail Pit Project was 1 $x10^{-8}$ to 3 x 10^{-8} m/s (Golder 2016c). As discussed, in support of TC15 and the development of the Project, additional packer testing was conducted subsequent to the FEIS and the data indicate the hydraulic conductivity of bedrock over this depth interval is likely lower (1 x 10^{-9} m/s based on the geometric average of the test data) (Golder 2018a). Considering the measured gradient (0.008), the historical range of bedrock hydraulic conductivity adopted in the FEIS (1 $x10^{-8}$ to 3 x 10^{-8}) and the now refined hydraulic conductivity (1 x 10^{-9} m/s) and an assumed effective porosity of 0.001 (Maidment 1992; Stober and Bucher 2007), the estimated downward groundwater flow velocity is between approximately 0.25 m/yr and 8 m/yr. The lower bound of this range is considered more reasonable, as it uses the refined hydraulic conductivity data discussed above, which is based on the geometric mean of all the packer test measurements (pre- and post-FEIS).

Gradients measured during this monitoring program are considered a reasonable interpretation of what long-term gradients could be post-closure following the formation of the pit lake. Recharge and discharge from the base of Whale Tail Lake or a flooded pit lake will be controlled by the vertical hydraulic gradients and the bedrock hydraulic conductivity near the base of the permafrost. Considering the approximate area of the Whale Tail Pit (0.5 km^2), the range in bedrock hydraulic conductivity (1 x 10^{-9} to 3 x 10^{-8} m/s), and the measured downward gradient (0.008), the data would indicate long-term groundwater flux would be approximately 0.3 m^3/day to 11 m3/day. Similar to the estimated groundwater velocity, the lower bound of this range is considered more reasonable, as it uses the refined estimate of hydraulic conductivity. Overall, the estimated flux is similar to the long-term predicted discharge from the pit lake at post-closure (1.7 m3/day; Golder 2016c) and supports the conclusion in the FEIS that long-term predicted flows from the pit lake to the groundwater flow system will be negligible relative to the surface water exchange into the pit lake (Golder 2018c).

3 GROUNDWATER MONITORING PLAN

Water quantity and quality monitoring data will be used to verify the predicted water quality and quantity trends and to conduct adaptive management should differing trends be observed. Monitoring will be initiated at the start of mining and continue during operations and closure.

The GWMP will be further defined as the open pit is developed and will be conducted in agreement with the WMP for the Project.

3.1 HORIZONTAL AND VERTICAL GROUNDWATER FLOW MONITORING

Thermal monitoring will continue at each of the installed thermistors to monitor the presence of permafrost below the active layer during construction and operations phases. The monitoring will continue until such time as a thermistor is destroyed by active mining. Two thermistors, AMQ17-1233 and AMQ17-337, are located outside of the pit footprint and will be used to monitor permafrost conditions between Nemo Lake and Whale Tail Pit. The thermistor data will be used to verify the presence of permafrost and the restricted horizontal movement of groundwater below the active layer due to permafrost in the upper 425 to 495 m of bedrock.

As part of the Whale Tail Dike Operation Maintenance and Surveillance manual, performance of the Whale Tail dike will be monitored with different instruments (e.g. piezometers) located in the principal horizontal groundwater flow pathway between Whale Tail South Basin and the Whale Tail pit. Piezometer readings and water level in the Whale Tail South Basin and the Attenuation Pond will be available to calibrate the hydrogeological model during operation if deemed necessary.

Vertical groundwater flow conditions in the area of Whale Tail Pit will be monitored by the Westbay Well system. Agnico Eagle will be sampling the Westbay Well system commencing in March 2019 and will continue to sample and report on an annual basis during the Construction and Operations Phases. The monitoring will include the measurement of the vertical hydraulic gradient and the collection of groundwater samples. During operations, this data will be supplemented by the direct measurement of groundwater quality in the seepage inflow to the pit (Section 3.2). Water sampling parameters will be consistent with the sump sampling and seepage surface parameters planned for the pit (Section 3.2.2).

Data collected during construction and operations phases will be used to develop an appropriate monitoring for closure and will be documented in the Interim Closure and Reclamation Plan.

3.2 GROUNDWATER QUANTITY AND QUALITY MONITORING

3.2.1 Water Quantity

Groundwater inflow to the open pit will be collected in sumps prior to being pumped to surface. Water collected in the sumps represents the bulk, or combined inflow to the open pit, and may include other sources of water, such as precipitation. During construction and operations, groundwater inflow to the pit will be evaluated four time per calendar year as per Water Licence 2AM-WTP1826 requirements. Management of the pumped-out water is described in the WMP.

The above flow monitoring will be supplemented by periodic seepage surveys to be conducted twice during the first year of mining and once a year thereafter. In the first year of pit development, one of the seepage surveys will be conducted in early summer, following snow melt and thawing of any ice in the pit walls, and then again in late August. In the following years of mining, one survey will be conducted in August of each year. The objective of the seepage surveys is to identify preferential groundwater flow paths in the walls of the open pit, if present, and to determine their relative contribution to the groundwater inflow to the pit with respect to water quantity and quality.

3.2.2 Water Quality

During the operations phase, the quality of water from the sumps (either at the sump or at end of pipe at the surface) will be monitored four time per calendar year as per Water Licence 2AM-WTP1826 requirements.

Water samples will also be collected from seeps in the pit walls if there is sufficient water for analysis and if access to the seep is possible.

For each sample, field parameters will be recorded (pH, turbidity, salinity and electrical conductivity). Analytical parameters will include:

- Total and Dissolved Metals: aluminium, antimony, arsenic, boron, barium, beryllium, cadmium, copper, chromium, iron, lithium, manganese, mercury, molybdenum, nickel, lead, selenium, tin, strontium, titanium, thallium, uranium, vanadium and zinc.

- Nutrients: ammonia-nitrogen, total kjeldahl nitrogen, nitrate nitrogen, nitrite-nitrogen, ortho-phosphate, total phosphorous, total organic carbon, total dissolved organic carbon and reactive silica.

- Conventional Parameters: bicarbonate alkalinity, chloride, carbonate alkalinity, conductivity, hardness, calcium, potassium, magnesium, sodium, sulphte, pH, total alkalinity, total dissolved solids, total suspended solids and turbidity.

- Total cyanide and free cyanide. If total cyanide is detected above 0.05 mg/L at a monitoring station in receiving environment; further analysis of Weak Acid Dissociable Cyanide will be triggered.

Additional chemical analyses may be required to more completely characterize the chemical loading from the mine water. The additional analyses will be dependent on monitoring results.

3.3 DATA COMPILATION AND UPDATES TO GROUNDWATER MODEL

Groundwater monitoring data will be compiled into a Project-specific database and evaluated for trends in groundwater data with respect to pit and underground inflow quantity and quality.

Measured groundwater inflow rates will be compared to model predictions on an annual basis. If significant variations from model predictions are observed, the assumptions behind the data will be reviewed and the analysis updated if required. In addition, updates to the groundwater model will be made if operational changes occur as the open pit advances which could significantly alter groundwater inflow or quality.

Variations that would be considered significant and would be triggers for review of the data include:

- Groundwater inflow quantity to the mine, based on rolling monthly average of inflow over six consecutive months, is 20% higher than predicted groundwater inflow. The six-month averaging period of observation is based on observed seasonal variations in inflow quantities in mines situated in continuous permafrost regions, where half the year there is virtually no surface water component of flow to the pit.

- Collected water samples that indicate that the TDS is more than 25% higher than the estimated water quality, based on a 6-month rolling average.

- Temperature profiles observed in the sentinel thermistors (AMQ17-1233 and AMQ17-337) located between Nemo Lake and Whale Tail Lake are showing sign of permafrost degradation below the active layer.

- Observed inflow quantity and quality is lower than expected would not be of concern and/or effect water management plans on-site. Model updates or analysis would therefore not be conducted if predicted inflow quantity and quality is higher than observed conditions.

If the first three variations are triggered, the groundwater and/ or permafrost data would be assessed to evaluate trends, the potential causes of the triggers and the potential for long-term effects associated with the variation. If for example, the greater than predicted inflows were correlated to a short-term effect such as freezing in the pit walls, changes in mining rate, freshet or transient drainage of a high storage feature, then further reassessment of groundwater inflows may not be required, and the adaptive management of these short-term effects would be evaluated under the Water Management Plan (WMP). However, if the effects of these variations is found to be potentially long term, this may warrant review of the model and/or permafrost calibration and predictions.

Table 4 presents the adaptive management plan with respect to groundwater monitoring. The design of the water management infrastructure includes contingencies in case of unplanned events. The Whale Tail attenuation pond can handle higher groundwater inflows and the Operation Water Treatment Plan (O-WTP) is designed to handle total flow rates 60% higher than planned (including surface and groundwater inflows reporting to the Attenuation Pond). O-WTP has the capacity to treat more than a five times increase in groundwater inflows from the one predicted during operation. Moreover, if the inflows are greater than this then there is the capacity to store water within the pit and adjust the mining plan to deal with extra inflows. In any case, all contact water will be managed within the pit area.

The groundwater management strategies: the ponds, sumps and water conveyance strategies around the pit can be modified to mitigate the effect of additional groundwater volume or salinity prior to treatment and discharge. The water conveyance strategy will be evaluated and optimized during operations and closure to maintain post-closure commitments. Other engineering solutions such as depressurization wells, grouting and thermosiphons may be considered, if warranted.

If one of the thresholds in Table 4 is triggered and it is found to be a potentially long-term effect, then hydrogeological and thermal analyses will be required to define the best solution to address the exceedance. Agnico Eagle considers that adaptive management must be based on well informed decisions and may include re-calibration of the thermal and hydrogeological models, predictions based on these re-calibrations, and revised Site-Wide water balance and Site-Wide water quality forecasts.

Table 4: Groundwater Adaptive Management Plan

Threshold	Consequence	Likelihood	Adaptive Management
Groundwater inflows to the mine, based on rolling monthly average of inflow over six consecutive months, is 20% higher than predicted groundwater inflow	• Higher water volume to treat during operation • Potential to compromise storage capacity of the attenuation pond • Impact on mining sequence	Low	O-WTP have 60% contingency to manage higher inflow to attenuation pond (forecasted peak operation flow in the water balance is 1,300m^3/h during 12h a day vs treatment capacity of 1,800 m^3/h during 24h per day); O-WTP have the capacity to treat more than five times increase in groundwater inflows from the one predicted during operation; Attenuation pond has 50% contingency to manage higher groundwater inflow; Assess situation by performing additional inspection, monitoring and field investigation; Review hydrogeological model, Site-wide water balance and Site-wide water quality forecast with updated data; Review water management strategy (e.g. temporary storing water in the pit); Evaluate potential long-term mitigations (e.g., grouting); Review water management strategy.
Collected groundwater samples that indicate that the TDS is more than 25% higher than the estimated groundwater quality, Based on rolling monthly average over 6 consecutive months	• Higher TDS water quality to treat during operation • Compromise storage capacity of the attenuation pond • Potential to reduce water treatment efficiency and management plan if not meeting Metal and Diamond Mining Effluent Regulations • Impact on mining sequence	Low	O-WTP have 60% contingency to manage higher inflow to attenuation (forecasted peak operation flow in the water balance is 1,300m3/h during 12h a day vs treatment capacity of 1,800m3/h during 24h per day); O-WTP have the capacity to treat more than five times increase in groundwater inflows from the one predicted during operation; Flow to the pit is dominated by seepage loss from the Attenuation Pond and seepage from the South Basin of Whale Tail Lake. As the groundwater inflow to the pit is representing a small ratio of the overall water inflows in the attenuation pond, water treatment efficiency should not be impacted significantly by uncertainty in the groundwater

			TDS; Assess situation by performing additional inspection, monitoring and field investigation; Review hydrogeological model, Site-wide water balance and site-wide water quality forecast with updated data; Evaluate additional treatment and storage capacity required to manage flow in operation (e.g. storing water in the pit); Evaluate potential long term mitigations (e.g. grouting, thermosiphon); Review water management strategy.
Temperature profile observed in the sentinel thermistors (AMQ17-1233 and AMQ17-337) located between Nemo Lake and Whale Tail Lake are showing sign of permafrost degradation below the active layer.	• Horizontal groundwater flow observed between Whale Tail Pit north wall and Nemo Lake. • Potential for groundwater seepage to pit sump/pit lake. • Increased water treatment requirement.	Unlikely	Assess situation by performing additional inspection, monitoring and field investigation; Review thermal model, hydrogeological model, Site-wide water balance and site-wide water quality forecast with updated data; Install new thermistor(s) to evaluate the extent of the permafrost degradation; Evaluate additional treatment and storage capacity required to manage flow in operation (e.g. storing water in the pit); Evaluate potential long-term mitigations as depressurization wells, grouting, thermosiphon Review water management strategy.

4 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Quality Assurance (QA) refers to plans or programs that encompass a wide range of internal and external management and technical practices designed to ensure the collection of data of known quality that matches the intended use of the data. Quality Control (QC) is a specific aspect of QA that refers to the internal techniques used to measure and assess data quality. Specific QA and QC procedures that will be followed during sampling performed for the GWMP are described in Section 4.1 and 4.2.

4.1 QUALITY ASSURANCE

Quality assurance protocols will be diligently followed so data are of known, acceptable, and defensible quality. There are three areas of internal and external management, which are outlined in more detail below.

4.1.1 Field Staff Training and Operations

To make certain that field data collected are of known, acceptable, and defensible quality, field staff will be trained to be proficient in standardized field groundwater sampling procedures, data recording, and equipment operations applicable to the GWMP. All field work will be completed according to specified instructions and established technical procedures for standard sample collection, preservation, handling, storage and shipping protocols.

4.1.2 Laboratory

To make sure that high quality data are generated, accredited laboratories that will be selected for sample analysis. Accreditation programs are utilised by the laboratories so that performance evaluation assessments are conducted routinely for laboratory procedures, methods, and internal quality control.

4.1.3 Office Operations

A data management system will be utilized so that an organized consistent system of data control, data analysis, and filing will be applied to the GWMP. Relevant elements will include, but are not limited to the following:

- all required samples are collected;
- chain-of-custody and analytical request forms are completed and correct;
- proper labelling and documentation procedures are followed, and samples will be delivered to the appropriate locations in a timely manner;
- laboratory data will be promptly reviewed once they are received to validate data quality;
- sample data entered into a Mine-specific groundwater quality database will be compared to final laboratory reports to confirm data accuracy; and
- appropriate logic checks will be completed to ensure the accuracy of the calculations.

4.2 QUALITY CONTROL

The QC component will consist of applicable field and sample handling procedures, and the preparation and submission of two types of QC samples to the various laboratories involved in the program. The QC samples include blanks (e.g., travel, field, equipment) and duplicate/split samples.

Sample bottle preparation, field measurement and sampling handling QC procedures include the following:

- Sample bottles will be kept in a clean environment, capped at all times, and stored in clean shipping containers. Samplers will keep their hands clean, wear gloves, and refrain from eating or smoking while sampling.
- Where sampling equipment must be reused at multiple sampling locations, sampling equipment will be cleaned appropriately between locations.
- Temperature, pH, and specific conductivity will be measured in the field using hand held meters (e.g., YSI water quality sondes).
- Samples will be cooled to between 4°C and 10˚C as soon as possible after collection. Care will be taken when packaging samples for transport to the laboratory to maintain the appropriate temperature (between 4°C and 10˚C) and minimize the possibility of rupture. Where appropriate, samples will be treated with preservatives to minimize physical, chemical, biological processes that may alter the chemistry of the sample between sample collection and analysis.
- Samples will be shipped to the laboratory as soon as reasonably possible to minimize sample hold times. If for any reason, samples do not reach the laboratory within the maximum sample hold time for individual parameters, the results of the specific parameters will be qualified, or the samples will not be analysed for the specific parameters.
- Chain of custody sample submission forms will be completed by field sampling staff and will be submitted with the samples to the laboratory.
- Only staff with the appropriate training in the applicable sampling techniques will conduct water sampling.

Quality control procedures implemented will consist of the preparation and submission of QA/QC samples, such as field blanks, trip blanks, and split/duplicate water samples. These are defined as follows:

- Field Blank: A sample will be prepared in the field using laboratory-provided deionized water to fill a set of sample containers, which will then be submitted to the laboratory for the same analysis as the field water samples. Field blanks will be used to detect potential sample contamination during collection, shipping and analysis.
- Travel Blank: A sample will be prepared and preserved at the analytical laboratory prior to the sampling trip using laboratory-provided deionized water. The sample will remain unopened throughout the duration of the sampling trip. Travel blanks will be used to detect potential sample contamination during transport and storage.

- Duplicate Sample: Two samples will be collected from a sampling location using identical sampling procedures. They will be labelled, preserved individually and submitted for identical analyses. Duplicate samples will be used to assess variability in water quality at the sampling site. Duplicate will be collected and submitted for analyses at approximately, 10% of sampling locations. For smaller batches of samples (less than 10), at least one duplicate will be collected and submitted for analysis.

Additional QA/QC procedures that will be applied to the seepage survey component of the GWMP will include:

- Location – Universal Transverse Mercator (UTM) coordinates of seepage will be defined through the use of a hand-held Global Positioning System (GPS) unit and will be recorded in the field log book with a photograph of each pit wall.
- Sample Labels – appropriate sample nomenclature will be assigned to the sample labels that will define sample locations, sample type, year, and designation. These labels will distinguish between samples collected from seeps versus samples collected from sumps.

5 REFERENCES

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APPENDIX A – WHALE TAIL PIT POST-CLOSURE PIT LAKE THERMAL ASSESSMENT

GOLDER

TECHNICAL MEMORANDUM

DATE 30 July 2018 | 1789310-174-TM-Rev0

TO Jamie Quesnel
Agnico Eagle Mines Limited

CC Michel Groleau, Valérie Bertrand

FROM Colin McGrath, Jianfeng Chen, Don Chorley, and Serge Ouellet

EMAIL
Jianfeng_Chen@golder.com

WHALE TAIL PIT
POST-CLOSURE PIT LAKE THERMAL ASSESSMENT

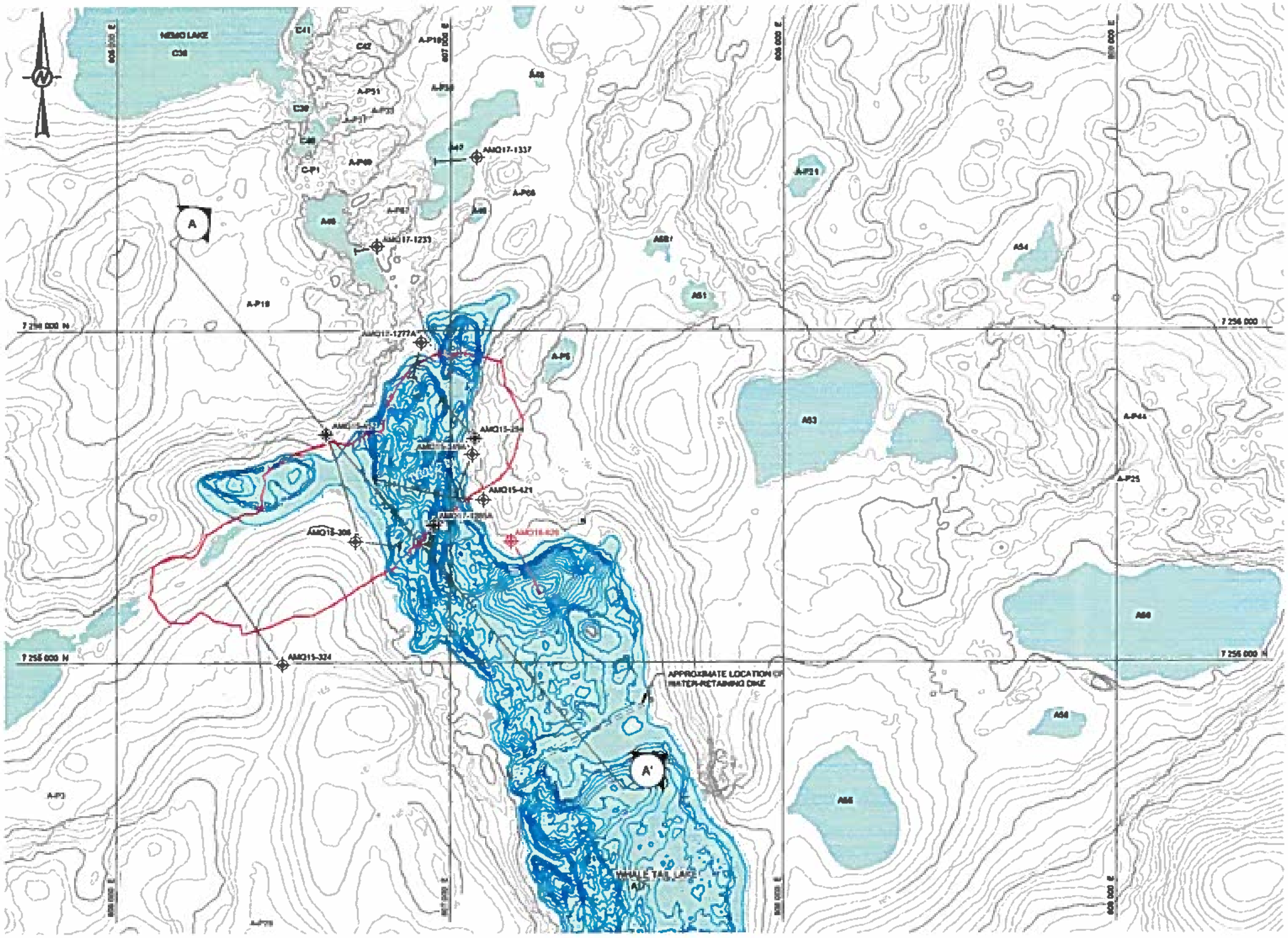
1.0 INTRODUCTION

Agnico Eagle Mines Limited (Agnico Eagle) is currently evaluating the potential development for mining the Whale Tail Pit Project (Project), a satellite deposit located on the Amaruq exploration property in Nunavut. The Amaruq property is a 408 km^2 site located in Inuit Owned Land approximately 150 km north of the hamlet of Baker Lake and approximately 50 km northwest of Agnico Eagle's operating Meadowbank Mine.

The following technical memorandum presents the assumptions and results of two-dimensional (2D) thermal analysis that was conducted in support of post-closure hydrogeological modelling for the Whale Tail Pit (Golder 2018a). The thermal analysis was conducted to evaluate how quickly the permafrost below Whale Tail Pit could melt following the formation of the Whale Tail Pit Lake during closure. The location of Whale Tail Pit is presented on Figure 1.

The thermal assessment included a review of the original Whale Tail Lake talik formation estimation based on available thermistor data at the time of the FEIS, the previous assessment completed by Golder (2017a), the current ground thermal conditions in the Whale Tail Lake area, and thermal changes during and after flooding the Whale Tail Pit.

This technical memorandum presents a summary of the updated evaluation of permafrost conditions based on the available thermistor data to October 2017, and the numerical modelling results of predicted thermal conditions under the Whale Tail Pit Lake post-closure.



LEGEND

- EXISTING GROUND SURVEY
- EXISTING BATHYMETRY
- WATER BODY
- THERMISTOR
- WESTBAY SYSTEM
- PHASE 1 WHALE TAIL PIT

NOTE(S)

1. ALL UNITS ARE IN METERS UNLESS NOTED OTHERWISE.
2. CONTOUR INTERVAL 1m MINOR AND 5m MAJOR.

REFERENCE

BASE PLAN AND BATHYMETRY DATA RECEIVED FROM AGNICO EAGLE MINES LTD. DATE RECEIVED NOVEMBER 25, 2015.
CAD FILE: COURBES2M_AMARUQ_GLOBAL_UTM14_20150828.DWG
CAD FILE: 1665854-2100B-CM-0002.DWG
CAD FILE: 61-000-142-001_R0BLOC.DWG

0 250 500
1:12,500 METRES

CLIENT	AGNICO EAGLE	AGNICO EAGLE MINES LTD.	
CONSULTANT	GOLDER	YYYY-MM-DD	2018-07-30
		DESIGNED	CTM
		PREPARED	CB
		REVIEWED	SO
		APPROVED	JFC

PROJECT
WHALE TAIL PIT PROJECT
POST CLOSURE PIT LAKE THERMAL ANALYSIS
NUNAVUT

TITLE
SITE PLAN AND SECTION LOCATION

PROJECT NO.	PHASE-TASK-DOC#	REV.	FIGURE
1789310	1000/12020/174	0	1

2.0 BACKGROUND

The Project is located in the zone of continuous permafrost. The land surface of the Project is underlain by permafrost except under the lake where water is too deep to freeze to the bottom during winter. Taliks (areas of unfrozen ground) are expected beneath a water body where the water depth is greater than the ice thickness. Closed talik formations consist of a depression in the permafrost table below relatively shallower and smaller lakes. Open talik formations that penetrate through the permafrost and connect the lake waterbody with the sub-permafrost hydrogeological regime are to be expected for relatively deeper and larger lakes in the Project area.

A previous site investigation on the Project completed by Knight Piésold (Knight Piésold 2015) between June and October of 2015 included the installation of six thermistors in the vicinity of the proposed development of Whale Tail Lake to collect ground temperature data.

The project site permafrost conditions were initially assessed by Knight Piésold (2015). A further review on site thermistor data was carried out by Golder during the thermal assessment for the Whale Tail Lake, with a summary of the thermal conditions presented in Golder (2017a). An additional four thermistors were installed within the vicinity of Whale Tail Lake in 2017 by Golder.

Based on site investigation data, soils in the project area are typically medium to coarse grained glacial till and colluvium with high coarse fragment content overlying bedrock at shallow depths. The six thermistor boreholes drilled in 2015 indicated soil thicknesses varying from 6.1 to 12.4 m. Review of existing data indicates the soil thicknesses varying from about 1 m to 12 m in the proposed waste rock storage facility area located northwest of the proposed pit. Underlying the soil, bedrock in the area generally consists of a stratigraphic sequence of greywacke, komatiite, and ultramafics, with varying thicknesses.

A mean annual air temperature for the site is of -11.3 °C, based on climate data provided by Agnico Eagle (Golder 2016a, Agnico Eagle 2016). Climate normal for Baker Lake between 1981 and 2000 shows a mean annual air temperature of -11.2 °C (Golder 2017b). Table 1 presents a summary of average air temperature at the site and at the Baker Lake climate station. The mean monthly temperatures of the two sets of data are similar. Mean monthly temperatures from Meadowbank site based on camp site data from 1997 to 2003 is included in the table for comparison (Golder 2003). The Meadowbank data gives a similar annual average of -11.1 °C.

Table 1: Mean Monthly Air Temperatures

	Whale Tail Project (Golder 2016a, Agnico Eagle 2016)	Meadowbank Project (1997 - 2003) (Golder 2003)	Baker Lake Climate Normal (1981 to 2000)
Unit	°C	°C	°C
January	-31.3	-31.6	-31.2
February	-31.1	-31.7	-31.0
March	-26.3	-25.5	-26.2
April	-17.0	-17.2	-17.0
May	-6.4	-5.6	-6.3
June	4.9	3.8	4.8
July	11.6	12.4	11.6
August	9.8	9.9	9.8
September	3.1	3.3	3.1
October	-6.5	-7.6	-6.4
November	-19.3	-18.0	-19.3
December	-26.8	-25.6	-26.5
Average	**-11.3**	**-11.1**	**-11.2**

3.0 SITE PERMAFROST CONDITIONS

The following sections present a summary of site-specific permafrost conditions based on the available thermistor data.

3.1 Thermistor Installation

The locations of the existing thermistors are shown in Figure 1; Table 2 presents a summary of thermistor data obtained to date.

Table 2: Thermistor Location and Installation Summary

Borehole	Collar Coordinates					Drilled Length (m)	Thermistor	Status[c]
	Northing	Easting	Elevation	Inclination (deg)	Azimuth (deg)		Depth Below Ground Surface (m)	
AMQ15-294	607,073.2	7,255,676.1	155.9	-45.18	322.7	220.5	144.4	Functioning
AMQ15-306	606,714.8	7,255,363.8	154.9	-45.41	96.3	201.0	141.5	Functioning[b]
AMQ15-324	606,496.8	7,254,995.2	161.8	-55.46	325.5	505.0	317.4	Functioning
AMQ15-349A	607,064.9	7,255,627.5	155.3	-45.32	204.4	202.5	140.6	Not functioning
AMQ15-421	607,098.3	7,255,490.8	155.1	-51.31	273.9	501.0	388.3	Not functioning
AMQ15-452	606,627.2	7,255,687.9	156.2	-49.98	159.5	501.0	382.3	Functioning
AMQ17-1265A	606,950.1	7,255,413.6	152.5	-80.0	196.0	425.0	349.6[a]	Functioning
AMQ17-1233	606,777.7	7,256,253.8	161.9	-59.06	252.7	156.0	132.4	Functioning
AMQ17-1337	607,078.4	7,256,522.0	155.2	-59.62	260.4	250.0	218.0	Functioning
AMQ17-1277A	606,911.1	7,255,963.6	153.2	-60.17	193.1	250.0	217.4	Functioning

a) Depth below lake water (ice) level.
b) Only the top node is functioning.
c) Based on information provided by Agnico Eagle in April 2018

3.2 Thermistor Data Summary

Table 3 presents a summary of the permafrost information estimated from the ten thermistors on site. The parameters were estimated using average values from September 2015 to October 2017. Ground temperature plots for the thermistor data is presented in Attachment 1.

Based on the thermistor data, the findings on the permafrost characteristics in the project area remain similar to those presented in Golder (2017a), with following updates:

- The thermistor AMQ17-1337 suggested deeper permafrost in the area away from deep lakes of up to 495 m, compared to the 427 m depth from the thermistor AMQ15-324
- The temperatures at the depths of zero amplitude changed slightly, they are now in the range of -3.0 °C to -8.4 °C (-3.1 °C to -8.6 °C reported in Golder 2017a)
- The thermistor AMQ17-1265A installed within the lake suggests the talik depth at this location is about 112 m from the lake water level

No additional groundwater quality and freezing point depression data were provided during this assessment; these are assumed to remain unchanged since the last assessment (Golder 2016b).

Table 3: Summary of Permafrost Conditions from Site Thermistors

Hole ID	Approx. Collar Distance to Lake (m)	Thermistor Location	Zero Annual Amplitude		Mean Annual Ground Temperature (°C)[a]	Geothermal Gradient (°C/m)	Estimated Permafrost Depth (metres below ground or lake surface)
			Approximate Depth (m)	Approximate Temperature (°C)			
AMQ15-294	31	Beneath Whale Tail Lake	19	-3.0	-3.5	Insufficient depth	Insufficient depth
AMQ15-306	55	Beneath Whale Tail Lake	20	-7.4	-8.1	Insufficient depth	Insufficient depth
AMQ15-324	370	On land	35	-8.4	-9.9	0.025[b]	427
AMQ15-349A	40	Beneath Whale Tail Lake	18	-5.2	-5.2	Insufficient depth	Insufficient depth
AMQ15-421	40	Beneath Whale Tail Lake	24	-3.6	-3.9	0.005[c]	445
AMQ15-452	50	Beneath Whale Tail Lake	23	-3.6	-3.4	0.011[d]	468
AMQ17-1265A	0 (within Whale Tail Lake)	Beneath Whale Tail Lake	N/A	N/A	N/A	0.016[e]	343 (including 112 m lake talik)
AMQ17-1233	21	Beneath A49 Lake	Insufficient depth	Insufficient depth	Insufficient depth	Insufficient depth	Insufficient depth
AMQ17-1337	12	Beneath A47 Lake	Insufficient depth	Insufficient depth	-9.5	0.019[f]	495
AMQ17-1277A	29	Beneath Whale Tail Lake	Insufficient depth	Insufficient depth	Insufficient depth	Insufficient depth	Insufficient depth

a) Estimated by projecting best fit line to surface.
b) Based on thermistor data from 105.1 to 282.1 m depth.
c) Based on thermistor data below 271.8 m depth.
d) Based on thermistor data below 248.4 m depth.
e) Based on thermistor data below 290.5 m depth.
f) Based on thermistor data below 166.2 m depth.

4.0 PIT LAKE THERMAL MODEL

Two-dimensional thermal modelling was carried out using the finite element program, TEMP/W, of GeoStudio 2007 (Ver. 7.23), developed by GEO-SLOPE International Ltd. This section presents the model scenarios, input parameters, and assumptions.

Golder previously conducted thermal modelling to evaluate the permafrost and talik conditions in the Whale Tail Lake and project area (Golder 2017a), and conducted thermal modelling for the cover of the Whale Tail waste rock storage facility (Golder 2017b, 2018b). A number of model parameters used in these assessments were adopted for this pit lake thermal modelling.

For the purpose of providing input to the pit hydrogeological modelling, the section A shown in Figure 1 was selected for thermal modelling of the post-closure pit lake. The modelling included the following steps.

- Evaluate the current condition of permafrost regime under Whale Tail Lake by reviewing of the existing thermistor data and the 2017 Whale Tail Lake thermal assessment results (Golder 2017a).
- Estimate the ground thermal conditions when the Whale Tail Pit is mined out, for use as the initial condition.
- Run a transient thermal model with the pit being flooded based on the proposed flooding schedule, to estimate the evolution of the permafrost regime during flooding at closure. The model stops when most of the permafrost under the pit lake thaws.
- Continue running the model to evaluate long-term permafrost regime, after the water-retaining dike is breached, and the Whale Tail Lake (South Basin) and the fully flooded Whale Tail Pit Lake are merged.
- Run a steady-state thermal model for the pit lake to estimate the ultimate permafrost regime.

4.1 Material Properties

Consistent with Golder (2017a), for the purposes of this thermal assessment, each model assumed a uniform thickness of 12 m of till overlying bedrock both on land and under the lake, except the pit lake. No lake bed sediment or weathered bedrock materials were included in the models. It is expected that the material properties of the bedrock will have a more significant effect on the thermal conditions than the soil due to the relative thickness of the soil compared to the bedrock. Material properties and depths used in the thermal models are summarized in Table 4. The material thermal properties were referenced from typical values presented in Andersland and Ladanyi (2004) and are consistent with Golder (2017a and b).

Table 4: Material Thermal Properties Used in the Models

Material	Assumed Volumetric Water Content	Thermal Conductivity (W/m-°C)		Volumetric Heat Capacity (MJ/m³-°C)		Assumed Depth Below Ground surface (m)
		Frozen	Unfrozen	Frozen	Unfrozen	
Till	30%	1.8	1.5	2.0	2.5	0 to 12
Bedrock	1%	3.0	3.0	2.0	2.0	>12

The thermal models were solved considering groundwater with a phase change temperature of 0 °C. The addition of salinity in the groundwater would result in a freezing point depression and could lower the phase change temperature to below 0 °C if salinity is high enough. The freezing point depression was not modelled directly. A Westbay well system is installed in borehole AMQ16-626. Groundwater samples collected from the Westbay system at depths from 276 m to 392 m indicated a salinity range of 0.3% to 0.4% (Golder 2016b). This salinity level indicates an approximate 0.2 °C of freezing point depression and is considered to have minor impact to the evolution of the thermal regime around the pit lake.

4.2 Boundary Conditions

4.2.1 Ground Surface Temperature

The monthly ground surface temperature function was estimated through numerical modelling using daily climate data from Baker Lake, and review of existing thermistor data from the Whale Tail site (Golder 2017b). Ground surface temperatures are often observed to be warmer than the air temperatures in permafrost regions. Figure 2 shows the ground surface temperature function used in the model, as well as the Baker Lake normal air temperatures from 1981 to 2010. The mean annual ground temperature is about -7.3 °C, which lies in the range of -3.4 to -9.9 °C, projected from the thermistor data (Table 3) and is considered to be reasonable for use in the transient model.

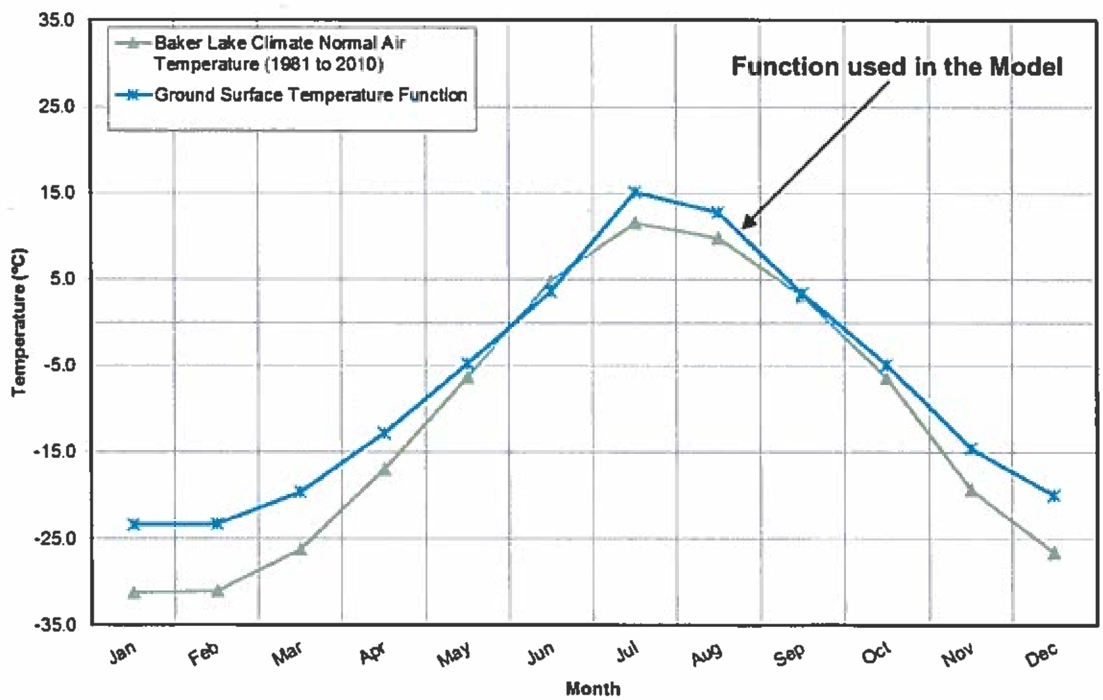


Figure 2: Monthly Air and Ground Surface Temperature Functions

4.2.2 Geothermal Gradient

A geothermal heat flux of 0.048 J/sec was applied to the models as the lower boundary condition based on the assumed bedrock thermal conductivity of 3.0 W/m-°C and a geothermal gradient of 0.016°C/m (Golder 2017a). This thermal gradient is consistent with the one estimated during the Meadowbank Project baseline study (Golder 2003).

4.2.3 Pit Lake Bottom Temperature

Typically, a mean annual lake bottom temperature is related to water depth in a permafrost region: the deeper the lake, the higher the expected mean annual lake bottom temperature. The mean annual lake bottom temperature is typically higher than the mean annual ground surface temperature in a permafrost region.

Deep pit lake temperatures tend to stabilize near +4°C at which the maximum water density typically occurs for fresh water and low salinity water. An assessment of the variation of the pit lake temperature was not carried out at this stage. A review of measured pit lake bottom temperatures from Pieters and Lawrence (2014) and Crusius et al. (2002) indicates the following:

- +3.5°C at about 110 m depth for Zone 2 Pit Lake at Colomac Mine located 250 km north of Yellowknife, NWT
- +5°C at about 90 m depth for Faro Pit Lake at Faro Mine near Faro, Yukon
- +4.5°C at about 60 m depth for Grum Pit Lake at Faro Mine near Faro, Yukon
- +4.2°C at about 50 m depth for Vangorda Pit Lake at Faro Mine near Faro, Yukon
- +5.2°C at about 120 m depth at Main Zone Pit Lake at Equity Mine near Houston, BC
- +5.5°C at about 40 m depth at Waterline Pit Lake at Equity Mine near Houston, BC

For the purpose of the modelling, the Whale Tail Pit Lake was assumed to have a constant mean annual bottom temperature of +4°C in all models based on the above review. Due to the depth of the proposed Whale Tail Pit Lake, meromictic conditions are expected to develop. When meromictic conditions are present, mixing of the surface and deep water is inhibited (stratification) which results in a stable bottom temperature.

For the relatively shallow lake area near the proposed water-retaining dike (Whale Tail Dike), a constant temperature of +2°C was assumed for the lake bottom.

4.3 Model Scenario and Assumptions

Pit flooding was adopted according to the mine schedule adopted in the 3D hydrogeological model at the time of the FEIS (Appendix 6-B of the FEIS). This 3D hydrogeological model also forms the basis of the post-closure prediction of groundwater inflows to the flooded pit lake. This thermal model was designed to provide reasonable assumptions for a conservative approach to melting of permafrost for the groundwater modelling. Since the FEIS, some changes in filling schedule have been potentially identified; however, for the scale of analysis being adopted and evaluated in the post-closure hydrogeological analysis, these changes will not significantly affect predictions of groundwater inflow quantity and quality to the pit lake. Pit flooding was assumed in the FEIS to commence in 2022 and was expected to reach the top of the pit / base of Whale Tail Lake (138 masl) in 2025. Subsequent re-flooding of Whale Tail Lake (North Basin) will continue until 2028. The assumed yearly water elevations during flooding is shown in Figure 3, and Table 5.

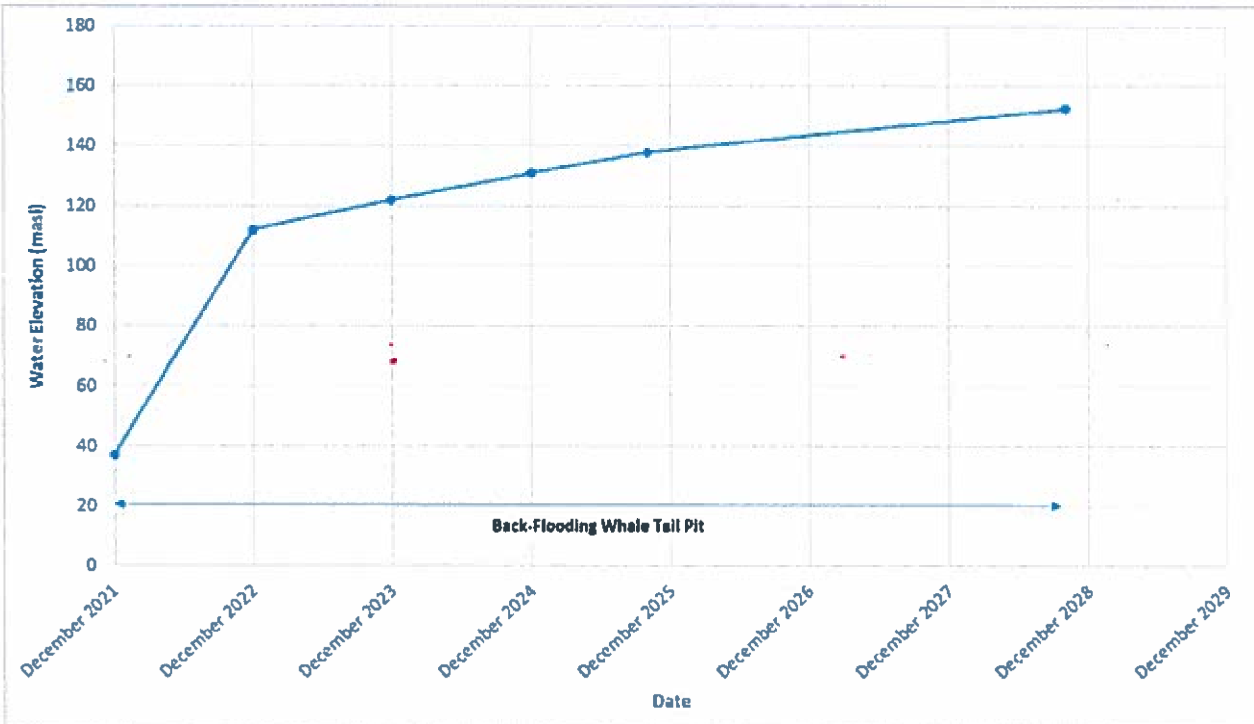


Figure 3: Whale Tail Pit Flooding Schedule from FEIS

The modelling scenario was developed to simulate the proposed Whale Tail Pit flooding elevations from years 1 to 7 as presented in Table 5.

Table 5: Thermal Model Back-Flooding Elevations

Year	Whale Tail Pit Back-Flooding Elevation (masl)
1	112
2	122
3	131
4	138
7	152.5

The post-closure pit lake and Whale Tail Lake are assumed to maintain the elevation of 152.5 masl.

The modelling was completed up to 300 years from start of flooding for the section through the centreline of the ultimate pit configuration. The model used the ground surface temperature function and a daily time step without consideration for any climate change. This hypothetical scenario assumed climatic conditions in 300 years remain similar to current site conditions.

The thermal modelling was completed to support the post-closure groundwater modelling in which the time to penetrate through the permafrost beneath the proposed Whale Tail Pit Lake was required. Climate change may accelerate slightly the warming progress of the upper ground thermal regime. This is considered to be insignificant for the purpose of supporting the hydrogeological study and therefore consideration for climate change was not included in the thermal model.

4.4 Thermal Conditions Prior to Flooding

Section A is located within Whale Tail Lake, in the longitudinal direction. Modelling the entire section is not expected to be appropriate to estimate the initial thermal conditions before pit flooding, as the lateral thermal impacts from surrounding colder ground cannot be accounted for in two dimensions. Instead, the initial thermal regime along section A was interpolated by modelling a steady-state condition of the northern terrace at the proposed Whale Tail Pit, the ground temperature data from thermistor AMQ17-1265A, and previous thermal analysis of the Whale Tail Lake completed by Golder (2017a). Based on the ground temperature profile from AMQ17-1265A, the extent of permafrost is expected to occur from El. 40.8 masl to -191 masl at the southeast side of the pit on section A. The assumed initial conditions are presented on Figure 2-1 of Attachment 2.

For the purpose of this assessment, the majority of the thermal regime prior to mining was assumed to be the same as when the mining is complete due to the short duration of mining. Some freeze-back during the pit mining is expected and was estimated to form a part of the initial thermal condition for the post-closure period.

5.0 SUMMARY OF MODEL RESULTS FOR THE POST-CLOSURE PERIOD

Post closure thermal modelling and hydrogeological analysis was not completed as part of the FEIS. In response to an information request regarding post closure groundwater flow, thermal modelling has been carried out to provide input to the hydrogeological study for post closure. The modelling was specifically conducted to evaluate how quickly the permafrost below Whale Tail Pit could melt following the formation of the Whale Tail Pit Lake during closure.

Several assumptions were made for the thermal modelling to evaluate when the permafrost below the pit could melt. The model results are presented in Figures 2-1 to 2-6 of Attachment 2 including:

- The assumed initial thermal conditions prior to pit flooding.
- Thermal conditions during the pit flooding in closure.
- Zero degree isolines at select years of post-closure, up to year 300.
- Steady-state thermal conditions for the post-closure pit lake.

The following findings are based on the model results:

- During pit flooding, the warm pit lake temperature impacts mostly the upper portion of the permafrost under the pit, and talik zones starts to occur around the pit wall and floor.
- The permafrost under the pit lake continues to thaw during the long term post-closure stage, and the open talik expands from the lake side (south) to the land side (north). The majority of the permafrost under the pit lake is thawed 300 years after closure.

- The steady-state model indicates the pit lake would thaw the permafrost in the long-term, and eventually reduce the permafrost depth under the ground northwest of the pit. A significantly longer time (in the order of 10,000 years) is likely required for the pit lake to reach the steady-state thermal conditions.

6.0 CLOSURE

The reader is referred to the Study Limitations, which follows the text and forms an integral part of this technical memorandum.

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

GOLDER ASSOCIATES LTD.

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CM/JFC/DC/VJB/jr

Attachments: Study Limitations
Attachment 1: Thermistor Readings
Attachment 2: Thermal Model Results

PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature
Date 31 July 2018
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

https://golderassociates.sharepoint.com/sites/19830g/1000_phase1commitments/reports_all subphases/thermal modelling/rev0/1789310-174-tm-rev0-phase1whaletailpit post-closurethermal.docx

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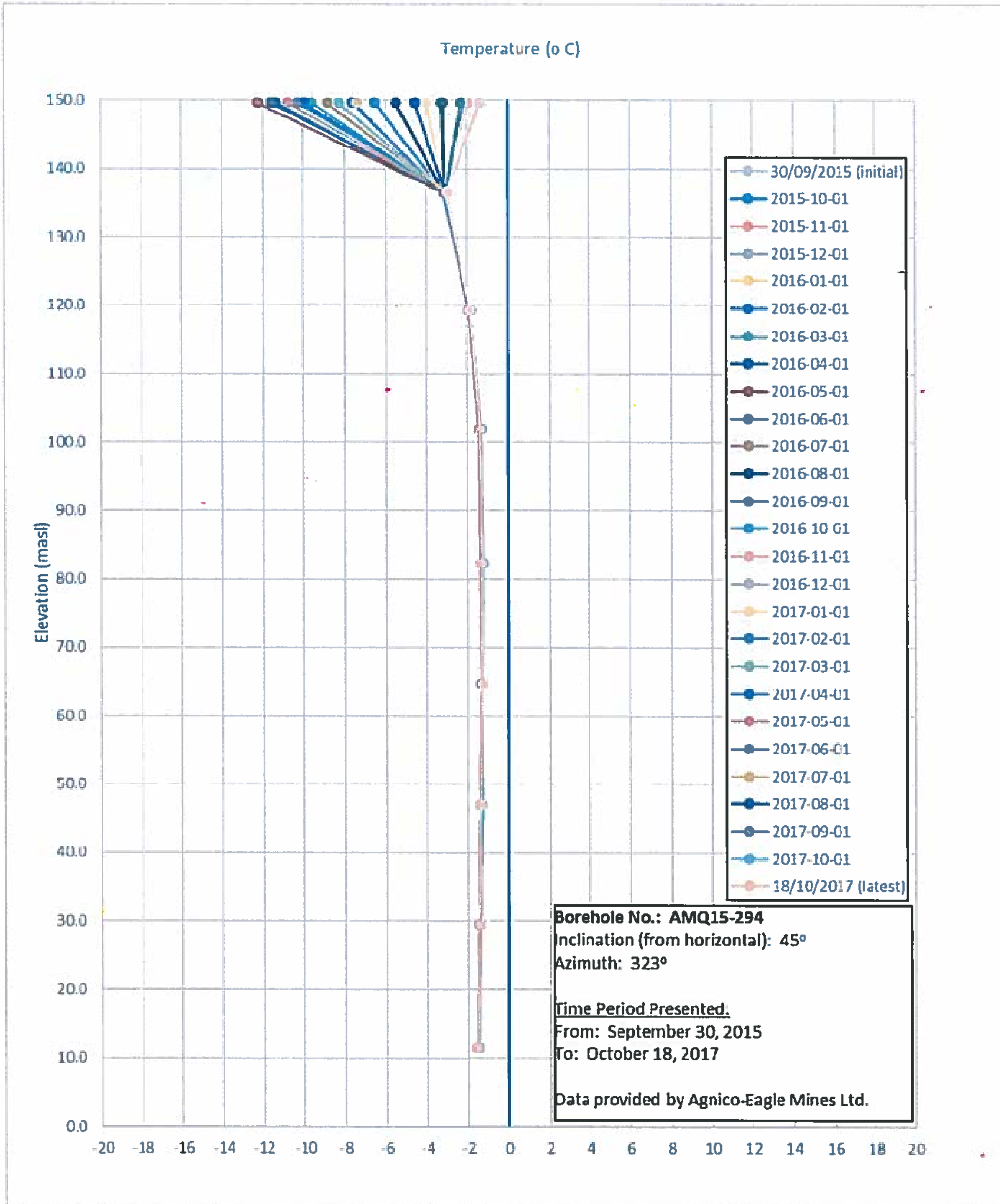
ATTACHMENT 1

Thermistor Readings



NOTE: Readings are shown once per month for clarity.

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CONSULTANT: GOLDER	YYYY-MM-DD: 2018-01-19	TITLE	THERMISTOR AMQ15-294 2015/2017 READINGS
	PREPARED: CTM		
	DESIGN: CTM		
	REVIEW: SO		
	APPROVED: JFC		

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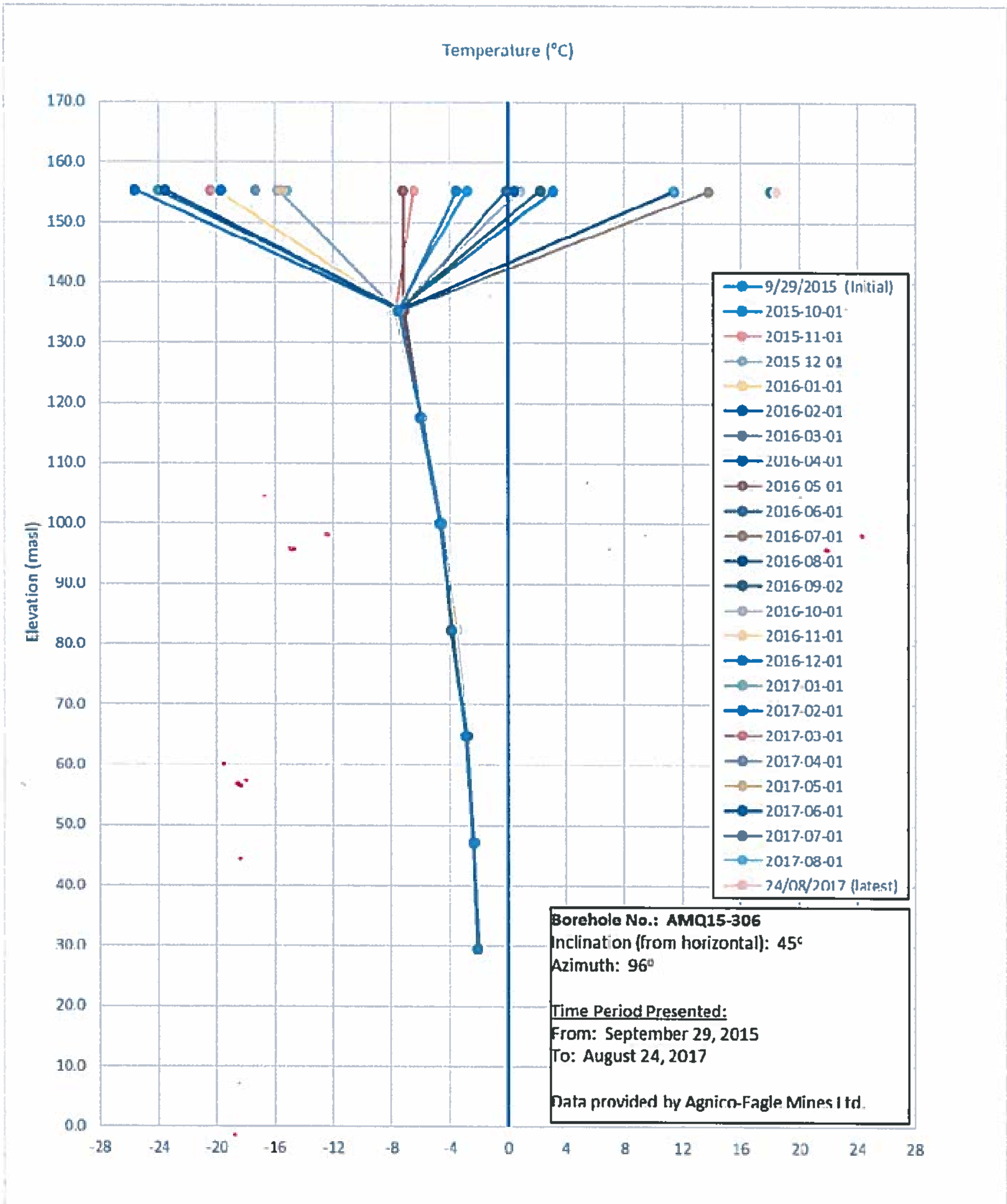

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PREPARED	CTM
DESIGN	CTM
REVIEW	SO
APPROVED	JFC

TITLE
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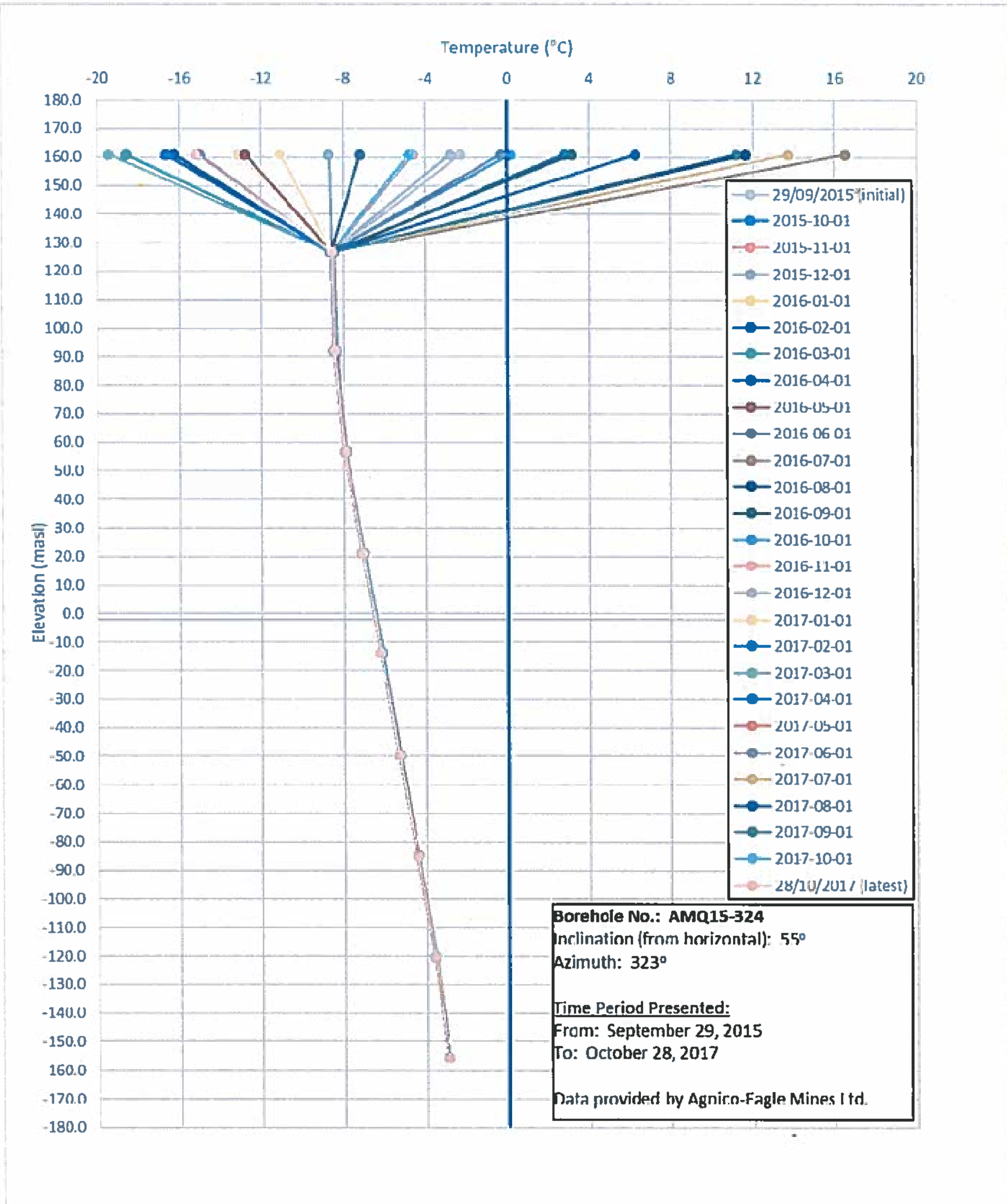

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CONSULTANT		
GOLDER	YYYY-MM-DD	2018-01-19
	PREPARED	CTM
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	REVIEW	SO
	APPROVED	JFC

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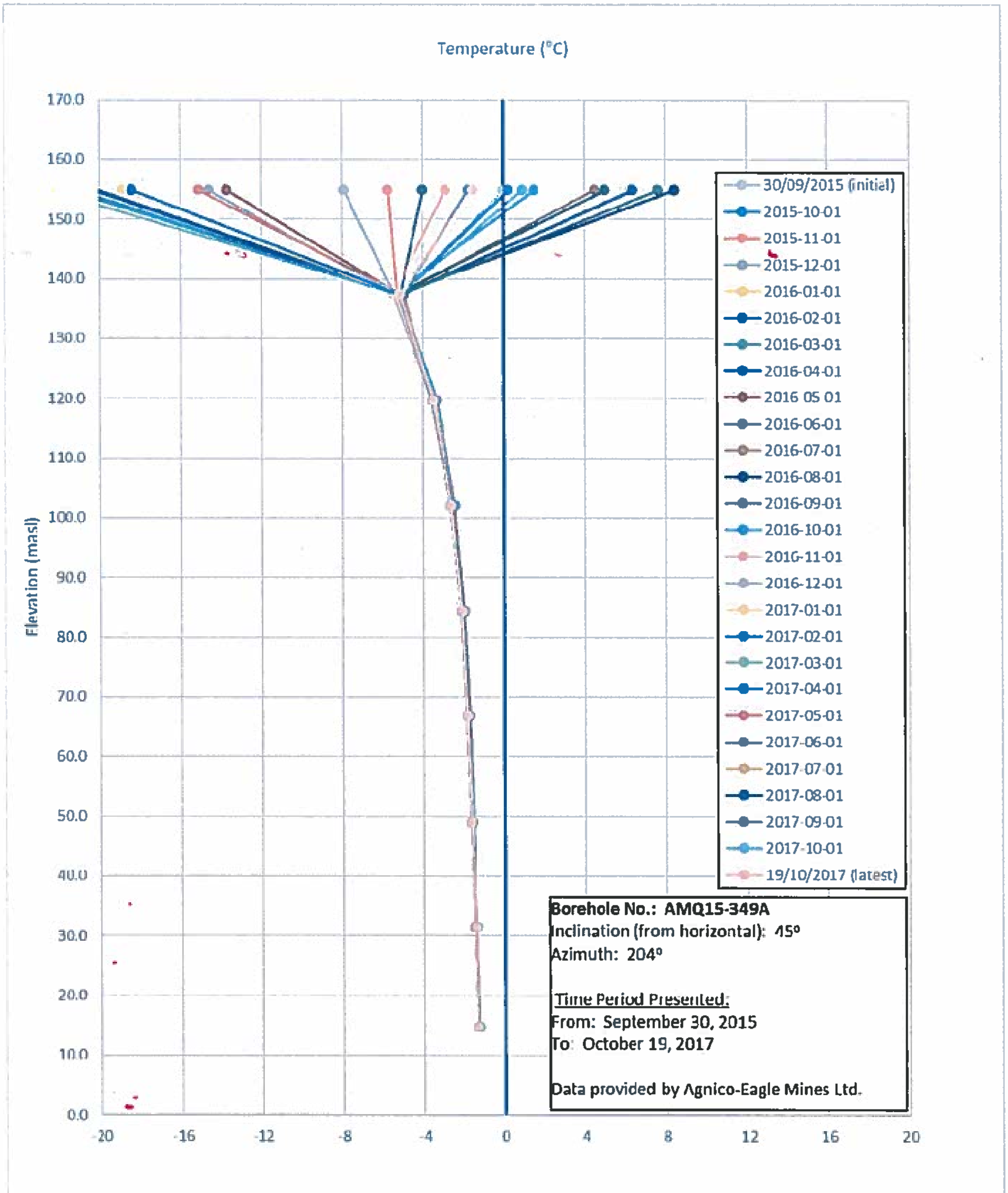

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PREPARED	CTM
DESIGN	CTM
REVIEW	SO
APPROVED	JFC

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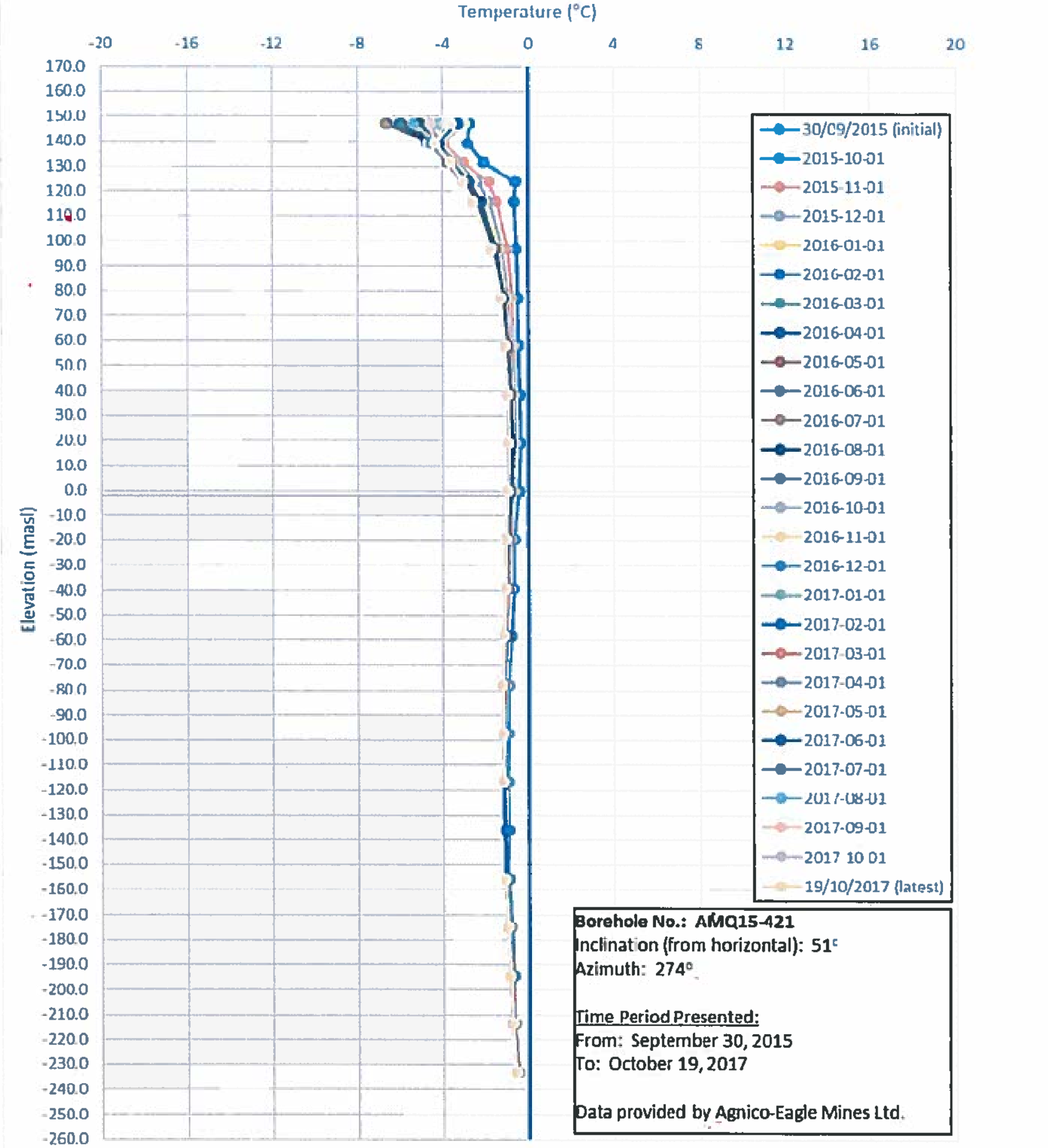

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PREPARED	CTM
DESIGN	CTM
REVIEW	SO
APPROVED	JFC

TITLE
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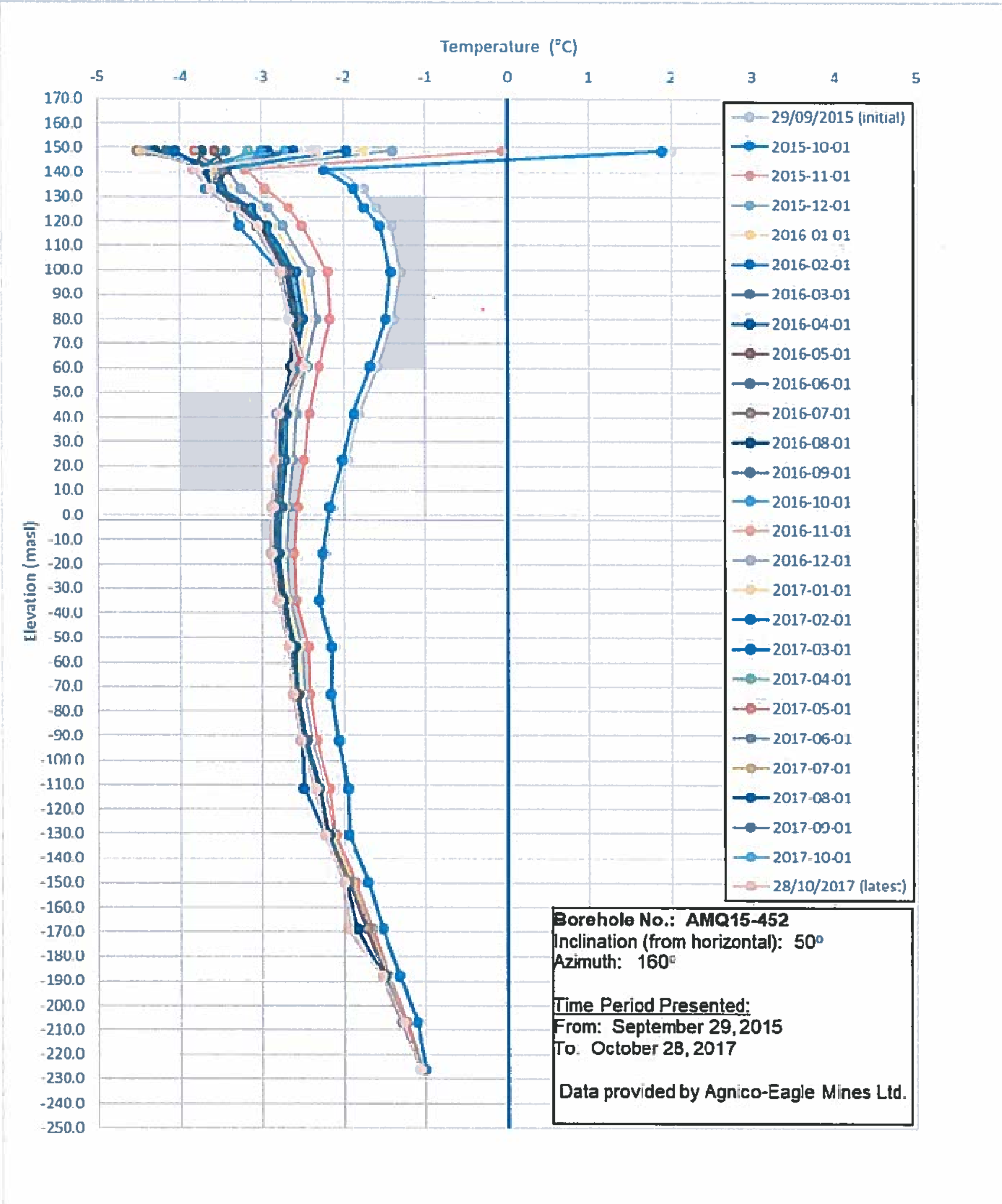

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WHALE TAIL PIT PROJECT
WHALE TAIL LAKE THERMAL ASSESSMENT
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YYYY-MM-DD	2018-01-19
PREPARED	CTM
DESIGN	CTM
REVIEW	SO
APPROVED	JFC

TITLE
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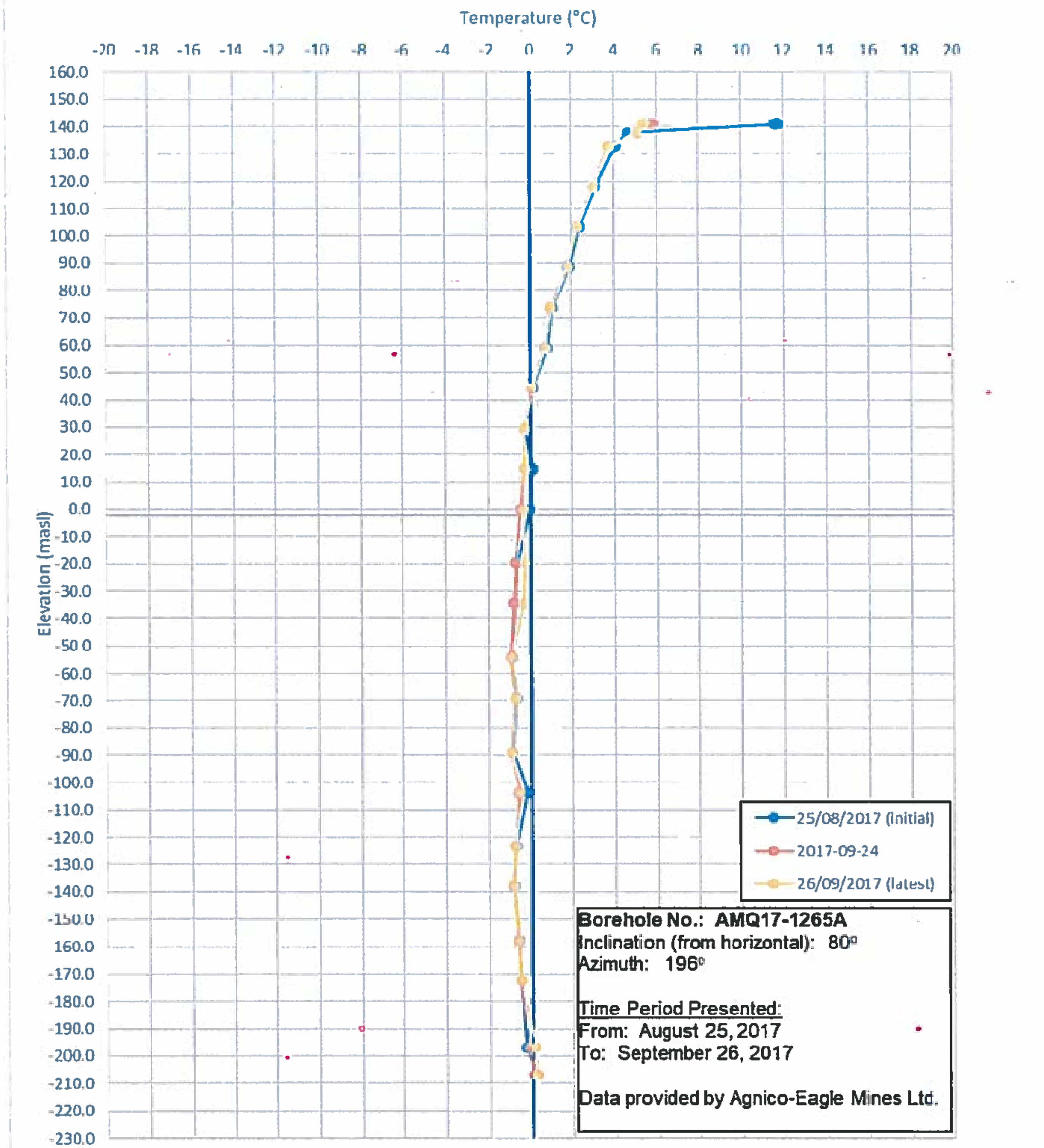

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CONSULTANT	GOLDER	TITLE	THERMISTOR AMQ17-1265A 2017 READINGS
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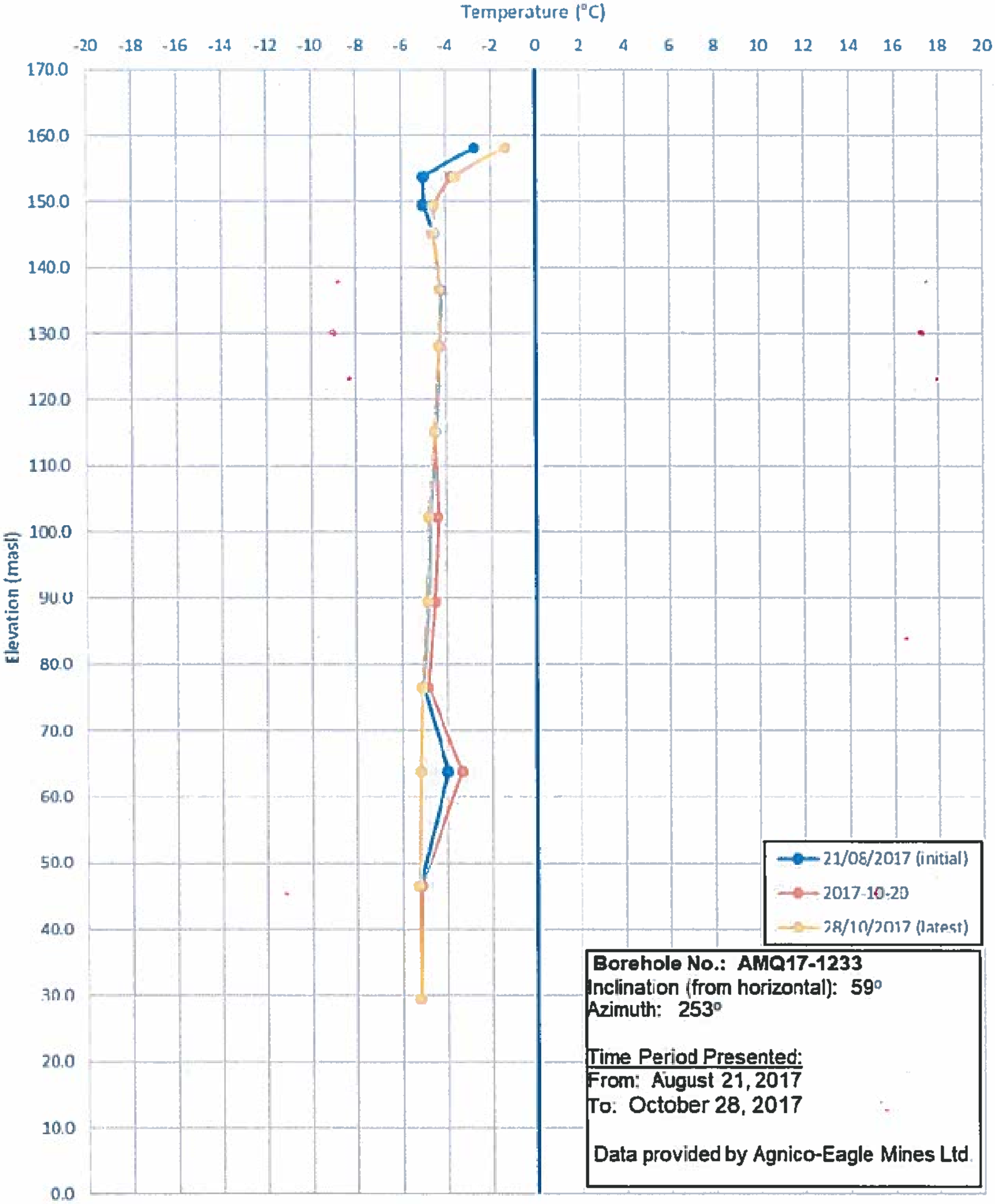
APPROVED	JFC		



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YYYY-MM-DD	2018-01-19
PREPARED	CTM
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REVIEW	SO
APPROVED	JFC

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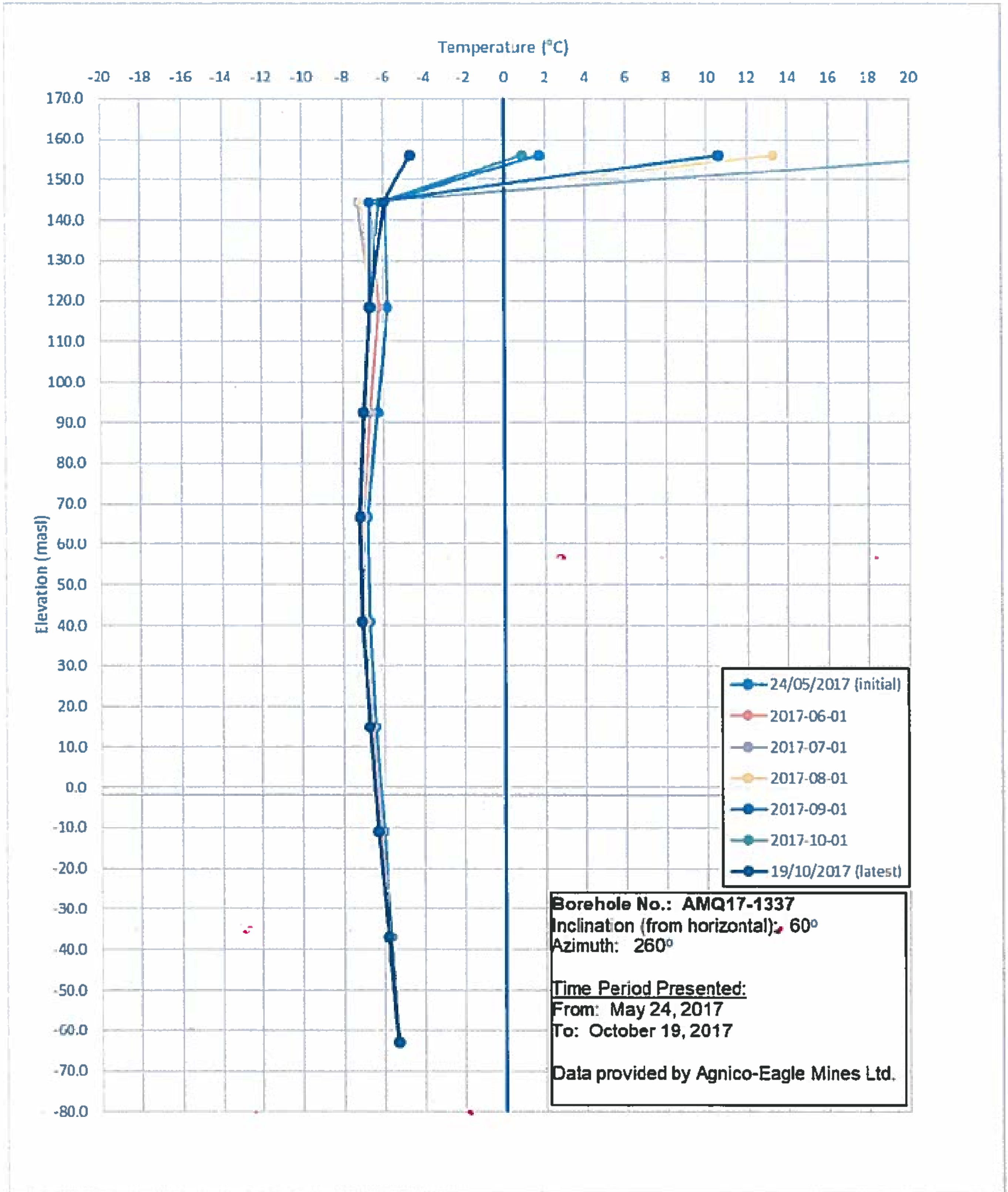
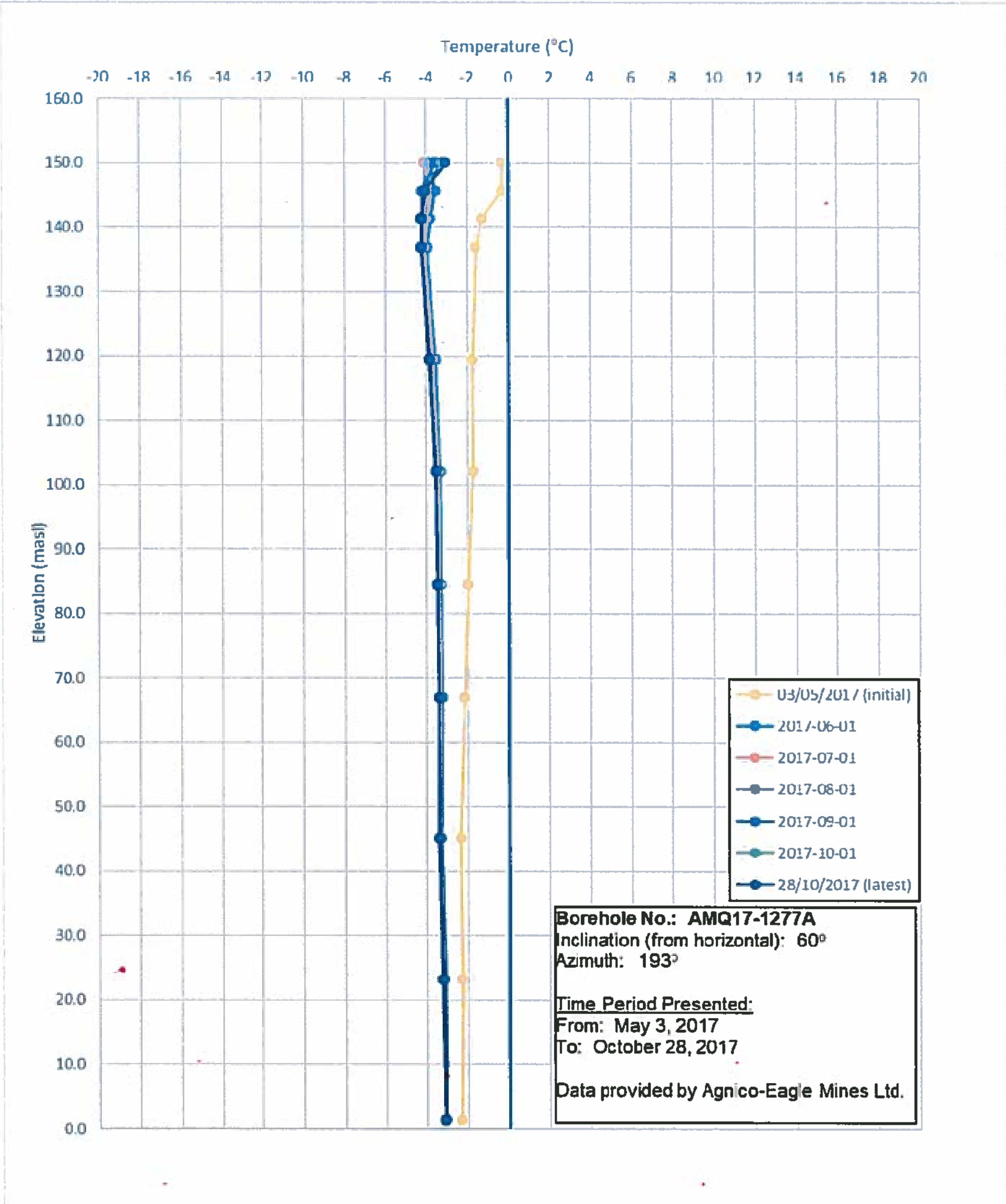


NOTE: Readings are shown once per month for clarity.

CLIENT AGNICO EAGLE MINES LTD.		PROJECT WHALE TAIL PIT PROJECT WHALE TAIL LAKE THERMAL ASSESSMENT NUNAVUT	
CONSULTANT GOLDER	YYYY-MM-DD: 2018-01-19 PREPARED: CTM DESIGN: CTM REVIEW: SO APPROVED: JFC	TITLE THERMISTOR AMQ17-1337 2017 READINGS	
		PROJECT No. 1789310	PHASE/TASK 1000/12020 · Rev 0 · FIGURE 1-9



NOTE: Readings are shown once per month for clarity.

CLIENT
AGNICO EAGLE MINES LTD.

PROJECT
WHALE TAIL PIT PROJECT
WHALE TAIL LAKE THERMAL ASSESSMENT
NUNAVUT

CONSULTANT: GOLDER

YYYY-MM-DD	2018-01-19
PREPARED	CTM
DESIGN	CTM
REVIEW	SO
APPROVED	JFC

TITLE
THERMISTOR AMQ17-1277A 2017 READINGS

PROJECT No.	PHASE/TASK	Rev.	FIGURE
1789310	1000/12020	0	1-10

ATTACHMENT 2

Thermal Model Results

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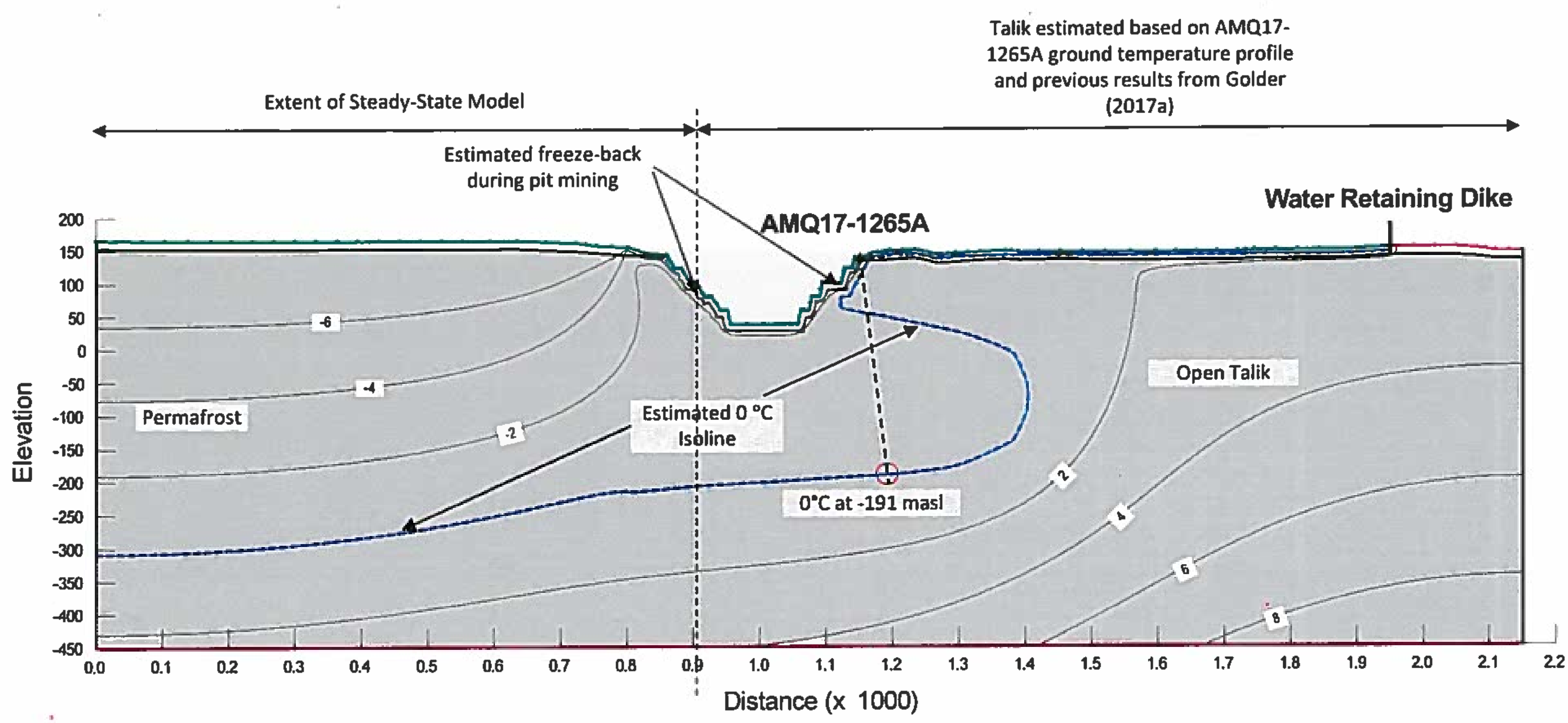

File Name: Phase 1 Section.gsz

Notes

1. Location of thermistor AMQ17-1265A is approximate.
2. Temperature contour interval 2 °C.

CLIENT AGNICO EAGLE MINES LTD.		PROJECT WHALE TAIL PIT PROJECT POST-CLOSURE PIT LAKE THERMAL ANALYSIS NUNAVUT
CONSULTANT GOLDER	YYYY-MM-DD: 2018-04-03 PREPARED: CTM DESIGN: CTM REVIEW: SO APPROVED: JFC	TITLE TRANSIENT THERMAL MODELLING ASSUMED INITIAL CONDITION BEFORE PIT FLOODING
		PROJECT No: 1789310 · Phase/Task: 1000/12020 · Rev: 0 · Figure: 2-1

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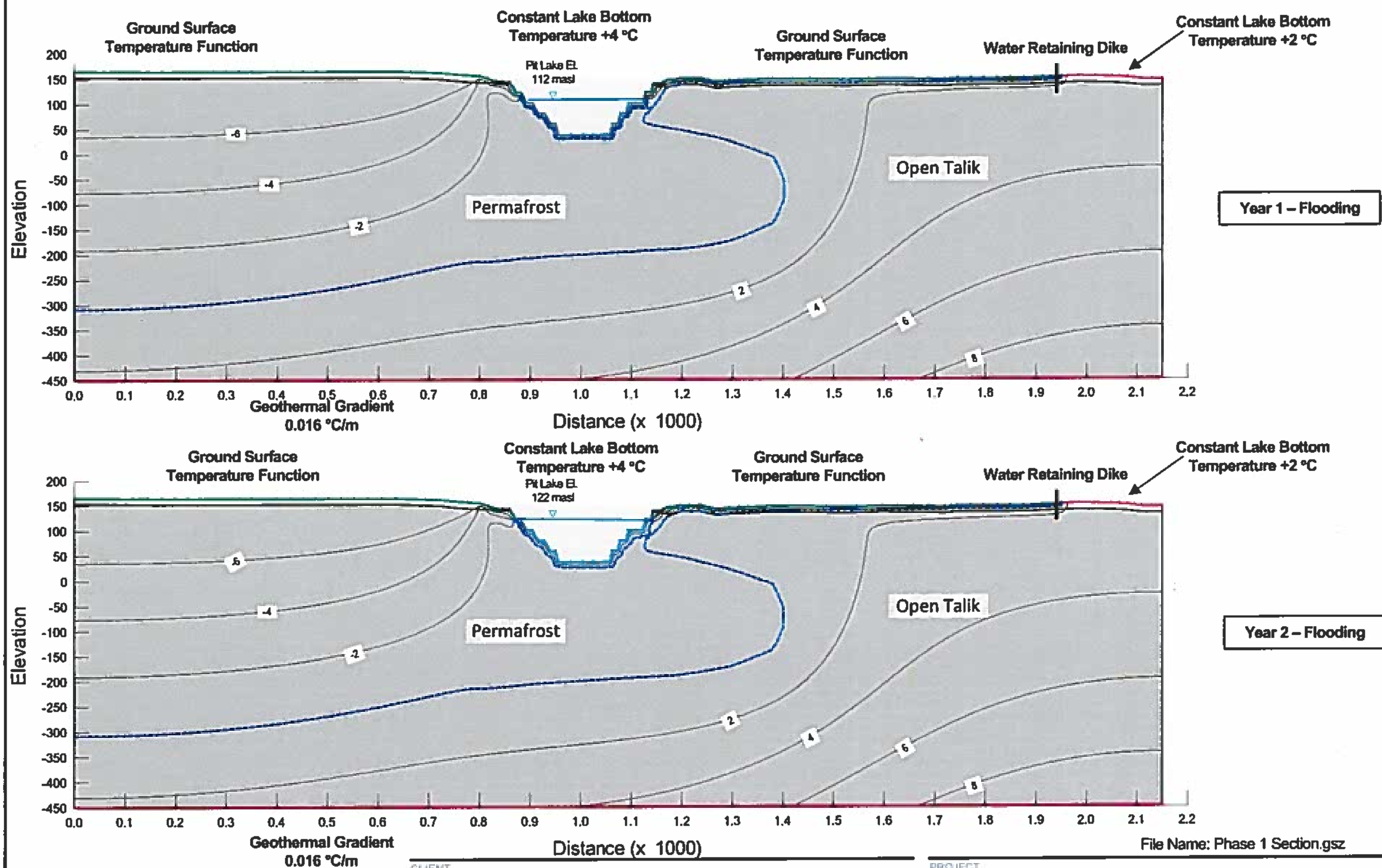

File Name: Phase 1 Section.gsz

Notes

1. Location of thermistor AMQ17-1265A is approximate.
2. Temperature contour interval 2 °C.

CLIENT	AGNICO EAGLE MINES LTD.
PROJECT	WHALE TAIL PIT PROJECT POST-CLOSURE PIT LAKE THERMAL ANALYSIS NUNAVUT
CONSULTANT	GOLDER
YYYY-MM-DD	2018-04-03
PREPARED	CTM
DESIGN	CTM
REVIEW	SO
APPROVED	JFC
TITLE	TRANSIENT THERMAL MODELLING PIT FLOODING YEARS 1 & 2

PROJECT No	Phase/Task	Rev	Figure
1789310	1000/12020	0	2-2

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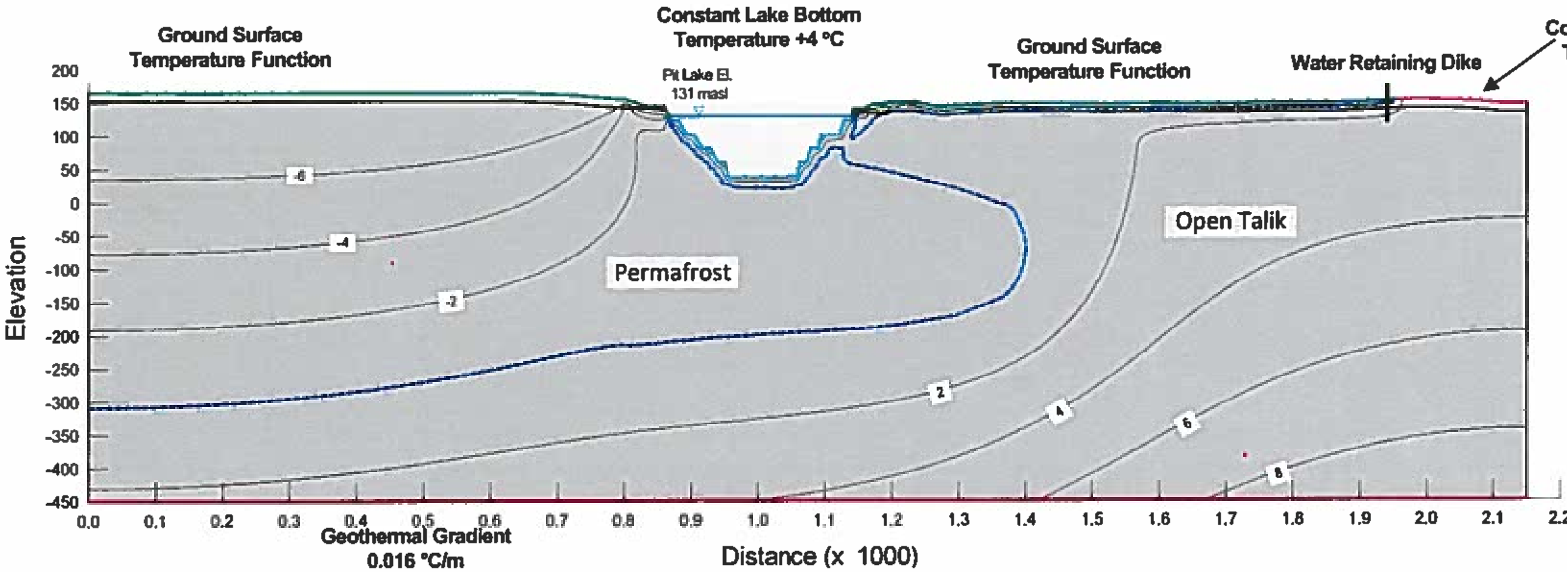

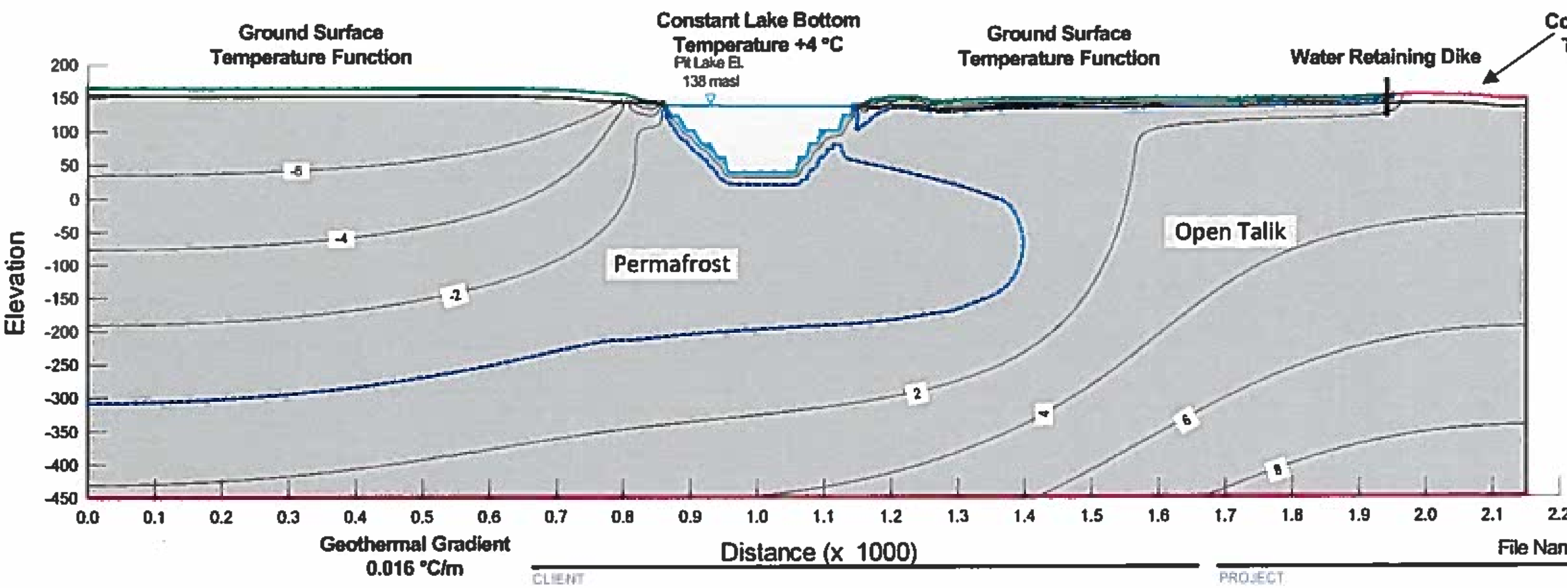

File Name: Phase 1 Section.gsz

Notes

1. Location of thermistor AMQ17-1265A is approximate.
2. Temperature contour interval 2 °C.

CLIENT
AGNICO EAGLE MINES LTD.

CONSULTANT
GOLDER

YYYY-MM-DD	2018-04-03
PREPARED	CTM
DESIGN	CTM
REVIEW	SO
APPROVED	JFC

PROJECT
WHALE TAIL PIT PROJECT
POST-CLOSURE PIT LAKE THERMAL ANALYSIS
NUNAVUT

TITLE
TRANSIENT THERMAL MODELLING
PIT FLOODING
YEARS 3 & 4

PROJECT No.	Phase/Task	Rev.	Figure
1789310	1000/12020	0	2-3

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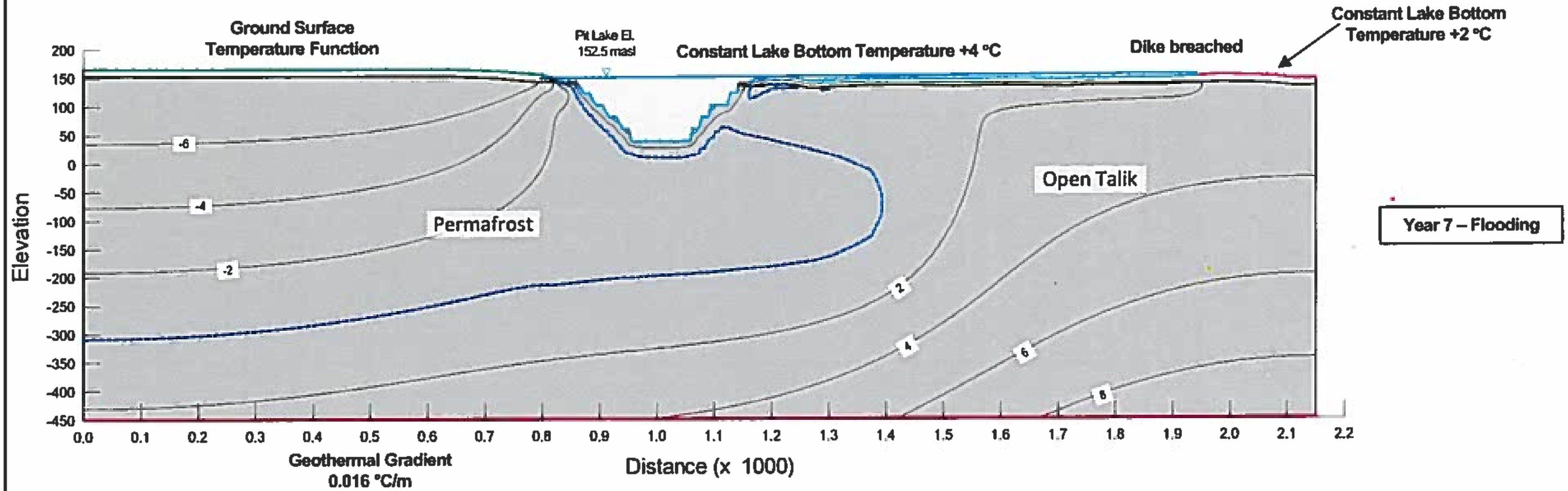

Notes

1. Location of thermistor AMQ17-1265A is approximate.
2. Temperature contour interval 2 °C.

File Name: Phase 1 Section.gsz

CLIENT AGNICO EAGLE MINES LTD.		PROJECT WHALE TAIL PIT PROJECT POST-CLOSURE PIT LAKE THERMAL ANALYSIS NUNAVUT	
CONSULTANT GOLDER	YYYY-MM-DD	2018-04-03	TITLE TRANSIENT THERMAL MODELLING PIT FLOODING YEAR 7
	PREPARED	CTM	
	DESIGN	CTM	
	REVIEW	SO	PROJECT No 1789310 · Phase/Task 1000/12020 · Rev 0 · Figure 2-4
	APPROVED	JFC	

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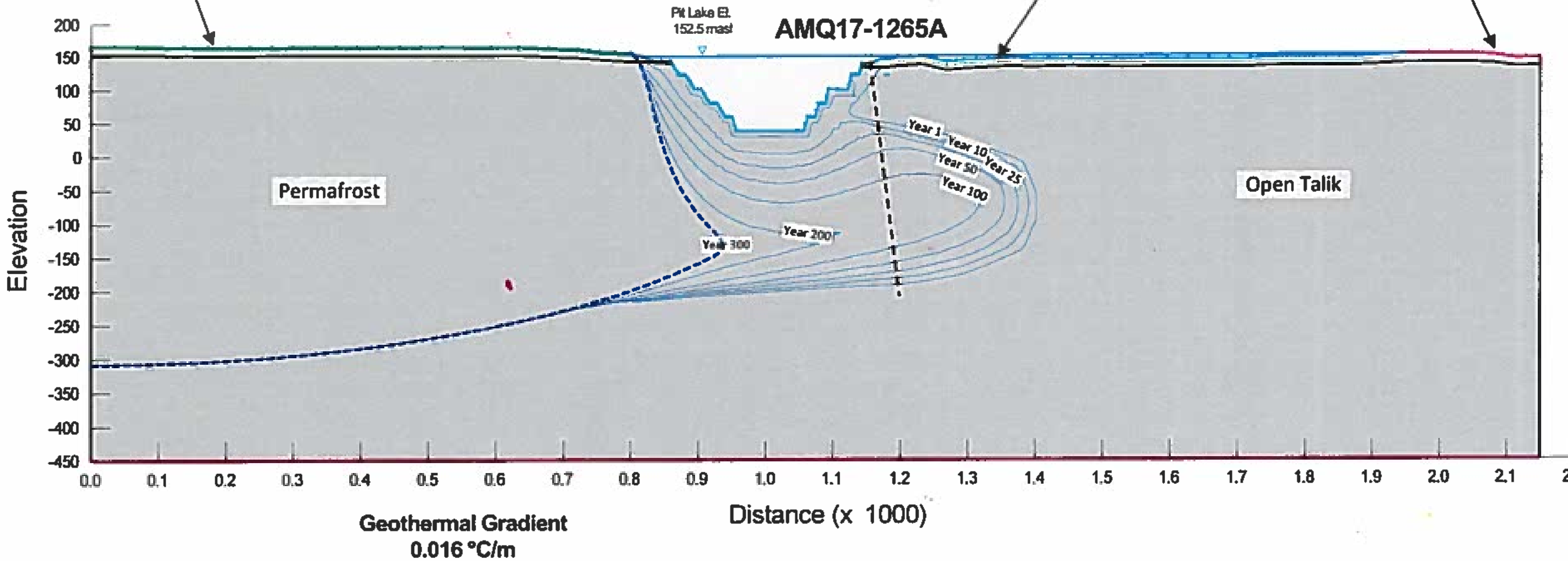


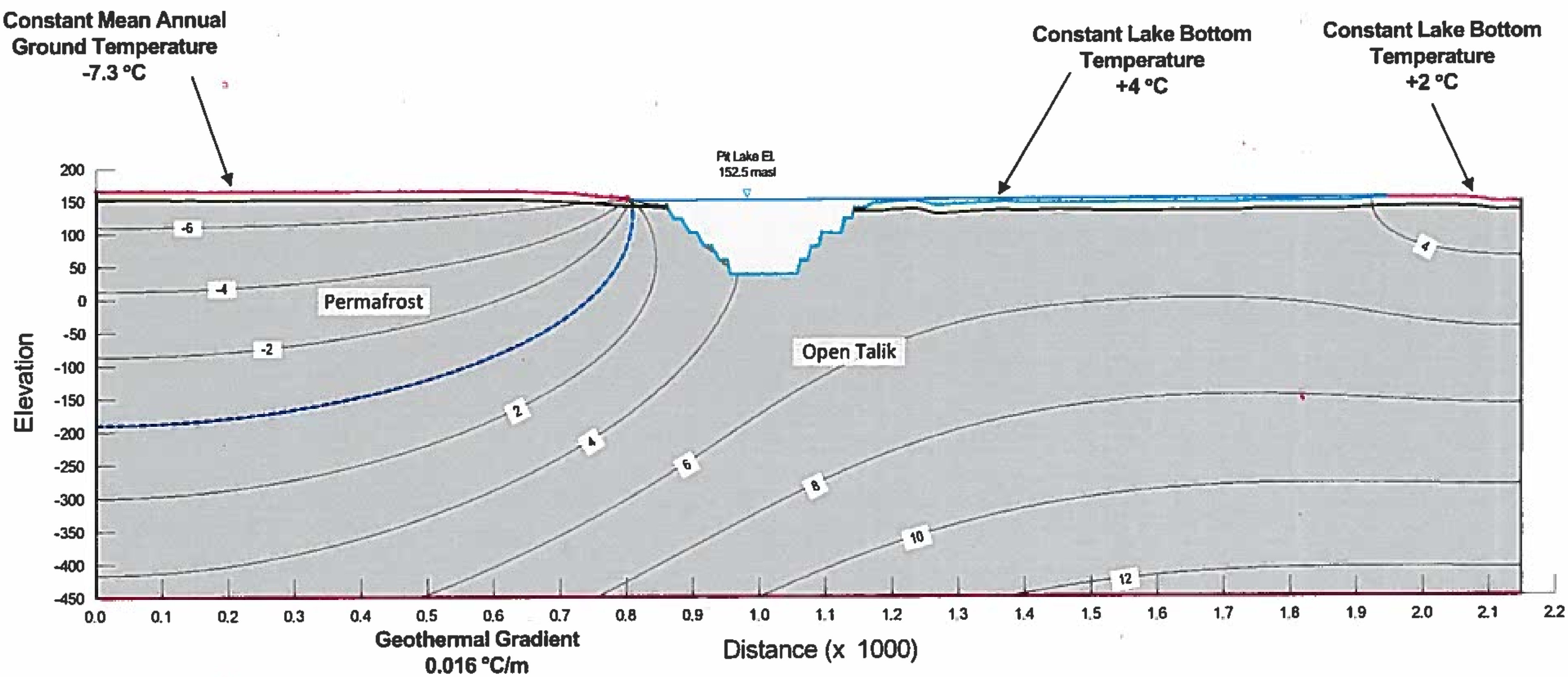
File Name: Phase 1 Section.gsz

Notes

1. Location of thermistor AMQ17-1265A is approximate.
2. The 300 year isotherm includes the 7 years of back-flooding.

CLIENT AGNICO EAGLE MINES LTD.		PROJECT WHALE TAIL PIT PROJECT POST-CLOSURE PIT LAKE THERMAL ANALYSIS NUNAVUT	
CONSULTANT GOLDER	YYYY-MM-DD	2018-04-03	TITLE TRANSIENT THERMAL MODELLING POST-CLOSURE PIT LAKE ZERO DEGREE ISOTHERMS AT SELECT YEARS
	PREPARED	CTM	
	DESIGN	CTM	
	REVIEW	SO	PROJECT No. 1789310 · Phase/Task 1000/12020 · Rev. 0 · Figure 2-5
	APPROVED	JFC	

Path: O:\Active\2016\3 Proj\1665859 Agnico Eagle_Water Mgmt_Whale Tail\1789310_Thermal\Thermal Analysis



Notes

1. Location of thermistor AMQ17-1265A is approximate.
2. Temperature contour interval 2 °C.

File Name: Phase 1 Section.gsz

CLIENT AGNICO EAGLE MINES LTD.		PROJECT WHALE TAIL PIT PROJECT POST-CLOSURE PIT LAKE THERMAL ANALYSIS NUNAVUT	
CONSULTANT GOLDER	YYYY-MM-DD: 2018-04-03 PREPARED: CTM DESIGN: CTM REVIEW: SO APPROVED: JFC	TITLE STEADY-STATE THERMAL MODELLING POST-CLOSURE PIT LAKE THERMAL REGIME	
		PROJECT No. 1789310	Phase/Task 1000/12020 · Rev 0 · Figure 2-6

APPENDIX B –2018 WESTBAY SYSTEM GROUNDWATER MONITRORING INVESTIGATION

GOLDER

TECHNICAL MEMORANDUM

DATE February 8, 2019

Project No. 1789310-244-TM-Rev0

TO Michel Groleau
Agnico-Eagle Mines Ltd.

FROM Valerie Bertrand, Dale Holtze, Jennifer Levenick

EMAIL vbertrand@golder.com

2018 WESTBAY SYSTEM GROUNDWATER MONITORING INVESTIGATION

1.0 INTRODUCTION

Agnico Eagle Mines Limited – Meadowbank Division (Agnico Eagle) is developing the Whale Tail Pit Project that was approved by the Nunavut Impact Review Board (NIRB). The property is a 408 square kilometre (km^2) site located on Inuit Owned Land approximately 150 kilometres (km) north of the hamlet of Baker Lake and approximately 50 km northwest of the Meadowbank Mine in the Kivalliq Region of Nunavut.

As part of the Approved Project baseline studies, groundwater samples were collected from a Westbay monitoring well installed in borehole AMQ16-626, drilled in March and April 2016 targeting the area of the talik zone below Whale Tail Lake near future mine developments. Agnico Eagle retained Nuqsana Golder Engineering and Environmental Inc. (Nuqsana Golder) to complete a groundwater monitoring program in November 2018. The objective of the program was to obtain additional pre-development hydraulic head and groundwater quality data in support of the Whale Tail Pit Project Certificate No. 008, Term and Condition No. 15 (TC15) (NIRB 2018).

This technical memorandum provides an interpretation of the data collected from AMQ16-626 in November 2018 with respect to hydraulic gradients and groundwater quality. The collected data was reviewed in the context of conceptual and numerical model predictions for the Whale Tail Pit Project to evaluate if follow-up assessment is required (i.e., if significant differences in the model assumptions or predictions was indicated by the collected data).

2.0 BACKGROUND

2.1 Westbay Well Installation

A Westbay groundwater well system was installed on site between March and April in 2016 to obtain groundwater quality and verify the vertical hydraulic gradient within the talik zone of Whale Tail Lake, in the area of future mine development, to define future effects of the mine workings on the groundwater flow regime and overall site water quality from development to post-closure.

The well was installed in the purpose-specific borehole (AMQ16-626) which was drilled at an inclination of -69 degrees, an azimuth of 152.6 degrees and advanced to a depth of 499 m along the borehole, through massive diorite throughout the borehole. The Westbay well was designed to tap discrete zones of unfrozen bedrock and, if encountered, zones of higher hydraulic conductivity that were observed during drilling and well testing conducted prior to well installation. Six sampling ports were installed at and below the depth of anticipated ramp development (0 to 385 metres below ground surface [mbgs]), listed in Table 1. Borehole drilling, packer test results along the borehole and well installation details are documented in another report (Golder 2016b). A schematic of the Westbay well instrument that was installed in borehole AMQ160626 is included in Appendix A for reference.

Table 1: Borehole AMQ16-626 Westbay System Zones

Sampling Interval	Depth Along Borehole			Interval Depth Vertical Depth		
	From	To	Length	From	To	Thickness
	(mah)	(mah)	(m)	(mbgs)	(mbgs)	(m)
Zone 6	276	287.4	11.4	257.7	268.3	10.6
Zone 5	298.9	310.3	11.4	279.0	289.7	10.6
Zone 4	349.3	359.1	9.8	326.1	335.2	9.1
Zone 3	381.3	392.7	11.4	356.0	366.6	10.6
Zone 2	440.8	452.2	11.4	411.5	422.2	10.6
Zone 1	488.1	499.0	10.9	455.7	465.9	10.2

Notes: Depth values were provided by Westbay Instruments Completion Report.
m = metres; mah = metres along the hole, relative to ground surface; mbgs = metres below ground surface.

Upon completion of the installation in 2016, the well was used to collect groundwater samples from select intervals that were within and below the proposed development; Ports 3, 4, and 6 ranging in depths from 276 m to 392 m. Sampling methods, data interpretation and water quality results were presented in Golder 2016a. The total dissolved solids (TDS) content in the Formation groundwater was determined to range between 3,198 mg/L and 4,042 mg/L (Golder 2016a).

The groundwater quality were used to predict groundwater inflow quantity into future mine developments (Golder 2016d), which were used as input to operational and post-closure hydrogeological and permafrost models (Golder 2018a) and into the Whale Tail pit lake hydrodynamic model (Golder 2018b). These models were ultimately used to assess effects of hydrogeological processes on site contact water quality during development, operations and closure and on pit lake water quality during closure and post-closure.

The results of the compendium of these studies for the Whale Tail Pit Project indicated that mass transfer from the pit to the pit lake is very low, that groundwater seepage into and out of the pit lake are negligible in volume, particularly compared to surface water exchanged annually post-closure when flows are re-established based on average climate year watershed runoff. The combination of results corroborates to support that the hydrogeological regime around the pit lake is not critical to pit lake water quality post-closure.

The data collected as part of the 2018 monitoring program aim to add to the pre-operational database of results and to verify model inputs and model outcomes obtained to date.

2.2 The Groundwater Monitoring Program

The 2018 groundwater monitoring program was completed to support the requirements of the Groundwater Monitoring Program stated in TC15 (NIRB 2018). TC15 requirements were as follows:

> *Subject to the additional direction and requirements of the Nunavut Water Board, the Proponent shall prepare and implement a Groundwater Monitoring Plan that, at a minimum includes:*
>
> - *The collection of additional site-specific hydraulic data (e.g., from new monitoring wells) in key areas during the pre-development, construction and operation phases;*

- *Definition of vertical and horizontal groundwater flows in the project development areas;*
- *Delineates monitoring plans for both vertical and horizontal ground water; and*
- *Thresholds that will trigger the implementation of adaptive management strategies that reflect site-specific conditions encountered at the project site.*

The groundwater monitoring program documented in this technical memorandum consisted of measurements of hydraulic head (vertical gradients) and sampling of the formation groundwater to evaluate groundwater quality with depth.

2.3 Thresholds for Additional Assessment or Adaptive Management

Groundwater monitoring data being collected in the pre-development phase is being compiled into a Project-specific data and will be used in combination with future data collected during operational and closure phases of the Project to evaluate trends in groundwater data with respect to pit inflow quantity and quality.

Measured groundwater inflow rates and groundwater quality will be compared to model predictions on an annual basis. If significant variations from model predictions are observed, the assumptions behind the data will be reviewed and the analysis updated if required. In addition, updates to the groundwater model will be made if operational changes occur as the open pit advances which could significantly alter groundwater inflow or quality.

Variations that would be considered significant include:

- Groundwater inflows to the mine, based on rolling monthly average of inflow over six consecutive months, is 20% higher than predicted groundwater inflow.
- Collected water samples that indicate that the concentration of total dissolved solids (TDS) is more than 25% higher than the estimated water quality.

If the above variations are observed, the groundwater data (quantity and quality) would be assessed to evaluate trends, the potential causes of the greater than expected groundwater inflow quantity or quality, and the potential for long-term effect associated with the groundwater flow or quality. If the greater than predicted flows were correlated to a short-term effect such as freezing in the pit walls, changes in mining rate, freshet or transient drainage of a high storage feature, then further reassessment of groundwater inflows may not be required, and the adaptive management of these short-term effects would be evaluated under the Water Management Plan.

If the greater than predicted flows or quality would be considered as potentially long term, consideration will be given to reviewing the model calibration. The six-month averaging period of observation is based on observed seasonal variations in inflow quantities in mines situated in permafrost regions.

If model re-calibration is deemed necessary, future groundwater inflow quantity and quality would be predicted using this re-calibrated model and new results will be considered as part of the adaptive management of the groundwater quantity contribution to the Water Management Plan.

Modification of groundwater management strategies: the ponds, sumps and water conveyance strategies around the pit can be modified to mitigate the effect of additional groundwater volume or salinity prior to treatment and discharge. The water conveyance strategy will be evaluated and optimized during operations and closure to maintain post-closure commitment.

Groundwater monitoring data collected at this stage is representative of the pre-development condition of the project, and therefore an evaluation of trends in flow quantity and quality is not possible for the operational and closure phases. Results of the monitoring has been compared to assumptions adopted in the initial conditions for groundwater conceptual and numerical models and has been used to assess if the post-closure predictions are likely reasonable in consideration of the observed vertical hydraulic gradients and flow directions in the November 2018 monitoring program.

3.0 2018 GROUNDWATER MONITORING PROGRAM

3.1 Objectives

The objectives of the program are as follows:

- To collect site specific hydraulic head data during Project pre-development through the measurement of the hydrostatic pressure profile from the existing Westbay well.
- Assess the vertical hydraulic gradient and groundwater flow direction in that location of the Whale Tail Lake talik.
- Collect groundwater samples from the Westbay Well for chemical analysis, adding to the database of groundwater quality results.
- Compared water quality results to the threshold adopted for additional assessment and adaptive management.

3.2 Monitoring Methods

3.2.1 Hydraulic Head Measurements and Assessment of Vertical Hydraulic Gradients

Hydraulic heads were derived from the formation pressures measured at each monitoring port installed along the Westbay system. The formation pressure for each monitoring port was measured on November 9, 2018 using the Mosdax sampler manufactured and supplied by Westbay Instruments (refer to Appendix B for instrument calibration record).

3.2.2 Groundwater Sampling

Groundwater samples were collected from fixed ports in the Westbay well system that are positioned at different intervals along the hole to assess baseline groundwater chemistry with depth. Ports 6, 4 and 3, which are located within the anticipated ramp development zone (0 to 385 m), were targeted for sampling because these intervals had been previously developed (drill water had been largely removed from the interval) in 2016. Port 2 was also sampled although it was less developed than the other sample intervals in 2016 in order to verify if the aquifer was naturally flushed of the drilling water. Information on each of the Ports that were purged is presented in Table 2.

Fluorescein tracer was added to the 2016 drilling water to differentiate between the drilling fluid and the formation water. It is assumed that the only source of fluorescein was introduced during the 2016 drilling activities of borehole AMQ16-626 such that it is a reliable tracer of introduced water into the Formation.

Table 2: 2018 AMQ16-626 Westbay Well Development and Groundwater Sampling Information

Sample Port	Sampling Interval (mah)		Volume of Water Removed in 2018 (L)	Sample Date	Groundwater Parameters at Sampling Period (field measured)			
	From	To			Residual Fluorescein (ppb)	Conductivity (mS/cm)	TDS (ppm)	pH
6	276.0	287.4	8.25	13-Nov-18	83.54	9.02	4543	6.37
4	349.3	359.1	13.25	11-Nov-18	66.21	14.56	7275	7.50
3	381.3	392.7	12.5	12-Nov-18	100.05	7.50	3765	8.33
2	440.8	452.2	6.25	10-Nov-18	73.30	17.52	8825	8.90
1	488.1	499.0	0.25	not sampled	-	-	-	-

m = metres, mah = metres along hole, relative to ground surface; L = litres, TDS = total dissolved solids

Throughout the development and upon water sample collection, field chemical parameters (pH, conductivity, TDS, fluorescein content and temperature) were measured in order to track the fluid introduced into the Formation by drilling and to follow the removal of this fluid from the Formation during development and sampling of groundwater. Fluorescein content was measured using the AquaFluor handheld Fluorometer manufactured by Turner Designs. Temperature, pH, TDS and electrical conductivity values were measured with a Hanna Combo tester (HI 98130). A drilling water content of less than 5% (estimated using fluorescein content) is targeted in order to provide a reliable estimate of formation groundwater quality. Higher residual drilling fluid content can be used for this purpose but decreases the precision of the calculation of groundwater quality.

Groundwater sampling was preformed using the Westbay Mosdax sampler in a similar fashion as the initial development and sampling program completed in 2016. The Mosdax sampler collects 1 Litre of groundwater at a time (per sampling instrument descent into the well); multiple sampler runs were carried out to collect one complete groundwater sample set from each interval. Calibration reports of the Mosdax sampler probe are included in Appendix B.

Groundwater samples were collected from Intervals 6, 4, 3, and 2 in triplicate. Groundwater samples were filtered and preserved in the field, as required, and collected in laboratory-supplied bottles which were packed and shipped to the analytical laboratory following the collection of each sample. Duplicate samples collected from Ports 6, 4, 3, and 2 were submitted for analysis, while the third sample set was kept on site as backup and disposed of upon receipt of the samples by the analytical laboratory. An equipment and field blank were also collected for quality assurance/quality control (QA/QC) purposes. Analysis of general chemistry was completed at ALS Environmental (ALS) in Vancouver for the following parameters:

- Physical tests, including hardness, pH, conductivity, total suspended solids and total dissolved solids
- Anions and nutrients, including alkalinity, ammonia, bicarbonate, bromide, carbonate, chloride, fluoride, nitrate, nitrite, phosphorus (total and dissolved) and sulphate
- Metals (dissolved and total), including aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, lithium, magnesium, manganese, mercury, molybdenum, nickel, selenium, silicon, silver, sodium, strontium, sulfur, tellurium, thallium, tin, titanium, uranium, vanadium and zinc. Additional metals were also analyzed by the analytical laboratory as part of the metals package, however they are not of interest to the project and will not be discussed herein out: cesium, rhenium, rubidium, sulfur, thorium, tungsten, yttrium and zirconium

Certificates of analysis from ALS are included in Appendix C.

3.3 Evaluation of Formation Water Quality

To properly assess the quality and salinity of true rock formation groundwater, the drilling fluid present in the sampling interval must be removed as much as possible by purging. The amount of drilling fluid present in the Formation is estimated from the concentration of fluorescein in the raw groundwater sample at each interval, compared to the fluorescein content of the drilling fluid used during drilling of the borehole. In 2016 upon well installation, the sampling intervals were purged to remove as much of the drilling fluid as possible within the task schedule, prior to collecting a sample for chemical analysis.

In 2018, the fluorescein, electrical conductivity and TDS of groundwater was monitored during sampling and compared to data from the end of development in 2016 to assess whether the interval remained purged and still reflected true Formation groundwater quality. Fluorescein and conductivity were within the range of values recorded in 2016 and groundwater samples were collected and submitted for chemical analysis.

The following summarizes the calculations made to estimate true Formation water quality and TDS from field measurements of electrical conductivity and laboratory analytical results of raw groundwater samples in 2018 and drilling water fluid in 2016.

1) **Estimation of the chemistry of the drilling fluid introduced in the Formation during the 2016 well borehole drilling and installation activities.** The drilling fluid consisted of very low TDS lake water to which was added a concentrated brine. The range of composition of the drill fluid (the dilute brine) was estimated by comparing both the initial and maximum conductivity values measured in samples from the Formation (for each port 6, 4, 3, and 2; conductivity varied between sampling ports) against the conductivity of the concentrated brine[1]. This Dilute Brine Factor was used to calculate composition of the drilling fluid introduced into the sampling interval during the 2016 drilling and well installation activities as per equation (1) below.

$$(1) \qquad Dilute\ Brine\ Factor_{Port\ i} = \frac{Field\ Conductivity_{Port\ i}}{Brine\ Conductivity_{calculated}}$$

This calculation assumes an insignificant proportion of formation water is present immediately after drilling, which is a fair assumption given that a high volume of drilling water was lost to the Formation (Golder, 2016a).

The drilling brine composition for each parameter was calculated from the product of the dilution brine factors and the chemistry of the drilling brine fluid for each port per equation (2).

$$(2) \qquad Dilute\ Brine_{Port\ i} = Laboratory\ Result_{Brine} \times Dilution\ Brine\ Factor_{Port\ i}$$

2) **Calculation of the proportion of drill brine remaining in the Formation upon sampling.** This was calculated based on the amount of residual fluorescein measured upon sample collection at each port in 2018 compared to the initial fluorescein content of the drilling fluid measured in 2016 (i.e. 512.7 ppb).

3) **Removal of the drilling fluid chemistry from the raw groundwater sample analysis.** The concentration of constituents from the drilling fluid are removed from the reported analytical results for each chemical constituent per the below equation (3). The November 2018 laboratory results are provided in Appendix C.

$$(3) \qquad Groundwater\ Quality_{calculated} = Laboratory\ Result - \frac{Proportion\ of\ Drill\ Brine \times Dilute\ Brine\ Chemistry}{Proportion\ of\ Formation\ Water}$$

[1] Brine conductivity was estimated from the calculated TDS of the drilling brine fluid using a conversion factor of 0.75 which is appropriate for brine solutions (Rusydi, 2017). Brine TDS was calculated based on constituent concentrations (refer to Table 3 and Appendix C). Laboratory-reported TDS and conductivity were not reliable as they exceeded instrument calibration.

The estimated drilling brine chemistry, proportion of residual drilling brine and Formation water for each sampling port are summarized in Table 4. The calculated groundwater quality for Ports 6, 4, 3 and 2 are summarized in Table 5.

4.0 RESULTS AND DISCUSSION

4.1 Hydraulic Head Profile and Groundwater Flow Direction Below Whale Tail Lake

The planned Whale Tail Pit sits within the closed talik below the North Basin of Whale Tail Lake. The closed talik is inferred to transition to open talik below the South Basin due to the increased width and depth of the lake towards the south. The water table below both basins will be equivalent to the lake surface elevation.

Permafrost underlies the land surrounding the lake, which restricts the lateral flow of groundwater to the talik and restricts the recharge of the sub-permafrost groundwater flow system by precipitation. Groundwater flow is controlled by surface water elevations in lakes with open talik; water moves vertically through the open talik to the underlying sub-permafrost groundwater flow system. In effect, lakes with open taliks in continuous permafrost regions are equivalent to large monitoring wells.

AMQ16-626 was installed to evaluate groundwater quality in the unfrozen bedrock and to verify the hydraulic gradient that exists below Whale Tail Lake. The hydraulic gradient, in combination with the bedrock hydraulic conductivity, will control the potential flux to or from Whale Tail Lake, and the flooded Whale Tail Pit post-closure.

Table 3 summarizes the calculated hydraulic heads based on the measured pressure in each of the ports. Although Zone 6 (shallowest port) is included in Table 3, it is suspected that this port may be in permafrost or near the permafrost contact, which could affect the measured hydraulic head. This inference is supported by the measured formation temperature, which is less than zero. Although the measured hydraulic head in the shallowest port is consistent with the overall trend, data from the deeper ports, which are confirmed to be in unfrozen rock by the formation temperature, were used to assess the vertical gradient.

Table 3: AMQ16-626 Westbay Well Hydraulic Heads and Formation Temperatures (November 9, 2018)

Port/ Zone	Measurement Interval (mah)		Measurement Interval (mbgs)		Port Depth (mah)	Port Depth (mbgs)	Calculated Depth to Water (mbgs)	Calculated Hydraulic Head (masl)	Formation Temperature (°C)
	From	To	From	To					
6	276.0	287.4	257.7	268.3	276.2	257.9	1.9	154.0	-0.17
4	349.3	359.1	326.1	335.2	349.5	326.3	1.6	153.6	0.24
3	381.3	392.7	356.0	366.6	381.5	356.2	1.1	153.4	0.36
2	440.8	452.2	411.5	422.2	441.0	411.7	0.9	152.9	0.87
1	488.1	499.0	455.7	465.9	488.3	455.9	0.5	152.6	1.29

Source: Golder (2016a).
m = metres; mah = metres along hole relative to ground surface (borehole angled to surface); mbgs = metres below ground surface (vertical down from surface); masl = metres above sea level (elevation)

The data collected at AMQ16-626, indicates the presence of a downward hydraulic gradient. Assuming the measured hydraulic head is representative of the midpoint of the measurement interval, the downward gradient between Port 1 and Port 4 is 0.008 m/m. This gradient is consistent with the estimated gradient derived from looking at the relative elevation of Whale Tail Lake and DS1 (0.008 m/m), as reported in Agnico Eagles response to TC15 (Agnico Eagle 2018). DS1 is the predicted receptor from water in the area of Whale Tail Pit and Underground (Golder 2016c).

For the depth interval over which the hydraulic head was measured (326 to 456 mbgs), the estimated hydraulic conductivity of the bedrock for the FEIS for the Whale Tail Pit Project was 1 x10^{-8} to 3 x 10^{-8} m/s (Golder 2016c). In support of TC15 and the development of the Project, additional packer testing was conducted subsequent to the FEIS and the data indicate the hydraulic conductivity of bedrock over this depth interval is likely lower (1 x 10^{-9} m/s based on the geometric average of the test data) (Golder 2018a). Considering the measured gradient (0.008), the historical range of bedrock hydraulic conductivity adopted in the FEIS (1 x10^{-8} to 3 x 10^{-8}) and the now refined hydraulic conductivity (1 x 10^{-9} m/s) and an assumed effective porosity of 0.001 (Maidment 1992; Stober and Bucher 2007), the estimated downward groundwater flow velocity is between approximately 0.25 m/yr and 8 m/yr. The lower bound of this range is considered more reasonable, as it uses the refined hydraulic conductivity data discussed above, which is based on the geometric mean of all the packer test measurements (pre- and post-FEIS).

Gradients measured during this monitoring program are considered a reasonable interpretation of what long-term gradients could be post-closure following the formation of the pit lake. Recharge and discharge from the base of Whale Tail Lake or a flooded pit lake will be controlled by the vertical hydraulic gradients and the bedrock hydraulic conductivity near the base of the permafrost. Considering the approximate area of the Whale Tail Pit (0.5 km^2), the range in bedrock hydraulic conductivity (1 x 10^{-9} to 3 x 10^{-8} m/s), and the measured downward gradient (0.008), the data would indicate long-term groundwater flux would be approximately 0.3 m^3/day to 11 m^3/day. Similar to the estimated groundwater velocity, the lower bound of this range is considered more reasonable, as it uses the refined estimate of hydraulic conductivity. Overall, the estimated flux is similar to the long-term predicted discharge from the pit lake at post-closure (1.7 m^3/day; Golder 2016c) and supports the conclusion in the FEIS that long-term predicted flows from the pit lake to the groundwater flow system will be negligible relative to the surface water exchange into the pit lake (Golder 2018c).

4.2 Groundwater Quality

Field measurements of electrical conductivity and fluorescein concentration serve, in part, to evaluate whether the groundwater accessed via the Westbay well sampling ports continues to be representative of Formation groundwater quality.

The 2016 and 2018 electrical conductivity and fluorescein trends measured throughout the sampling program in Ports 6, 4, 3, 2, and 1 are summarized in Figures 1 and 2, respectively. Groundwater samples were collected from Ports 6, 4, 3, and 2. Port 1 groundwater quality was deemed not representative of Formation groundwater and was not sampled. The field measurements of electrical conductivity, TDS and fluorescein recorded at the time of sampling are summarized in Table 3. The values are averages from the subsamples collected to obtain the required volume of water for analysis.

Port 6

The temperature measured by the Mosdax sampler during the pressure profile and sampling at Port 6 was below zero (-0.17 °C, refer to Table 3) and slush was present in the sampling canister from this Port. The cryopeg zone (temperature below 0 degrees, but not frozen) is interpreted to extend to at least 258 m depth (top interval of Port 6) within the vicinity of the Westbay well. Groundwater from the crypogeg (Port 6) could have a heterogenous composition (non-saline ice and slightly saline groundwater) where free water is primarily transmitted through the more permeable unfrozen zones. Groundwater collected from Port 6 is interpreted to be located within the cryopeg have the potential to yield variable water quality even following periods of sufficient development.

Notwithstanding this, the estimation of true Formation groundwater quality was still completed per the method described in Section 2.3. Table 5 presents the minimum and maximum range of calculated concentrations of formation water at each port sampled in 2018 and 2016 for comparison.

The 2018 field-measured groundwater fluorescein content and electrical conductivity at the port remained within the same range albeit slightly higher than values recorded at the end of the well development period in 2016. This suggests that groundwater quality at that location remained representative of true Formation water since it was last sampled in 2016. The results of the 2018 groundwater quality estimation (Table 5) are also within the same order of magnitude but slightly higher than those reported in 2016 suggesting that residual drilling brine fluid is still present in Formation water at a proportion slightly higher than at the end of development in 2016. This can occur where drilling fluid that is still present in undeveloped zones in the aquifer (for example, in zones between sampling Ports) migrates back into the developed zones tapped by the sampling Ports following the normal movement of groundwater along the downward vertical gradient.

The estimated Formation groundwater minimum and maximum TDS concentrations in 2018 are 25% and 38% higher than the minimum and maximum TDS values estimated in 2016. The difference is higher than the TDS variability threshold of 25%. This is attributed to the higher proportion of drilling brine fluid in the Formation at Port 6 collected in 2018.

Arsenic concentration in groundwater at Port 6 is estimated to be low based on 2018 calculations, within the range of 2016 estimation.

The 2016 data is considered potentially more accurate, but 2018 data is still valid. The initial model input is still considered accurate and the new data does not warrant revising the conceptual model of groundwater TDS.

Ports 3 and 4

The 2018 field-measured groundwater fluorescein content and electrical conductivity at these sampling ports were similar (slightly higher) to measured values recorded at the end of the well development period in 2016, suggesting that groundwater quality remained representative of true Formation water at these zones. These slightly higher 2018 readings suggest that a small influx of drilling fluid that was still present in undeveloped zones migrated back into the developed zones as for Port 6. The higher proportion of drilling brine fluid in the Formation and in the samples collected may result in a lower accuracy of calculated groundwater quality from samples collected in 2018 compared to those collected in 2016 after a more complete purge; nonetheless, the data is still considered valid.

Figure 2 illustrates how electrical conductivity and fluorescein concentrations evolved in parallel during the short development period at Ports 3 and 4, inferring that groundwater in the vicinity of the Westbay well has not been affected by an outside brine source that could have originated from salt water used in exploration drilling nearby, approximately 26 metres from the Westbay well.

Estimated true Formation groundwater quality is shown in Table 5 presenting the minimum and maximum range of calculated concentrations of Formation water at each port sampled in 2018 and 2016. The results of the 2018 groundwater quality data are within the same order of magnitude to those reported in 2016 albeit slightly higher than in 2016. Port 3 minimum and maximum estimated TDS values are 35% and 28% higher than the calculated minimum and maximum values from 2016 data. At Port 4, they are 76% and 86% higher than the calculated minimum and maximum values from 2016 data. Variability is higher than the threshold of 25%. This is attributed to the higher proportion of drilling brine fluid in the Formation collected in 2018 compared to 2016.

Arsenic concentrations at both Ports 4 and 3 are estimated to be in the same order of magnitude as concentration ranges calculated in 2016.

The 2016 data is considered potentially more accurate, but 2018 data is still valid. The initial model input is still considered accurate and the new data does not warrant revising the conceptual model of groundwater TDS.

Port 2

Due to time constraints in 2016, this Port had not been extensively developed, leaving a higher proportion of drilling brine in the groundwater prior to sampling. A groundwater sample was collected in 2018 to verify the progression of water quality at that location; to assess whether drilling brine might have flushed out of the horizon since 2016 through natural groundwater flow. The 2018 field-measured groundwater fluorescein content and electrical conductivity were within a similar range than after development in 2016. Values were slightly lower than in 2016 but the trend was rising throughout the brief purging period in 2018. Electrical conductivity and fluorescein progressed at different rates during purging (conductivity rose faster than fluorescein; Figure 2) suggesting interference by a source of saline water that is not tagged with fluorescein, such as possibly, adjacent exploration borehole drilling water. Given the continued high proportion of drilling brine potentially mixed with another source of saline water that cannot be quantified at this time, a proper estimation of true Formation groundwater quality is not deemed possible for from this Port.

Summary

The higher TDS values calculated at Ports 6, 4, and 3 in 2018 are above the threshold value of 25%. These higher values are attributed to the presence of a higher content of non-Formation drilling brine in groundwater in 2018 compared to 2016. Consequently, the initial model input is still considered accurate and the new data does not warrant revising the conceptual model of groundwater TDS.

Arsenic concentration at all sampling ports is still low, the maximum calculated to be at Port 6 measured in 2016. Based on the results of the groundwater sampling completed to date, arsenic presence is low in the formation water.

5.0 QUALITY ASSURANCE/QUALITY CONTROL

Groundwater samples were collected from each interval in triplicate and submitted in duplicate for analysis to the analytical laboratory as part of the quality assurance/quality control ('QA/QC') protocol. In addition, field and equipment blanks were also submitted for analysis of select parameters. The analytical laboratory performs equipment blanks as a method of internal QA/QC verification.

Analytical repeatability was tested by assessing the similarity between duplicate pairs of results. For each duplicate pairs of analysis where both results were higher than 5 times the method detection limit (MDL), the relative percent difference (RPD) was calculated as follows:

$$RPD = \frac{\text{absolute [difference (concentration of a given parameter)]}}{\text{[average (concentration of a given parameter)]}} \times 100$$

Per USEPA recommended methods (USEPA, 1994), an RPD of 20% or less was considered acceptable. Where one or both results of the duplicate pair were less than 5 times the MDL, a margin of +/- MDL was considered acceptable.

Table 6 presents the RPD or =/- MDL value calculated from the duplicate pair of results. Approximately 50% of duplicate pairs of analyses had one or both results below the method detection limit and consequently could not be assessed for repeatability. QA/QC results for the duplicate samples were within acceptable tolerance limits (RPD or +/- MDL) with the exception of duplicate concentrations of total suspended solids in Port 4 as well as duplicate concentrations of total chromium and nickel in Port 3. Trace components and major elements for all samples are considered adequately repeatable.

Groundwater samples were analyzed for TDS in the field and in 2018 by the analytical laboratory (ALS). The original brine fluid was analyzed by Multilab analytical laboratory. TDS values were also calculated from the laboratory results in order to assess potential discrepancies between the ionic balance and uncertainty of the results (refer to Tables 4 and 6). The results of the field, calculated, and laboratory measured values were within reasonable range limits for all samples, with the exception of the brine fluid. The TDS result reported for the brine fluid (36,946 mg/L) was significantly less than the calculated value (130,500 mg/L). The laboratory measured TDS and consequently electrical conductivity (55.42 mS/cm) of the brine fluid were deemed unreliable due to the ionic imbalance discrepancy. This assumption was confirmed during a telephone discussion between Nuqsana Golder and the analytical laboratory (H2Lab, formerly Multilab chemist Jean-Francois Bouffard) on January 15, 2019, where the chemist indicated the TDS and electrical conductivity values reported for the brine fluid were outside the suitable range for the analytical instrument and may not be accurate. The certificate of analysis for the brine fluid is included in Appendix D. The calculated TDS of the brine fluid was used to correct the groundwater quality data as discussed in Section 2.3 of the report.

Uncertainty in the calculated groundwater water quality results from the variability in drill water composition augmented by probable mixing between aquifer zones having different levels of development (purging of drill water); this has a higher potential influence on the accuracy of 2018 calculated groundwater quality because of the higher proportion of drilling brine fluid remaining in the raw water samples compared to 2016 samples; thus while 2018 data remain valid to estimate water quality at Port 3, 4 and 6, 2016 results may be a more accurate representation of Formation groundwater quality than 2018 data.

6.0 CONCLUSION

The 2018 Westbay Well field program was carried out in support of the Whale Tail Pit Project Certificate No. 008, Term and Condition No. 15, to obtain additional pre-development groundwater quality data and to verify the hydraulic gradient. These data were used to verify modelling assumptions related to the groundwater quality and the hydraulic gradient near the mine development areas.

Hydraulic head measurements indicate that a downward vertical hydraulic gradient is present in the North Basin of Whale Tail Lake, which is consistent with the conceptual understanding of groundwater flow directions and the predicted conditions post-closure following the formation of the Whale Tail Pit Lake. Revisions to the numerical or conceptual models is not considered necessary based on the vertical gradients as the data is consistent the model assumptions.

Groundwater quality was estimated from the samples collected, removing the anticipated proportion of residual drilling water in the Formation (in the raw water sample). The 2018 program estimated groundwater quality at Ports 6, 4, and 3 are in the same range as previously estimated. The calculated groundwater TDS are slightly higher in 2018; the calculated increase in TDS ranges from 25% to 86% which is above the threshold value of 25% variability for TDS. The variation is attributed to the higher proportion of residual drilling water in the sample. In consideration that higher TDS is not considered to represent an increase in Formation water TDS, the assumptions for the conceptual model, which are based on the more reliable and applicable 2016 data, are still considered to be appropriate. Therefore, adaptive management is not considered necessary at this time.

The concentrations of metals and arsenic are low. The maximum calculated arsenic concentration remains similar to what was calculated for Port 6 in 2016. Given that the arsenic concentrations are similar to the assumptions adopted in the geochemical models (low arsenic in Formation groundwater), groundwater arsenic content is still not likely to have a significant effect on mine surface water quality.

7.0 STUDY LIMITATIONS

This technical memorandum was prepared for the exclusive use of Agnico Eagle Mines Limited. The technical memorandum, which specifically includes all tables and attachments, is based on data and information collected by Golder Associates Ltd. and is based solely on the conditions of the property at the time of the work, supplemented by historical information and data obtained by Golder Associates Ltd. as described in this technical memorandum.

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The findings and conclusions of this technical memorandum are valid only as of the date of this technical memorandum and for the locations investigated. If new information is discovered in future work, including excavations, borings, or other studies, Golder Associates Ltd. should be requested to re-evaluate the conclusions of this technical memorandum and provide amendments as required.

8.0 CLOSURE

We trust this report meets your needs at this time. Should you have any questions, please do not hesitate to contact the undersigned.

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Attachments: Tables 4, 5, 6
Figure 1 – 2016 and 2018 Development Record
Figure 2 – 2018 Development Record
Appendix A – AMQ160626 Westbay System Installation Details
Appendix B – Westbay Instruments Mosdax Sampler Calibration Reports
Appendix C – 2018 Laboratory Certificates of Analysis
Appendix D – 2016 Laboratory Certificate of Analysis – Brine Fluid

9.0 REFERENCES

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Table 4
Drilling Brine Composition
Westbay Well in Whale Tail Lake Talik
Whale Tail Project, Nunavut

Sample		Brine Fluid	Calculated Drilling Brine Port 6		Calculated Drilling Brine Port 4		Calculated Drilling Brine Port 3	
			Initial Brine	Maximum Brine	Initial Brine	Maximum Brine	Initial Brine	Maximum Brine
Date		17-Apr-16	21-Jul-16	21-Jul-16	24-Apr-16	27-Apr-16	02-Sep-16	02-Sep-16
Field measured parameters	Units							
Fluorescein Concentration	mg/L	512.70	138.00	158.10	512.70	341.90	445.90	437.20
Drilling Fluid Proportion		1.00	0.27	0.31	1.00	0.67	0.87	0.85
Formation Water Proportion		0.00	0.73	0.69	0.00	0.33	0.13	0.15
Initial Conductivity Reading	uS/cm	0	10240	12210	3810	19400	52280	53800
Dilution of Brine Factor in Port		0.00	0.06	0.07	0.02	0.11	0.30	0.31
Conventional Parameters								
Total dissolved solids (calculated)	mg/L	130500	7680	3122	2858	14550	39210	40350
Total dissolved solids (lab)	mg/L	36946	-	-	-	-	-	-
pH	S.U.	10	11.25	7.40	12	11	11	11
Conductivity (lab)	uS/cm	55420	-	-	-	-	-	-
Conductivity (calculated)	uS/cm	174000	10240	4684	3810	19400	52280	53800
Reported Hardness	mg $CaCO_3$/L	105554	6212	2230	2311	11769	31715	32637
Alkalinity	mg $CaCO_3$/L	145.0	8.5	38.0	3.2	16.2	43.6	44.8
Bicarbonate (HCO3)	mg $CaCO_3$/L	27.0	1.6	38.0	0.6	3.0	8.1	8.3
Major ions								
Calcium (Ca)	mg/L	42266	2487	2966	925	4712	12699	13068
Magnesium (Mg)	mg/L	3.92	0.23	0.28	0.09	0.44	1.18	1.21
Potassium (K)	mg/L	1717	101	120	38	191	516	531
Sodium (Na)	mg/L	838	49	59	18	93	252	259
Bromide (Br)	mg/L	1066	63	75	23	119	320	330
Chloride (Cl)	mg/L	83700	4926	5873	1833	9332	25149	25880
Fluoride (F)	mg/L	0.060	0.004	0.004	0.001	0.007	0.018	0.019
Sulphate (SO4)	mg SO_4/L	<0.6	0	0	0	0	0	0
Nutrients								
Nitrates (NO3)	mg N/L	0.540	0.032	0.038	0.012	0.060	0.162	0.167
Nitrites (NO2)	mg N/L	0.060	0.004	0.004	0.001	0.007	0.018	0.019

Table 4
Drilling Brine Composition
Westbay Well in Whale Tail Lake Talik
Whale Tail Project, Nunavut

Sample		Brine Fluid	Calculated Drilling Brine Port 6		Calculated Drilling Brine Port 4		Calculated Drilling Brine Port 3	
			Initial Brine	Maximum Brine	Initial Brine	Maximum Brine	Initial Brine	Maximum Brine
Date		17-Apr-16	21-Jul-16	21-Jul-16	24-Apr-16	27-Apr-16	02-Sep-16	02-Sep-16
Field measured parameters	Units							
Fluorescein Concentration	mg/L	512.70	138.00	158.10	512.70	341.90	445.90	437.20
Drilling Fluid Proportion		1.00	0.27	0.31	1.00	0.67	0.87	0.85
Formation Water Proportion		0.00	0.73	0.69	0.00	0.33	0.13	0.15
Initial Conductivity Reading	uS/cm	0	10240	12210	3810	19400	52280	53800
Dilution of Brine Factor in Port		0.00	0.06	0.07	0.02	0.11	0.30	0.31
Metals (dissolved)								
Aluminium (Al)	mg/L	0.498	0.0293	0.0349	0.0109	0.0555	0.1496	0.154
Antimony (Sb)	mg/L	0.0354	0.0021	0.0025	0.0008	0.0039	0.0106	0.0109
Silver (Ag)	mg/L	<0.0001	0.0	0.0	0.0	0.0	0.0	0.0
Arsenic (As)	mg/L	0.766	0.045	0.054	0.017	0.085	0.23	0.237
Barium (Ba)	mg/L	0.113	0.007	0.008	0.002	0.013	0.034	0.035
Berillium (Be)	mg/L	<0.0005	0.0	0.0	0.0	0.0	0.0	0.0
Bismuth (Bi)	mg/L	<0.0005	0.0	0.0	0.0	0.0	0.0	0.0
Boron (B)	mg/L	13.2	0.8	0.9	0.3	1.5	4.0	4.1
Cadmium (Cd)	mg/L	<0.00002	0.0	0.0	0.0	0.0	0.0	0.0
Chromium (Cr)	mg/L	<0.0006	0.0	0.0	0.0	0.0	0.0	0.0
Cobalt (Co)	mg/L	0.0406	0.0024	0.0028	0.0009	0.0045	0.0122	0.0126
Copper (Cu)	mg/L	0.0039	0.0002	0.0003	0.0001	0.0004	0.0012	0.0012
Tin (Sn)	mg/L	<0.001	0	0	0	0	0	0
Iron (Fe)	mg/L	2.6	0.15	0.18	0.06	0.29	0.78	0.8
Lithium (Li)	mg/L	34.52	2.03	2.42	0.76	3.85	10.37	10.67
Manganese (Mn)	mg/L	<0.0005	0	0	0	0	0	0
Mercury (Hg)	mg/L	0.0	0.00002	0.00003	0.00001	0.00004	0.00012	0.00012
Dissolved Mercury (Hg)	mg/L	-	0.00002	0.00003	0.00001	0.00004	0.00012	0.00012
Molybdenum (Mo)	mg/L	<0.0005	0	0	0	0	0	0
Nickel (Ni)	mg/L	1.35	0.08	0.09	0.03	0.15	0.41	0.42
Lead (Pb)	mg/L	<0.0003	0	0	0	0	0	0
Selenium (Se)	mg/L	3.83	0.23	0.27	0.08	0.43	1.15	1.18
Silica (Si)	mg/L	2.93	0.17	0.21	0.06	0.33	0.88	0.91
Strontium (Sr)	mg/L	656.0	38.61	46.03	14.36	73.14	197.1	202.83
Telluride (Te)	mg/L	<0.0005	0	0	0	0	0	0
Thallium (Tl)	mg/L	<0.002	0	0	0	0	0	0
Titanium (Ti)	mg/L	45.2	2.66	3.17	0.99	5.04	13.58	13.98
Uranium (U)	mg/L	-	0	0	0	0	0	0
Vanadium (V)	mg/L	<0.001	0	0	0	0	0	0
Zinc (Zn)	mg/L	<0.0005	0	0	0	0	0	0
QA/QC								
Calculated TDS (lab)	-	130500	-	-	-	-	-	-
Lab measured vs Calculated TDS	-	28%	-	-	-	-	-	-
Lab measured TDS vs Conductivity	-	0.67	-	-	-	-	-	-
Calculated TDS vs Calculated Conductivity	-	0.75	-	-	-	-	-	-

Table 5
Rock Formation Groundwater Quality Corrected to Remove Residual Drilling Water
Whale Tail Lake Talik
Whale Tail Project, Nunavut

Sample		Port 6				Port 4				Port 3			
Date		2-Aug-2016		13-Nov-2018		20-Jul-2016		11-Nov-2018		14-Sep-2016		12-Nov-2018	
Drilling Fluid Proportion		0.04	0.24	0.16		0.09	0.18	0.13		0.08	0.18	0.20	
Formation Water Proportion		0.96	0.76	0.84		0.91	0.82	0.87		0.92	0.82	0.80	
Sampling interval depth (metres along borehole)		274.0 m - 287.4 m				349.3 m - 359.1 m				381.3 m - 392.7 m			
Sampling interval vertical depth (metres)		257.7 m - 268.3 m				326.1 m - 335.2 m				356.0 m - 366.6 m			
Estimated concentration range (calculated)		minimum	maximum	minimum	maximum	minimum	maximum	minimum	maximum	mininum	maximum	minimum	maximum
Average Field measured parameters													
Fluorescein	ppb	41.77		83.54		93.00		66.21		81.90		100.05	
Total dissolved solids	mg/L	-	-	4543		-	-	7275		-	-	3765	
pH	S.U.	-	-	6.36		-	-	7.50		-	-	8.35	
Conductivity	uS/cm	4610		9083		6650		14555		4450		7500	
Estimated Water Quality													
Conventional parameters													
Total dissolved solids	mg/L	3198	4042	4681	5171	3581	3966	7970	9945	3483	3918	<4980	<5100
pH	S.U.	7.41	7.27	6.50	6.57	7.87	7.82	6.88	6.91	7.96	7.91	7.31	7.41
Conductivity	uS/cm	4797	6042	8041	8496	5366	5938	13084	15511	5220	5866	<7350	<7530
Reported Hardness	mg $CaCO_3$/L	2397	3030	2883	3127	2627	2910	4169	5582	1680	1891	<2600	<2740
Alkalinity	mg $CaCO_3$/L	40	51	30	31	18	20	9	11	52	58	51	52
Bicarbonate (HCO3)	mg $CaCO_3$/L	40	51	31	32	18	20	11	12	52	58	60	61
Major ions													
Calcium (Ca)	mg/L	960	1213	1071	1164	1032	1143	1563	2125	671	756	<1040	<1090
Magnesium (Mg)	mg/L	22	27	51	51	12	14	62	66	1	1	1	1
Potassium (K)	mg/L	8	10	<20	<20	38	42	67	67	16	18	<38	<40
Sodium (Na)	mg/L	232	293	287	293	267	296	341	365	306	344	285	313
Bromide (Br)	mg/L	25	32	34	37	32	35	51	77	22	25	<32.5	<32.7
Chloride (Cl)	mg/L	2089	2641	2453	2697	2582	2860	3818	5722	1714	1929	<2700	<2700
Fluoride (F)	mg/L	0.21	0.27	<1.0	<1.0	0.5	0.5	<1.0	<1.0	1.1	1.2	<1.0	<1.0
Sulphate (SO4)	mg SO_4/L	-	-	<15	<15	-	-	<15	<15	-	-	<15	<15
Nutrients													
Ammonia N (NH3+NH4)	mg N/L	-	-	<0.437	<0.443	-	-	0.180	0.181	-	-	0.169	0.173
Nitrates (NO3)	mg N/L	0.063	0.079	<0.25	<0.25	0.06	0.06	<0.25	<0.25	0.016	0.018	<0.25	<0.25
Nitrites (NO2)	mg N/L	0.010	0.013	<0.050	<0.050	0.011	0.012	<0.050	<0.050	0.038	0.043	<0.050	<0.050
Total Phosphorous (P)	mg P/L	0.021	0.026	<0.0043	<0.0043	0.011	0.012	0.01	0.01	0.049	0.055	0.01	0.01

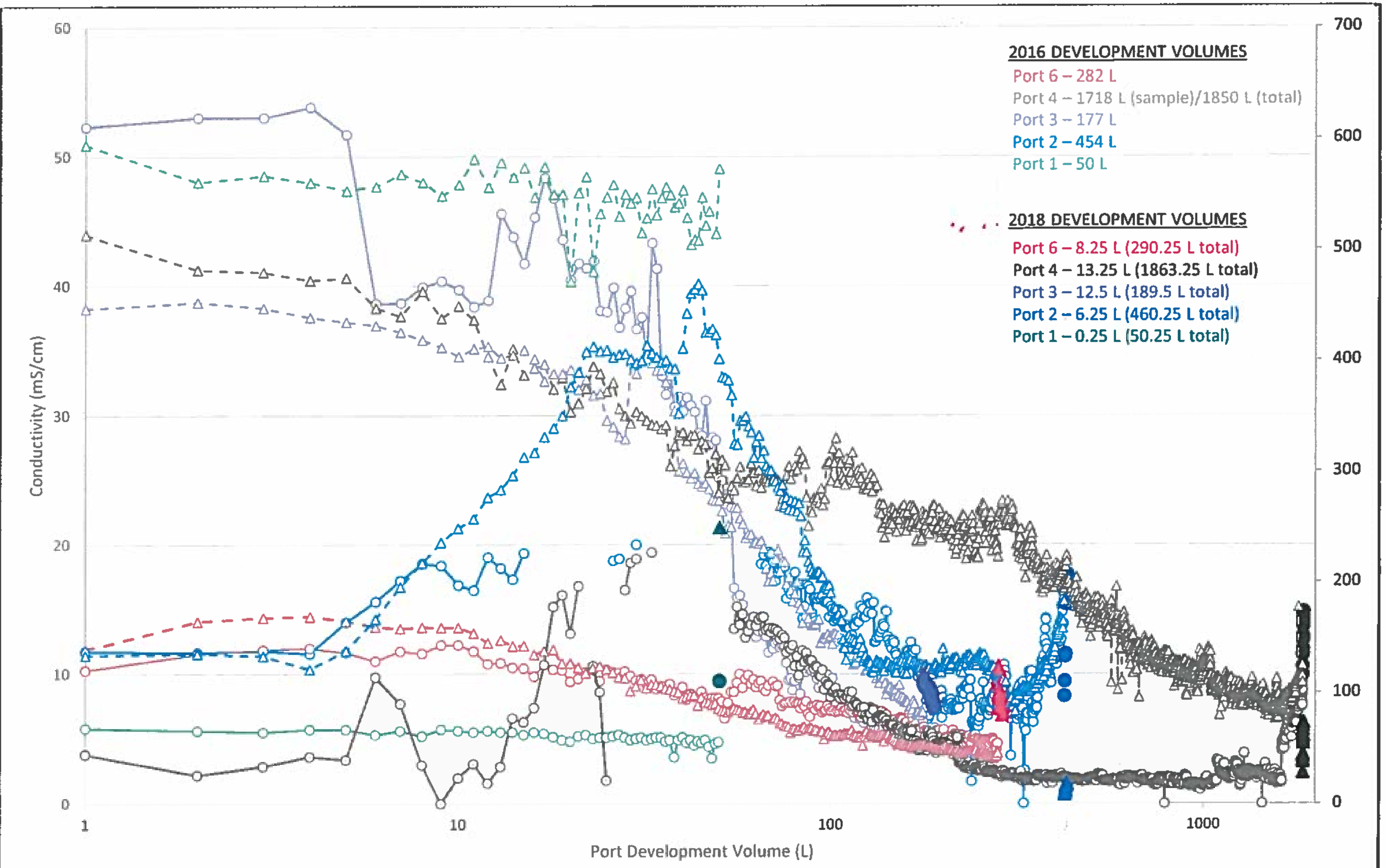
Table 5
Rock Formation Groundwater Quality Corrected to Remove Residual Drilling Water
Whale Tail Lake Talik
Whale Tail Project, Nunavut

Sample		Port 6				Port 4				Port 3			
Date		2-Aug-2016		13-Nov-2018		20-Jul-2016		11-Nov-2018		14-Sep-2016		12-Nov-2018	
Drilling Fluid Proportion		0.04	0.24	0.16		0.09	0.18	0.13		0.08	0.18	0.20	
Formation Water Proportion		0.96	0.76	0.84		0.91	0.82	0.87		0.92	0.82	0.80	
Sampling interval depth (metres along borehole)		274.0 m - 287.4 m				349.3 m - 359.1 m				381.3 m - 392.7 m			
Sampling interval vertical depth (metres)		257.7 m - 268.3 m				326.1 m - 335.2 m				356.0 m - 366.6 m			
Estimated concentration range (calculated)		minimum	maximum	minimum	maximum	minimum	maximum	minimum	maximum	mininum	maximum	minimum	maximum
Dissolved Metals													
Aluminium (Al)	mg/L	<0.006	<0.006	<0.0050	<0.0050	-	-	0.000	0.008	-	-	<0.0115	<0.0126
Antimony (Sb)	mg/L	0.0002	0.0003	0.001	0.001	0.003	0.004	0.001	0.002	0.0026	0.0029	0.001	0.001
Silver (Ag)	mg/L	<0.0001	<0.0001	<0.00010	<0.00010	<0.0001	<0.0001	<0.00010	<0.00010	<0.0001	<0.0001	<0.00010	<0.00010
Arsenic (As)	mg/L	0.0050	0.0063	<0.0021	<0.0024	0.0031	0.0035	<0.0020	<0.0020	<0.0005	<0.0005	<0.0034	<0.0034
Barium (Ba)	mg/L	0.528	0.667	0.947	0.976	0.134	0.148	0.533	0.561	0.057	0.065	0.098	0.104
Berillium (Be)	mg/L	<0.0005	<0.0005	<0.00050	<0.00050	<0.0005	<0.0005	<0.00050	<0.00050	<0.0005	<0.0005	<0.00050	<0.00050
Bismuth (Bi)	mg/L	<0.0005	<0.0005	<0.00050	<0.00050	<0.0005	<0.0005	<0.00050	<0.00050	<0.0005	<0.0005	<0.00050	<0.00050
Boron (B)	mg/L	0.30	0.38	0.24	0.28	0.58	0.64	0.82	1.05	0.53	0.60	0.28	0.33
Cadmium (Cd)	mg/L	-	0.000033	<0.000050	<0.000050	<0.00002	<0.00002	<0.000050	<0.000050	<0.00002	<0.00002	<0.000050	<0.000050
Chromium (Cr)	mg/L	0.0070	0.0089	<0.00050	<0.00050	0.0054	0.0060	<0.00050	<0.00050	0.0048	0.0055	<0.00050	<0.00050
Cobalt (Co)	mg/L	0.0015	0.0019	<0.000050	<0.000050	0.0017	0.0018	<0.000050	<0.000050	0.0011	0.0012	<0.000050	<0.000050
Copper (Cu)	mg/L	0.0055	0.0069	<0.00050	<0.00050	0.0020	0.0023	<0.00050	<0.00050	0.0046	0.0052	<0.00050	<0.00050
Tin (Sn)	mg/L	0.0010	<0.001	<0.0010	<0.0010	0.0011	0.0012	<0.0010	<0.0010	<0.001	<0.001	<0.0010	<0.0010
Iron (Fe)	mg/L	0.17	0.21	0.264	0.276	0.15	0.16	0.078	0.120	0.08	0.09	<0.018	<0.019
Lithium (Li)	mg/L	0.33	0.41	0.15	0.24	0.64	0.71	1.06	1.63	0.31	0.34	<0.749	<0.779
Manganese (Mn)	mg/L	0.04	0.05	0.115	0.116	0.022	0.024	0.093	0.096	0.008	0.009	0.022	0.023
Mercury (Hg)	mg/L	0.0008	0.0010	<0.000010	<0.000010	0.0028	0.0031	<0.000010	<0.000010	0.00215	0.00242	<0.000010	<0.000010
Dissolved Mercury (Hg)	mg/L	0.0005	0.0006	<0.000010	<0.000010	0.0031	0.0034	<0.000010	<0.000010	0.00217	0.00244	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.02	0.02	0.029	0.031	0.0062	0.0068	0.013	0.013	0.019	0.021	0.018	0.019
Nickel (Ni)	mg/L	0.05	0.06	<0.00050	<0.00050	0.05	0.05	<0.00050	<0.00050	0.04	0.05	<0.00050	<0.00050
Lead (Pb)	mg/L	<0.0003	<0.0003	<0.00030	<0.00030	0.0027	0.0030	<0.00030	<0.00030	<0.0003	<0.0003	<0.00030	<0.00030
Selenium (Se)	mg/L	0.11	0.14	<0.0020	<0.0020	0.12	0.13	<0.0020	<0.0020	0.08	0.09	<0.0020	<0.0020
Silica (Si)	mg/L	4.00	5.06	3.19	3.31	4.18	4.63	2.48	2.63	4.29	4.82	3.51	3.51
Strontium (Sr)	mg/L	13.2	16.7	14.3	16.0	18.9	20.9	27.7	36.5	12.7	14.2	<16.9	<17.2
Telluride (Te)	mg/L	<0.0005	<0.0005	<0.00050	<0.00050	<0.0005	<0.0005	<0.00050	<0.00050	<0.0005	<0.0005	<0.00050	<0.00050
Thallium (Tl)	mg/L	<0.0008	<0.0008	<0.000050	<0.000050	<0.0008	<0.0008	<0.000050	<0.000050	<0.0008	<0.0008	<0.000050	<0.000050
Titanium (Ti)	mg/L	0.350	0.442	<0.0050	<0.0050	0.336	0.373	<0.0050	<0.0050	0.229	0.257	<0.0050	<0.0050
Uranium (U)	mg/L	<0.001	<0.001	0.025	0.026	<0.001	<0.001	0.051	0.052	0.064	0.072	0.085	0.090
Vanadium (V)	mg/L	0.002	0.002	<0.000050	<0.000050	<0.0005	<0.0005	<0.000050	<0.000050	<0.001	<0.001	0.00020	0.00020
Zinc (Zn)	mg/L	1.3	1.7	<0.00050	<0.00050	0.63	0.70	<0.00050	<0.00050	<0.0005	<0.0005	<0.00050	<0.00050

Table 6
QA/QC of Rock Formation Groundwater Quality
Whale Tail Lake Talik
Whale Tail Project, Nunavut

Sample			Port 6					Port 4			Port 3		
Date			13-Nov-2018		RPD			11-Nov-2018		RPD	12-Nov-2018		RPD
Certificate No			L2198327-1	L2198327-2				L2197641-3	L2197641-4		L2197641-5	L2197641-6	
Sample ID	Method		Zone 6	Zone 66		Method		Zone 4	Zone 44		Zone 3	Zone 33	
Parameters	Detection Limit	Units				Detection Limit	Units						
Physical Tests (Water)													
Conductivity	2	uS/cm	8720	8780	1%	2	uS/cm	13900	14000	1%	7530	7350	2%
pH	0.1	pH	6.58	6.65	1%	0.1	pH	6.97	6.94	0%	7.40	7.50	1%
Total Suspended Solids	3	mg/L	8	10	13%	3	mg/L	24	20	18%	8	8	5%
Total Dissolved Solids	30	mg/L	5580	5410	3%	3	mg/L	9030	8820	2%	5100	4980	2%
Anions and Nutrients													
Alkalinity, Bicarbonate (as CaCO3)	1	mg/L	27	26	3%	1	mg/L	10	10	2%	51	50	1%
Alkalinity, Carbonate (as CaCO3)	1	mg/L	<1.0	<1.0	–	1	mg/L	<1.0	<1.0	–	<1.0	<1.0	–
Alkalinity, Hydroxide (as CaCO3)	1	mg/L	<1.0	<1.0	–	1	mg/L	<1.0	<1.0	–	<1.0	<1.0	–
Alkalinity, Total (as CaCO3)	1	mg/L	27	26	3%	1	mg/L	10	10	2%	51	50	1%
Ammonia, Total (as N)	0.005	mg/L	0.443	0.437	1%	0.005	mg/L	0.157	0.158	1%	0.139	0.136	2%
Bromide (Br)	2.5	mg/L	41	41	1%	0.05	mg/L	70	60	15%	33	33	1%
Chloride (Cl)	5	mg/L	3010	3060	2%	0.5	mg/L	5220	4530	14%	2700	2700	0%
Fluoride (F)	1	mg/L	<1.0	<1.0	–	0.02	mg/L	<1.0	<1.0	–	<1.0	<1.0	–
Nitrate (as N)	0.25	mg/L	<0.25	<0.25	–	0.005	mg/L	<0.25	<0.25	–	<0.25	<0.25	–
Nitrite (as N)	0.05	mg/L	<0.050	<0.050	–	0.001	mg/L	<0.050	<0.050	–	<0.050	<0.050	–
Phosphorus (P)-Total	0.002	mg/L	0.004	0.005	19%	0.002	mg/L	0.01	0.01	13%	0.006	0.008	+/- MDL
Sulfate (SO4)	15	mg/L	<15	<15	–	0.3	mg/L	<15	<15	–	<15	<15	–
Physical Tests													
Hardness (as CaCO3)	4.8	mg/L	3630	3620	0.3%	4.8	mg/L	5160	5150	0%	2600	2740	5%
Dissolved Metals													
Aluminum (Al)-Dissolved	0.005	mg/L	<0.0050	<0.0050	1%	0.005	mg/L	0.0085	0.0076	11%	0.0126	0.0115	9%
Antimony (Sb)-Dissolved	0.0005	mg/L	<0.00050	0.0005	+/- MDL	0.0005	mg/L	0.00163	0.00172	5%	0.00308	0.003	3%
Arsenic (As)-Dissolved	0.002	mg/L	0.0021	0.0024	13%	0.002	mg/L	<0.0020	<0.0020	–	0.0034	0.0034	0%
Barium (Ba)-Dissolved	0.001	mg/L	0.818	0.794	3%	0.001	mg/L	0.466	0.489	5%	0.0902	0.0854	5%
Beryllium (Be)-Dissolved	0.0005	mg/L	<0.00050	<0.00050	–	0.0005	mg/L	<0.00050	<0.00050	–	<0.00050	<0.00050	–
Bismuth (Bi)-Dissolved	0.0005	mg/L	<0.00050	<0.00050	–	0.0005	mg/L	<0.00050	<0.00050	–	<0.00050	<0.00050	–
Boron (B)-Dissolved	0.1	mg/L	0.36	0.35	3%	0.1	mg/L	0.9	0.95	5%	1.04	1.02	2%
Cadmium (Cd)-Dissolved	0.00005	mg/L	<0.000050	<0.000050	–	0.00005	mg/L	<0.000050	<0.000050	–	<0.000050	<0.000050	–
Calcium (Ca)-Dissolved	1	mg/L	1380	1380	0%	1	mg/L	1970	1970	0%	1040	1090	5%
Cesium (Cs)-Dissolved	0.0005	mg/L	<0.00050	<0.00050	–	0.0005	mg/L	0.00075	0.00074	1%	<0.00050	<0.00050	–
Chromium (Cr)-Dissolved	0.0005	mg/L	<0.00050	<0.00050	–	0.0005	mg/L	<0.00050	<0.00050	–	<0.00050	<0.00050	–
Cobalt (Co)-Dissolved	0.00005	mg/L	<0.000050	<0.000050	–	0.00005	mg/L	<0.000050	<0.000050	–	<0.000050	<0.000050	–
Copper (Cu)-Dissolved	0.0005	mg/L	<0.00050	<0.00050	–	0.0005	mg/L	<0.00050	<0.00050	–	<0.00050	<0.00050	–
Gallium (Ga)-Dissolved	0.0005	mg/L	<0.00050	<0.00050	–	0.0005	mg/L	<0.00050	<0.00050	–	<0.00050	<0.00050	–
Iron (Fe)-Dissolved	0.01	mg/L	0.251	0.256	2%	0.01	mg/L	0.112	0.105	6%	0.018	0.019	5%
Lead (Pb)-Dissolved	0.0003	mg/L	<0.00030	<0.00030	–	0.0003	mg/L	<0.00030	<0.00030	–	<0.00030	<0.00030	–
Lithium (Li)-Dissolved	0.02	mg/L	0.533	0.52	2%	0.02	mg/L	1.42	1.52	7%	0.779	0.749	4%
Magnesium (Mg)-Dissolved	1	mg/L	42.8	42.8	0%	1	mg/L	57.8	53.9	7%	1.2	1.2	0%
Manganese (Mn)-Dissolved	0.0002	mg/L	0.0961	0.097	1%	0.0002	mg/L	0.0836	0.0812	3%	0.0184	0.0181	2%
Mercury (Hg)-Dissolved	0.00001	mg/L	<0.000010	<0.000010	–	0.00001	mg/L	<0.000010	<0.000010	–	<0.000010	<0.000010	–
Molybdenum (Mo)-Dissolved	0.002	mg/L	0.0257	0.0245	5%	0.002	mg/L	0.0112	0.0116	4%	0.0154	0.0144	7%
Nickel (Ni)-Dissolved	0.0005	mg/L	<0.00050	<0.00050	–	0.0005	mg/L	<0.00050	<0.00050	–	<0.00050	<0.00050	–
Phosphorus (P)-Dissolved	0.05	mg/L	<0.050	<0.050	–	0.05	mg/L	<0.050	<0.050	–	<0.050	<0.050	–
Potassium (K)-Dissolved	20	mg/L	<20	<20	–	20	mg/L	67	66	2%	38	40	5%
Rhenium (Re)-Dissolved	0.0005	mg/L	<0.00050	<0.00050	–	0.0005	mg/L	<0.00050	<0.00050	–	<0.00050	<0.00050	–
Rubidium (Rb)-Dissolved	0.005	mg/L	0.0151	0.0146	3%	0.005	mg/L	0.0891	0.0914	3%	0.0549	0.0528	4%
Selenium (Se)-Dissolved	0.002	mg/L	<0.0020	<0.0020	–	0.002	mg/L	<0.0020	<0.0020	–	<0.0020	<0.0020	–
Silicon (Si)-Dissolved	1	mg/L	2.8	2.7	4%	1	mg/L	2.3	2.2	4%	3	3	0%
Silver (Ag)-Dissolved	0.0001	mg/L	<0.00010	<0.00010	–	0.0001	mg/L	<0.00010	<0.00010	–	<0.00010	<0.00010	–
Sodium (Na)-Dissolved	20	mg/L	253	250	1%	20	mg/L	309	320	3%	280	301	7%
Strontium (Sr)-Dissolved	0.05	mg/L	19.5	19.7	1%	0.05	mg/L	33.6	33.6	0%	16.9	17.2	2%
Sulfur (S)-Dissolved	5	mg/L	<5.0	<5.0	–	5	mg/L	<5.0	<5.0	–	<5.0	<5.0	–
Tellurium (Te)-Dissolved	0.0005	mg/L	<0.00050	<0.00050	–	0.0005	mg/L	<0.00050	<0.00050	–	<0.00050	<0.00050	–
Thallium (Tl)-Dissolved	0.00005	mg/L	<0.000050	<0.000050	–	0.00005	mg/L	<0.000050	<0.000050	–	<0.000050	<0.000050	–
Thorium (Th)-Dissolved	0.0005	mg/L	<0.00050	<0.00050	–	0.0005	mg/L	<0.00050	<0.00050	–	<0.00050	<0.00050	–
Tin (Sn)-Dissolved	0.001	mg/L	<0.0010	<0.0010	–	0.001	mg/L	<0.0010	<0.0010	–	<0.0010	<0.0010	–
Titanium (Ti)-Dissolved	0.005	mg/L	<0.0050	<0.0050	–	0.005	mg/L	<0.0050	<0.0050	–	<0.0050	<0.0050	–
Tungsten (W)-Dissolved	0.001	mg/L	0.0214	0.0208	3%	0.001	mg/L	0.0455	0.0441	3%	0.0722	0.0687	5%
Uranium (U)-Dissolved	0.00005	mg/L	<0.000050	<0.000050	–	0.00005	mg/L	<0.000050	<0.000050	–	0.00016	0.000144	11%
Vanadium (V)-Dissolved	0.0005	mg/L	<0.00050	<0.00050	–	0.0005	mg/L	<0.00050	<0.00050	–	<0.00050	<0.00050	–
Yttrium (Y)-Dissolved	0.0005	mg/L	<0.00050	<0.00050	–	0.0005	mg/L	<0.00050	<0.00050	–	<0.00050	<0.00050	–
Zinc (Zn)-Dissolved	0.003	mg/L	0.0244	0.021	6%	0.001	mg/L	0.0096	0.01	4%	<0.0030	<0.0030	–
Zirconium (Zr)-Dissolved	0.0005	mg/L	<0.00050	<0.00050	–	0.0005	mg/L	<0.00050	<0.00050	–	<0.00050	<0.00050	–
QA/QC													
Calculated TDS (lab)	-	mg/L	4779	4826	-	-	-	5749	7050	-	4165	4237	-
Lab measured vs Calculated TDS	-	-	156%	162%	-	-	-	154%	159%	-	148%	148%	-
Lab measured TDS vs conductivity	-	uS/cm	0.6	0.6	-	-	-	0.6	0.6	-	0.7	0.7	-

Notes
Concentrations are mg/L, unless otherwise noted.
[1] Part F item 2 of Meadowbank Water License. All regulated parameters for total concentration
RPD value exceeds 20%
FD = Field duplicate
RPD = relative percent difference
– not calculated (one or both result below MDL)



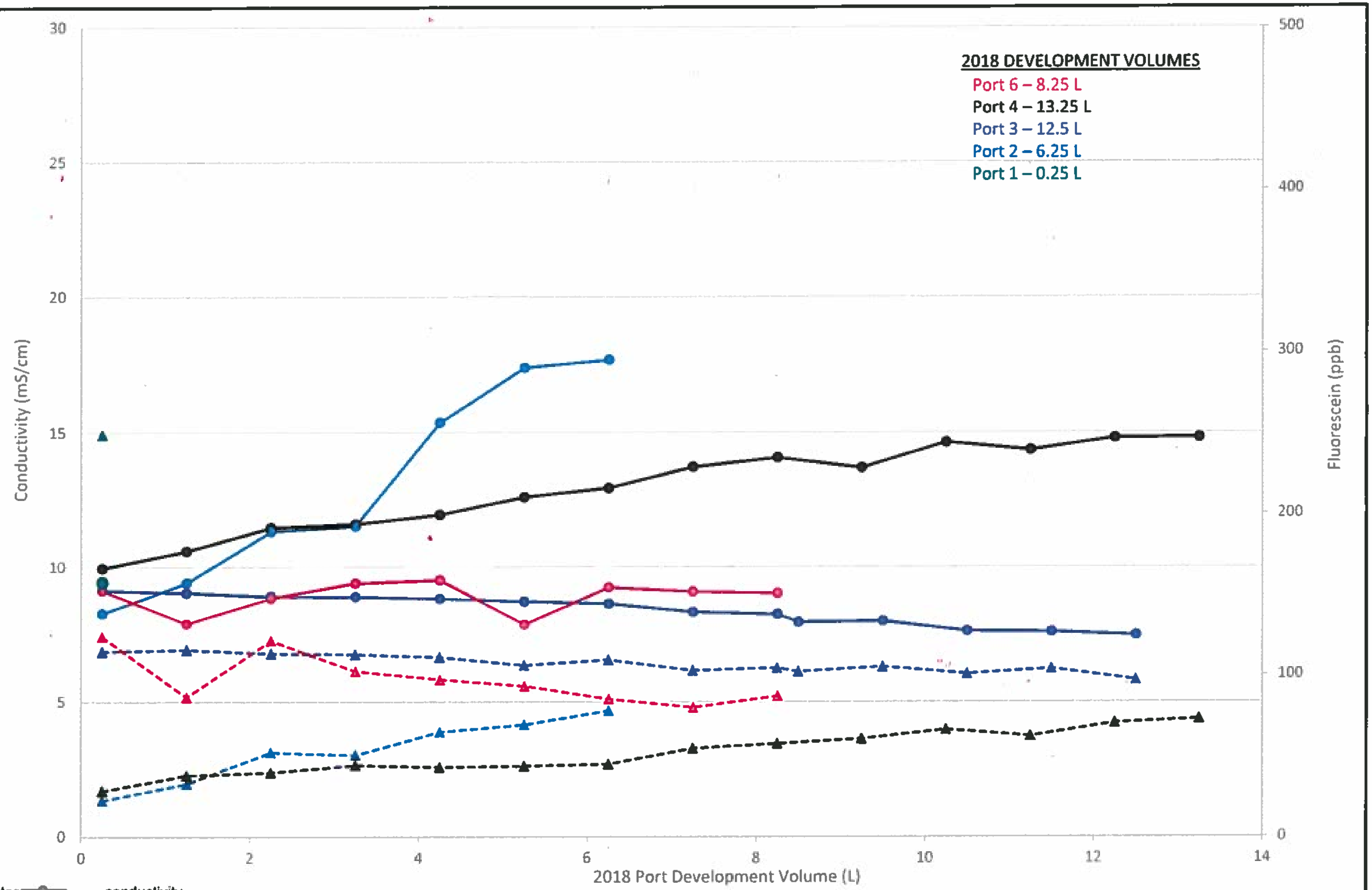
Notes: 2016 conductivity; 2016 fluorescein; 2018 conductivity; 2018 fluorescein

Volumes reported at time of sample collection and/or end of development (Port 1, Port 4 - 1855 L only)

2016 Data: Port 6, Port 4, Port 3, Port 2 and Port 1
2018 Data: Port 6, Port 4, Port 3, Port 2 and Port 1

CLIENT AGNICO EAGLE MINES LIMITED		PROJECT 2018 WESTBAY SYSTEM GROUNDWATER MONITORING INVESTIGATION	
CONSULTANT GOLDER	YYYY-MM-DD: 2019-02-08 PREPARED: DH DESIGN: – REVIEW: VJB APPROVED: VJB	TITLE 2016 AND 2018 DEVELOPMENT RECORD	
		PROJECT No. 1789310-244	Rev

FIGURE 1



Notes: conductivity
fluorescein
Volumes reported at time of sample collection and/or end of development (for Port 1)

Colours Port 6, Port 4, Port 3, Port 2 and Port 1

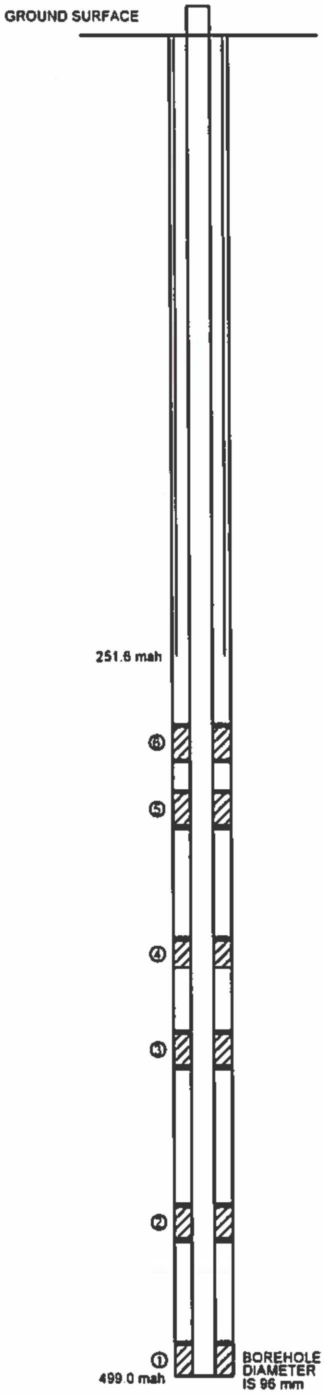
CLIENT AGNICO EAGLE MINES LIMITED		PROJECT 2018 WESTBAY SYSTEM GROUNDWATER MONITORING INVESTIGATION	
CONSULTANT GOLDER	YYYY-MM-DD 2019-02-08 PREPARED DH DESIGN – REVIEW VJB APPROVED VJB	TITLE 2018 DEVELOPMENT RECORD	
		PROJECT No. 1789310-244	Rev.

FIGURE 2

APPENDIX A

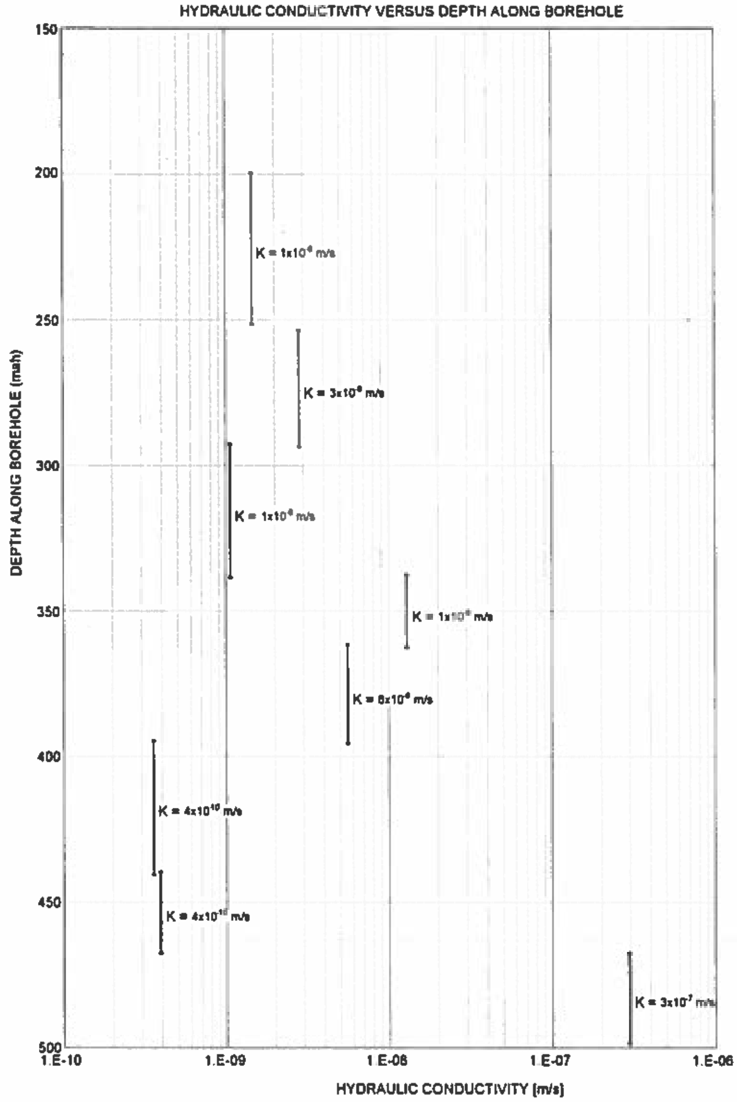
AMQ160626 Westbay System Installation Details

BOREHOLE AMQ16-626



WESTBAY SYSTEM ZONE DEPTH SUMMARY						
	DEPTH ALONG HOLE			VERTICAL DEPTH		
ZONE	FROM	TO	LENGTH	FROM	TO	THICKNESS
	(mah)	(mah)	(m)	(mbgs)	(mbgs)	(m)
6	276.0	287.4	11.4	257.7	268.3	10.6
5	298.9	310.3	11.4	279	289.7	10.6
4	349.3	359.1	9.8	326.1	335.2	9.1
3	381.3	392.7	11.4	356.0	366.6	10.6
2	440.8	452.2	11.4	411.5	422.2	10.6
1	488.1	499.0	10.9	455.7	465.9	10.2

HYDRAULIC CONDUCTIVITY VERSUS DEPTH ALONG BOREHOLE



LEGEND

▬	PACKER	K	HYDRAULIC CONDUCTIVITY
① ▨	WESTBAY MONITORING ZONE	mah	METRES ALONG BOREHOLE, RELATIVE TO GROUND SURFACE
——	STEEL CASING	mbgs	METRES BELOW GROUND SURFACE
		m/s	METRES PER SECOND

NOTES

1. ALL UNITS ARE IN METERS UNLESS OTHERWISE NOTED
2. PERMAFROST ASSUMED 200 m ALONG HOLE ALIGNMENT.
3. DRILL RODS TO 251.6 m ALONG HOLE.
4. BOREHOLE LOCATED IN UTM NAD 83 ZONE 14, N =7255363.5 E = 607181.68 ELEVATION = 154.46 m.
5. AVERAGE BOREHOLE INCLINATION IS 69°.

NOT TO SCALE
SCHEMATIC ONLY

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
D	2016-07-08	ISSUED FOR FINAL	JJ	PP	DV	DC
A	2016-05-27	ISSUED FOR REVIEW	JJ	PP		

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED
WHALE TAIL PIT PROJECT
NUNAVUT, CANADA

TITLE

AMQ16-626 WESTBAY SYSTEM INSTALLATION DETAILS

Golder Associates

PROJECT No.	1649355.4000.3000		FILE No.	1649355-4000-3000-03
DESIGN	JJ	2016-07-08	SCALE	NOT TO SCALE
CADD	PP	2016-07-08	FIGURE	3
CHECK	DV	2016-07-08		
REVIEW	DC	2016-07-08		

APPENDIX B

Westbay Instruments Mosdax Sampler Calibration Reports

MOSDAX Calibration Report 1: EMS - 1764 Module 323

Full Scale: 2000 (psia) — File: E:\DATA\CAL\0-2018\2000\26JAN2-1\01764

Pressure Reference: Paroscientific Model 42K-101 S/N 59937 — Range: 2K PSI

Date of last reference to traceable standard: Oct 5 2017

EMS - 1764 Jan 26 17:09:52 2018
Range 1 Temp 3.1° C

Ref Pres (psia)	Error (psia)	(% FS)
14.817	0.208	0.010
193.345	-0.073	-0.004
393.618	-0.272	-0.014
589.887	-0.183	-0.009
787.108	-0.110	-0.006
992.089	-0.024	-0.001
1191.192	0.036	0.002
1390.713	0.133	0.007
1589.940	0.097	0.005
1781.966	0.014	0.001
1987.965	-0.329	-0.016
1817.144	-0.012	-0.001
1618.742	0.102	0.005
1413.125	0.180	0.009
1213.194	0.108	0.005
1009.488	0.089	0.004
807.541	-0.027	-0.001
606.650	-0.114	-0.006
406.828	-0.184	-0.009
205.695	-0.015	-0.001
14.824	0.214	0.011

EMS - 1764 Jan 26 07:09:09 2018
Range 2 Temp 10.1° C

Ref Pres (psia)	Error (psia)	(% FS)
14.763	0.210	0.011
193.566	-0.123	-0.006
392.913	-0.184	-0.009
591.481	-0.211	-0.011
790.656	-0.114	-0.006
990.073	0.058	0.003
1184.170	0.092	0.005
1382.638	0.117	0.006
1583.021	0.197	0.010
1783.679	0.027	0.001
1991.373	-0.178	-0.009
1816.737	0.061	0.003
1611.101	0.226	0.011
1410.177	0.278	0.014
1209.052	0.204	0.010
1008.134	0.118	0.006
809.316	-0.034	-0.002
608.601	-0.077	-0.004
406.467	-0.147	-0.007
205.759	-0.012	-0.001
14.783	0.231	0.012

EMS - 1764 Jan 26 02:21:39 2018
Range 3 Temp 19.9° C

Ref Pres (psia)	Error (psia)	(% FS)
14.745	0.228	0.011
193.251	-0.079	-0.004
392.313	-0.228	-0.011
591.070	-0.177	-0.009
790.016	-0.162	-0.008
988.877	-0.001	0.000
1189.677	-0.007	0.000
1383.376	0.058	0.003
1582.918	0.132	0.007
1783.642	-0.023	-0.001
1990.362	-0.278	-0.014
1807.379	-0.041	-0.002
1611.387	0.144	0.007
1410.184	0.103	0.005
1209.054	0.151	0.008
1007.771	0.068	0.003
807.386	-0.029	-0.001
608.200	-0.110	-0.005
407.925	-0.205	-0.010
206.304	-0.075	-0.004
14.730	0.212	0.011

EMS - 1764 Jan 25 20:49:38 2018
Range 4 Temp 29.9° C

Ref Pres (psia)	Error (psia)	(% FS)
14.664	0.129	0.006
193.289	-0.074	-0.004
392.551	-0.259	-0.013
590.683	-0.199	-0.010
790.879	-0.111	-0.006
989.404	-0.070	-0.003
1188.900	-0.088	-0.004
1383.144	0.006	0.000
1582.510	-0.017	-0.001
1783.117	-0.170	-0.008
1990.420	-0.360	-0.018
1817.923	-0.145	-0.007
1612.561	0.046	0.002
1409.796	0.050	0.003
1208.930	0.011	0.001
1007.679	0.001	0.000
807.799	-0.074	-0.004
607.517	-0.125	-0.006
406.301	-0.139	-0.007
205.701	-0.048	-0.002
14.686	0.149	0.007

EMS - 1764 Jan 25 15:45:50 2018
Range 5 Temp 39.9° C

Ref Pres (psia)	Error (psia)	(% FS)
14.630	0.147	0.007
193.274	-0.098	-0.005
393.384	-0.239	-0.012
590.646	-0.204	-0.010
792.587	-0.140	-0.007
989.121	-0.059	-0.003
1188.417	-0.084	-0.004
1390.226	0.040	0.002
1582.457	0.023	0.001
1783.077	-0.054	-0.003
1990.337	-0.125	-0.006
1809.812	-0.012	-0.001
1612.027	0.084	0.004
1410.656	0.064	0.003
1207.895	0.018	0.001
1007.484	0.004	0.000
807.295	-0.056	-0.003
608.401	-0.142	-0.007
406.285	-0.237	-0.012
205.685	-0.138	-0.007
14.645	0.098	0.005

Issued by

Westbay Instruments

MOSDAX Calibration Report 2: EMS - 1764 Module 323

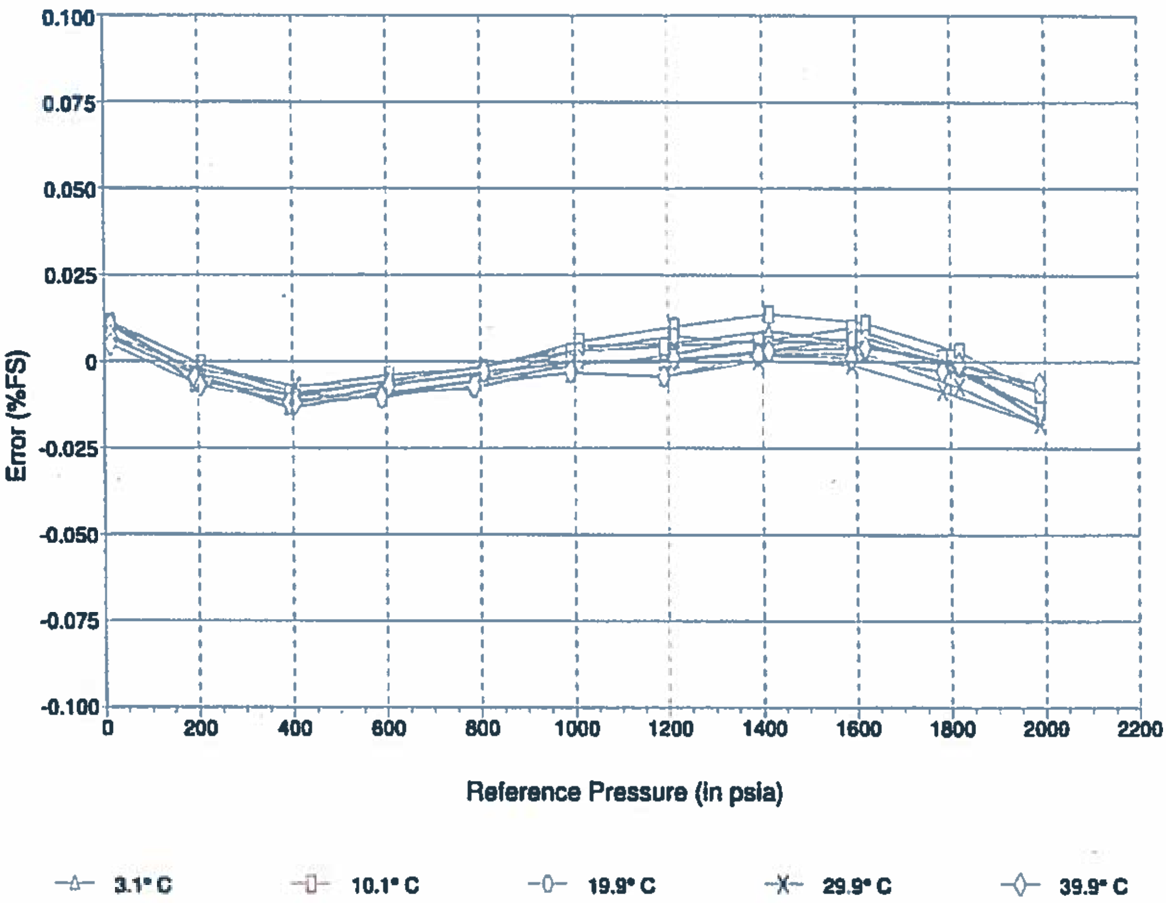
Full Scale: 2000 (psia) File: E:\DATA\CAL\0-2018\2000\26JAN2-1\01764

Pressure Reference: Paroscientific Model 42K-101 S/N 59937 Range: 2K PSI

Date of last reference to traceable standard: Oct 5 2017

Plot of Error vs. Reference Pressure

EMS - 1764 Module 323



Comments

Issued by

As Received MOSDAX Cal. Report 2: EMS - 1764 Module 323

Full Scale: 2000 (psia)

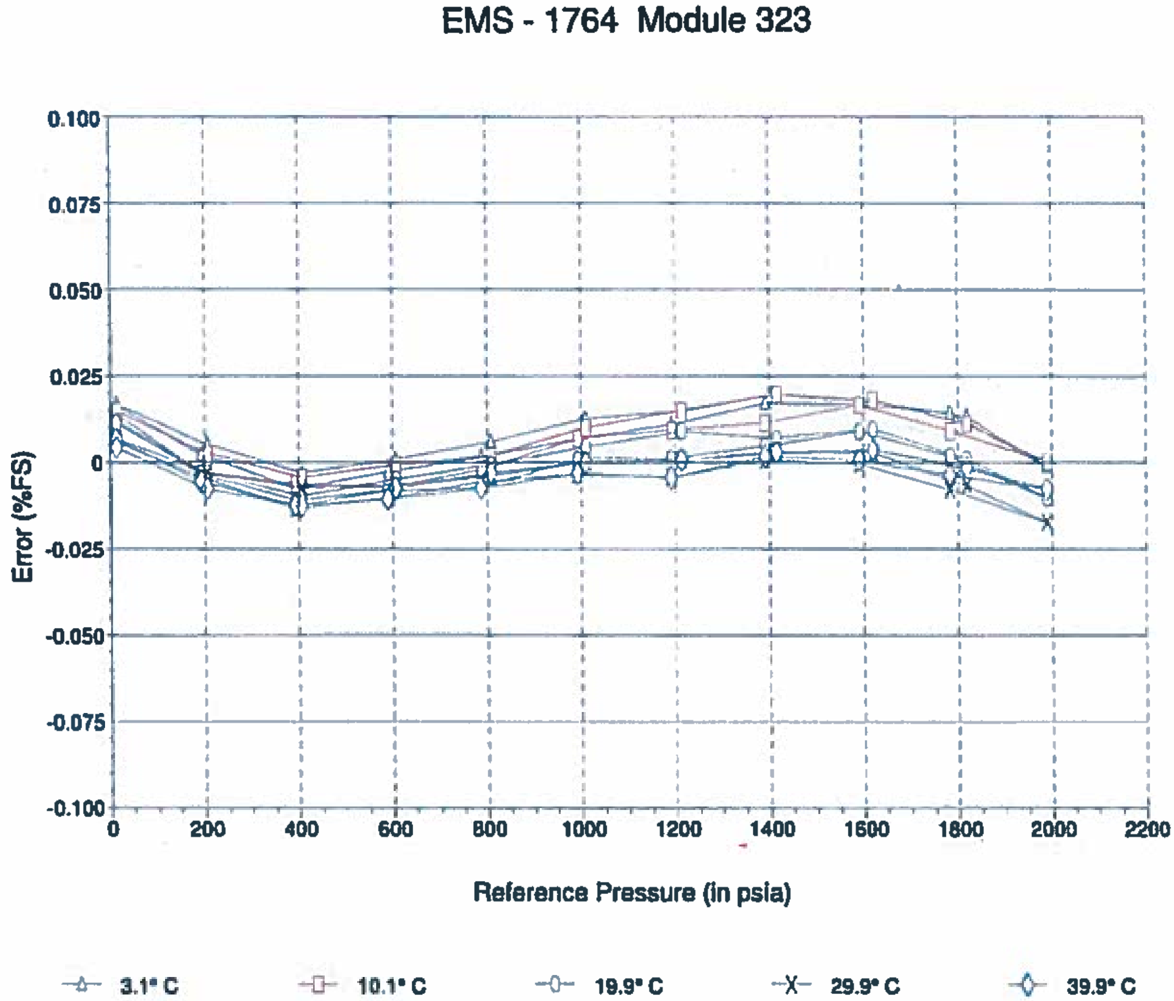
File: E:\DATA\CAL\0-2018\2000\26JAN2-1\01764

Pressure Reference: Paroscientific Model 42K-101 S/N 59937

Range: 2K PSI

Date of last reference to traceable standard: Oct 5 2017

Plot of Error vs. Reference Pressure



Comments

Issued by

As Received MOSDAX Cal. Report 1: EMS - 1764 Module 323

Full Scale: 2000 (psia)

File: E:\DATA\CAL\0-2018\2000\25JAN2-1\01764

Pressure Reference: Paroscientific Model 42K-101 S/N 59937

Range: 2K PSI

Date of last reference to traceable standard: Oct 5 2017

EMS - 1764 Jan 26 17:09:52 2018
Range 1 Temp 3.1° C

Ref Pres (psia)	Error (psia)	(% FS)
14.817	0.330	0.016
193.345	0.046	0.002
393.618	-0.152	-0.008
589.887	-0.055	-0.003
787.108	0.031	0.002
992.089	0.136	0.007
1191.192	0.219	0.011
1390.713	0.343	0.017
1589.940	0.337	0.017
1781.966	0.285	0.014
1987.965	-0.022	-0.001
1817.144	0.265	0.013
1618.742	0.348	0.017
1413.125	0.394	0.020
1213.194	0.296	0.015
1009.488	0.252	0.013
807.541	0.117	0.006
606.650	0.016	0.001
406.828	-0.062	-0.003
205.695	0.104	0.005
14.824	0.336	0.017

EMS - 1764 Jan 26 07:09:09 2018
Range 2 Temp 10.1° C

Ref Pres (psia)	Error (psia)	(% FS)
14.763	0.276	0.014
193.566	-0.061	-0.003
392.913	-0.123	-0.006
591.481	-0.147	-0.007
790.656	-0.043	-0.002
990.073	0.140	0.007
1184.170	0.188	0.009
1382.638	0.231	0.012
1583.021	0.331	0.017
1783.679	0.185	0.009
1991.373	0.007	0.000
1816.737	0.223	0.011
1611.101	0.363	0.018
1410.177	0.394	0.020
1209.052	0.302	0.015
1008.134	0.201	0.010
809.316	0.037	0.002
608.601	-0.013	-0.001
406.467	-0.087	-0.004
205.759	0.050	0.002
14.783	0.297	0.015

EMS - 1764 Jan 26 02:21:39 2018
Range 3 Temp 19.9° C

Ref Pres (psia)	Error (psia)	(% FS)
14.745	0.240	0.012
193.251	-0.068	-0.003
392.313	-0.217	-0.011
591.070	-0.165	-0.008
790.016	-0.146	-0.007
988.877	0.020	0.001
1189.677	0.022	0.001
1383.376	0.095	0.005
1582.918	0.179	0.009
1783.642	0.037	0.002
1990.362	-0.203	-0.010
1807.379	0.021	0.001
1611.387	0.194	0.010
1410.184	0.141	0.007
1209.054	0.180	0.009
1007.771	0.089	0.004
807.386	-0.013	-0.001
608.200	-0.098	-0.005
407.925	-0.194	-0.010
206.304	-0.064	-0.003
14.730	0.225	0.011

EMS - 1764 Jan 25 20:49:38 2018
Range 4 Temp 29.9° C

Ref Pres (psia)	Error (psia)	(% FS)
14.664	0.116	0.006
193.289	-0.086	-0.004
392.551	-0.268	-0.013
590.683	-0.206	-0.010
790.879	-0.114	-0.006
989.404	-0.069	-0.003
1188.900	-0.084	-0.004
1383.144	0.013	0.001
1582.510	-0.007	0.000
1783.117	-0.157	-0.008
1990.420	-0.345	-0.017
1817.923	-0.132	-0.007
1612.561	0.056	0.003
1409.796	0.058	0.003
1208.930	0.015	0.001
1007.679	0.001	0.000
807.799	-0.077	-0.004
607.517	-0.131	-0.007
406.301	-0.148	-0.007
205.701	-0.059	-0.003
14.686	0.136	0.007

EMS - 1764 Jan 25 15:45:50 2018
Range 5 Temp 39.9° C

Ref Pres (psia)	Error (psia)	(% FS)
14.630	0.132	0.007
193.274	-0.112	-0.006
393.384	-0.250	-0.013
590.646	-0.212	-0.011
792.587	-0.146	-0.007
989.121	-0.063	-0.003
1188.417	-0.088	-0.004
1390.226	0.034	0.002
1582.457	0.014	0.001
1783.077	-0.071	-0.004
1990.337	-0.153	-0.008
1809.812	-0.030	-0.002
1612.027	0.074	0.004
1410.656	0.058	0.003
1207.895	0.014	0.001
1007.484	0.000	0.000
807.295	-0.062	-0.003
608.401	-0.150	-0.007
406.285	-0.249	-0.012
205.685	-0.152	-0.008
14.645	0.083	0.004

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Westbay Instruments

Document: SCAL 9607

MOSDAX Calibration Report 1: EMS - 2652 Module 3008

Full Scale: 2000 (psia)

File: E:\DATA\CAL\0-2018\2000\2JUNE2-1\02652

Pressure Reference: Paroscientific Model 42K-101 S/N 59937

Range: 2K PSI

Date of last reference to traceable standard: Oct 5 2017

EMS - 2652 Jun 02 12:30:14 2018 — Range 1 Temp 3.3° C

Ref Pres (psia)	Error (psia)	(% FS)
14.846	-0.142	-0.007
192.843	-0.001	0.000
393.849	0.122	0.006
587.948	-0.023	-0.001
791.882	-0.022	-0.001
990.911	-0.057	-0.003
1190.327	-0.189	-0.009
1390.264	-0.181	-0.009
1589.406	-0.082	-0.004
1781.525	0.044	0.002
1989.515	0.123	0.006
1818.398	0.071	0.004
1619.022	-0.012	-0.001
1412.880	-0.003	0.000
1211.907	-0.038	-0.002
1009.806	0.075	0.004
808.334	0.096	0.005
606.956	0.169	0.008
406.373	0.123	0.006
205.741	0.110	0.006
14.848	-0.083	-0.004

EMS - 2652 Jun 02 07:51:36 2018 — Range 2 Temp 10.3° C

Ref Pres (psia)	Error (psia)	(% FS)
14.855	-0.105	-0.005
192.231	-0.010	-0.001
393.607	0.068	0.003
593.420	0.070	0.003
792.296	0.087	0.004
991.833	0.075	0.004
1191.049	-0.061	-0.003
1390.953	-0.006	0.000
1589.174	0.014	0.001
1781.549	0.156	0.008
1989.230	0.324	0.016
1818.861	0.206	0.010
1618.518	0.147	0.007
1415.894	0.075	0.004
1212.127	0.094	0.005
1010.514	0.213	0.011
808.014	0.218	0.011
606.949	0.179	0.009
406.191	0.137	0.007
206.072	0.110	0.005
14.863	-0.040	-0.002

EMS - 2652 Jun 02 03:10:20 2018 — Range 3 Temp 20.1° C

Ref Pres (psia)	Error (psia)	(% FS)
14.842	-0.118	-0.006
194.509	-0.104	-0.005
390.935	0.064	0.003
592.897	0.002	0.000
791.655	0.062	0.003
991.348	0.019	0.001
1190.921	-0.121	-0.006
1390.842	-0.037	-0.002
1589.397	-0.028	-0.001
1781.207	0.088	0.004
1989.355	0.295	0.015
1816.258	0.129	0.006
1618.089	0.091	0.005
1413.069	0.081	0.004
1212.924	0.023	0.001
1009.965	0.189	0.009
807.813	0.215	0.011
606.634	0.213	0.011
407.189	0.192	0.010
205.699	0.162	0.008
14.852	-0.051	-0.003

EMS - 2652 Jun 01 22:31:07 2018 — Range 4 Temp 30.0° C

Ref Pres (psia)	Error (psia)	(% FS)
14.847	-0.019	-0.001
194.042	-0.002	0.000
393.209	0.097	0.005
593.265	0.087	0.004
792.056	0.052	0.003
991.614	0.043	0.002
1189.236	-0.151	-0.008
1389.839	-0.128	-0.006
1588.713	-0.048	-0.002
1788.124	0.061	0.003
1989.624	0.201	0.010
1817.189	0.140	0.007
1616.308	0.001	0.000
1412.900	0.022	0.001
1212.611	0.060	0.003
1009.750	0.246	0.012
808.478	0.183	0.009
606.817	0.225	0.011
406.966	0.233	0.012
205.745	0.163	0.008
14.853	-0.013	-0.001

EMS - 2652 Jun 01 17:53:01 2018 — Range 5 Temp 39.8° C

Ref Pres (psia)	Error (psia)	(% FS)
14.838	-0.006	0.000
194.229	0.072	0.004
393.823	0.095	0.005
592.922	0.099	0.005
792.743	0.066	0.003
991.261	0.057	0.003
1190.280	-0.056	-0.003
1389.590	-0.057	-0.003
1588.437	0.020	0.001
1789.309	0.187	0.009
1989.755	0.368	0.018
1818.126	0.224	0.011
1615.388	0.129	0.006
1413.930	0.177	0.009
1208.395	0.080	0.004
1009.785	0.309	0.015
808.128	0.308	0.015
606.791	0.317	0.016
407.604	0.144	0.007
206.494	0.092	0.005
14.839	-0.005	0.000

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MOSDAX Calibration Report 2: EMS - 2652 Module 3008

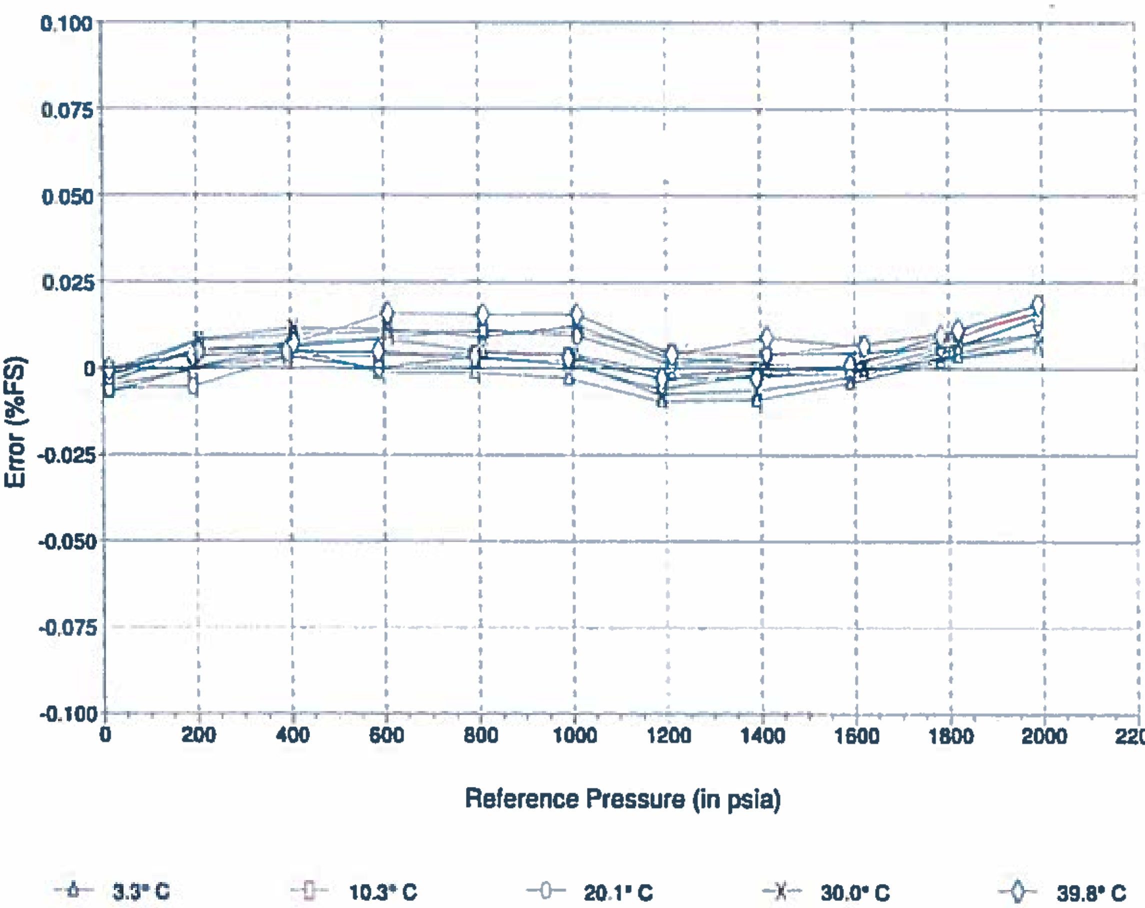
Full Scale: 2000 (psia)   File E:\DATA\CAL\0-2018\2000\2JUNE2-1\02652

Pressure Reference: Paroscientific Model 42K-101 S/N 59937   Range: 2K PSI

Date of last reference to traceable standard: Oct 5 2017

Plot of Error vs. Reference Pressure

EMS - 2652 Module 3008



Comments

Issued by

As Received MOSDAX Cal. Report 1: EMS - 2652 Module 3008

Full Scale: 2000 (psia)

File: E:\DATA\CAL\0-2018\2000\2JUNE2-1\02652

Pressure Reference: Paroscientific Model 42K-101 S/N 59937

Range: 2K PSI

Date of last reference to traceable standard: Oct 5 2017

EMS - 2652 Jun 02 12:30:14 2018
Range 1 Temp 3.3° C

Ref Pres (psia)	Error (psia)	(% FS)
14.846	0.013	0.001
192.843	0.170	0.008
393.849	0.313	0.016
587.948	0.190	0.009
791.882	0.218	0.011
990.911	0.211	0.011
1190.327	0.110	0.005
1390.264	0.152	0.008
1589.406	0.286	0.014
1781.525	0.449	0.022
1989.515	0.569	0.028
1818.398	0.484	0.024
1619.022	0.362	0.018
1412.880	0.333	0.017
1211.907	0.264	0.013
1009.806	0.346	0.017
808.334	0.338	0.017
606.956	0.385	0.019
406.373	0.315	0.016
205.741	0.282	0.014
14.848	0.072	0.004

EMS - 2652 Jun 02 07:51:36 2018
Range 2 Temp 10.3° C

Ref Pres (psia)	Error (psia)	(% FS)
14.855	0.042	0.002
192.231	0.155	0.008
393.607	0.255	0.013
593.420	0.277	0.014
792.296	0.315	0.016
991.833	0.321	0.016
1191.049	0.204	0.010
1390.953	0.279	0.014
1589.174	0.318	0.016
1781.549	0.476	0.024
1989.230	0.662	0.033
1818.861	0.530	0.027
1618.518	0.453	0.023
1415.894	0.362	0.018
1212.127	0.362	0.018
1010.514	0.462	0.023
808.014	0.447	0.022
606.949	0.388	0.019
406.191	0.325	0.016
206.072	0.277	0.014
14.863	0.107	0.005

EMS - 2652 Jun 02 03:10:20 2018
Range 3 Temp 20.1° C

Ref Pres (psia)	Error (psia)	(% FS)
14.842	0.032	0.002
194.509	0.061	0.003
390.935	0.244	0.012
592.897	0.196	0.010
791.655	0.268	0.013
991.348	0.236	0.012
1190.921	0.105	0.005
1390.842	0.196	0.010
1589.397	0.211	0.011
1781.207	0.331	0.017
1989.355	0.540	0.027
1816.258	0.372	0.019
1618.089	0.330	0.017
1413.069	0.314	0.016
1212.924	0.250	0.013
1009.965	0.407	0.020
807.813	0.422	0.021
606.634	0.408	0.020
407.189	0.373	0.019
205.699	0.328	0.016
14.852	0.098	0.005

EMS - 2652 Jun 01 22:31:07 2018
Range 4 Temp 30.0° C

Ref Pres (psia)	Error (psia)	(% FS)
14.847	0.148	0.007
194.042	0.167	0.008
393.209	0.270	0.013
593.265	0.263	0.013
792.056	0.233	0.012
991.614	0.229	0.011
1189.236	0.040	0.002
1389.839	0.070	0.003
1588.713	0.156	0.008
1788.124	0.271	0.014
1989.624	0.418	0.021
1817.189	0.351	0.018
1616.308	0.205	0.010
1412.900	0.220	0.011
1212.611	0.252	0.013
1009.750	0.432	0.022
808.478	0.364	0.018
606.817	0.403	0.020
406.966	0.406	0.020
205.745	0.332	0.017
14.853	0.154	0.008

EMS - 2652 Jun 01 17:53:01 2018
Range 5 Temp 39.8° C

Ref Pres (psia)	Error (psia)	(% FS)
14.838	0.193	0.010
194.229	0.252	0.013
393.823	0.259	0.013
592.922	0.253	0.013
792.743	0.216	0.011
991.261	0.209	0.010
1190.280	0.104	0.005
1389.590	0.117	0.006
1588.437	0.215	0.011
1789.309	0.410	0.020
1989.755	0.624	0.031
1818.126	0.450	0.023
1615.388	0.327	0.016
1413.930	0.354	0.018
1208.395	0.241	0.012
1009.785	0.462	0.023
808.128	0.458	0.023
606.791	0.471	0.024
407.604	0.307	0.015
206.494	0.271	0.014
14.839	0.194	0.010

Issued by

Westbay Instruments

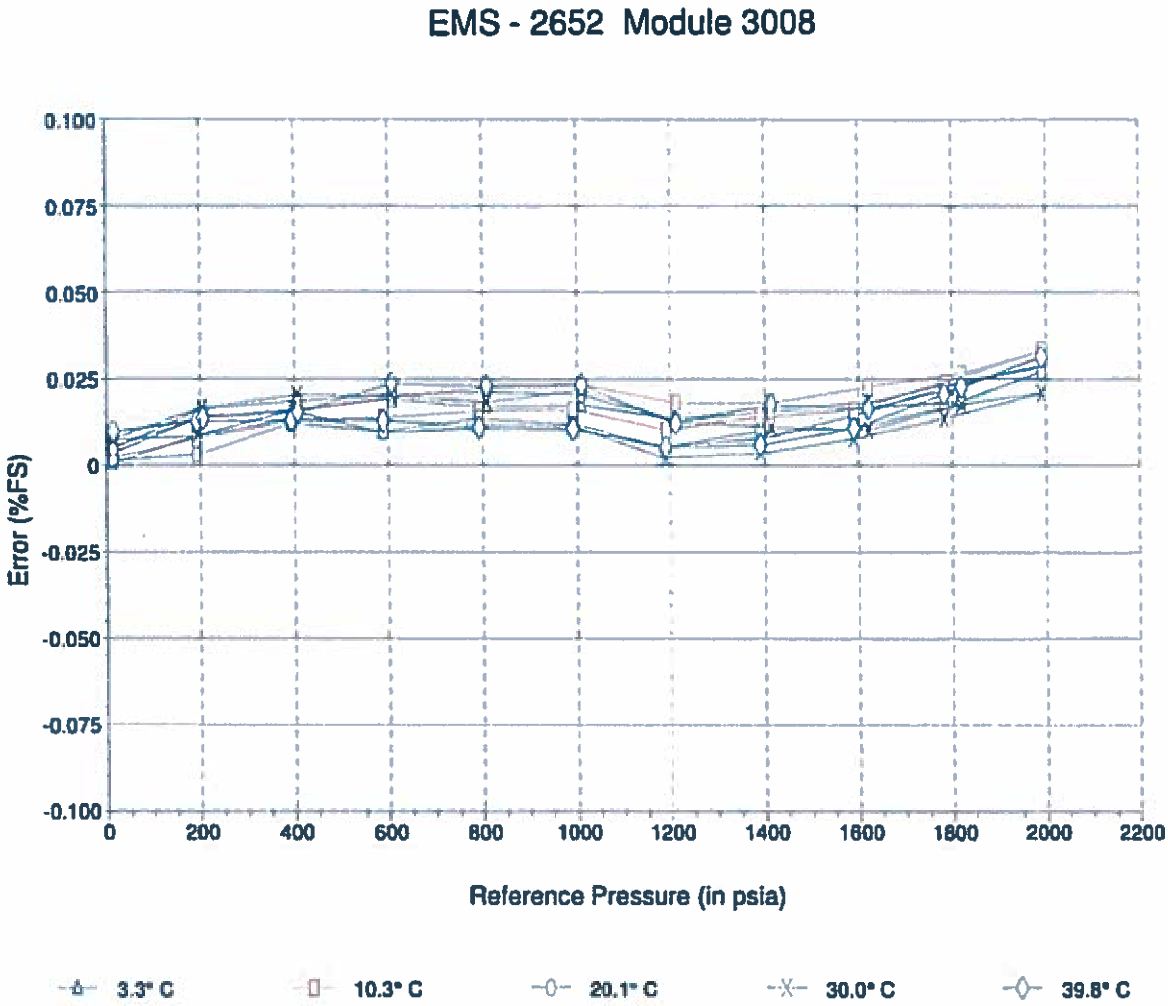
As Received MOSDAX Cal. Report 2: EMS - 2652 Module 3008

Full Scale: 2000 (psia) File: E:\DATA\CAL\0 2018\2000\2JUNE2-1\02652

Pressure Reference: Paroscientific Model 42K-101 S/N 59937 Range: 2K PSI

Date of last reference to traceable standard: Oct 5 2017

Plot of Error vs. Reference Pressure



Comments

Issued by

Westbay Instruments

APPENDIX C

2018 Laboratory Certificates of Analysis

Golder Associates Ltd. (Ottawa)
ATTN: Dale Holtze
1931 Robertson Road
Ottawa ON K2H 5B7

Date Received: 16-NOV-18
Report Date: 22-NOV-18 16:58 (MT)
Version: FINAL REV. 2

Client Phone: 613-592-9600

Certificate of Analysis

Lab Work Order #: L2197641

Project P.O. #: NOT SUBMITTED
Job Reference: 1789310
C of C Numbers: 17-720417
Legal Site Desc:

Comments: ADDITIONAL 21-NOV-18 16:20
ADDITIONAL 19-NOV-18 17:56

Joanne Lee
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2197641-1	L2197641-2	L2197641-3	L2197641-4	L2197641-5
	Description	GW	GW	GW	GW	GW
	Sampled Date	10-NOV-18	10-NOV-18	11-NOV-18	11-NOV-18	12-NOV-18
	Sampled Time	17:30	17:30	17:30	17:30	17:30
	Client ID	ZONE 2	ZONE 22	ZONE 4	ZONE 44	ZONE 3
Grouping	**Analyte**					
SEAWATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	6260	6260	5160	5150	2600
Total Metals	Aluminum (Al)-Total (mg/L)	0.118	0.126	0.0140	0.0139	0.0128
	Antimony (Sb)-Total (mg/L)	0.00126	0.00129	0.00180	0.00186	0.00322
	Arsenic (As)-Total (mg/L)	<0.0020	<0.0020	0.0021	0.0022	0.0032
	Barium (Ba)-Total (mg/L)	0.102	0.0985	0.493	0.510	0.0918
	Beryllium (Be)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	1.86	1.72	0.97	1.00	1.10
	Cadmium (Cd)-Total (mg/L)	<0.000050	<0.000050	<0.000050	0.000055	<0.000050
	Calcium (Ca)-Total (mg/L)	2710	2580	2040	1920	991
	Cesium (Cs)-Total (mg/L)	0.00190	0.00184	0.00075	0.00077	<0.00050
	Chromium (Cr)-Total (mg/L)	0.00246	0.00119	0.0130	0.0127	0.00999
	Cobalt (Co)-Total (mg/L)	0.000120	0.000101	0.000237	0.000231	0.000166
	Copper (Cu)-Total (mg/L)	0.00272	0.00303	0.00113	0.00102	<0.00050
	Gallium (Ga)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Iron (Fe)-Total (mg/L)	0.555	0.584	0.366	0.354	0.076
	Lead (Pb)-Total (mg/L)	0.00460	0.00472	<0.00030	<0.00030	<0.00030
	Lithium (Li)-Total (mg/L)	2.33	2.14	1.48	1.65	0.802
	Magnesium (Mg)-Total (mg/L)	<1.0	<1.0	55.3	53.3	1.2
	Manganese (Mn)-Total (mg/L)	0.0215	0.0228	0.0816	0.0752	0.0181
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	0.0096	0.0092	0.0130	0.0141	0.0172
	Nickel (Ni)-Total (mg/L)	0.00276	0.00190	0.00818	0.00817	0.00703
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	106	100	67.1	70.8	35.9
	Rhenium (Re)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Rubidium (Rb)-Total (mg/L)	0.171	0.171	0.0933	0.101	0.0559
	Selenium (Se)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Silicon (Si)-Total (mg/L)	3.2	3.6	2.2	1.9	2.7
	Silver (Ag)-Total (mg/L)	0.00034	0.00038	<0.00010	<0.00010	<0.00010
	Sodium (Na)-Total (mg/L)	379	372	326	318	275
	Strontium (Sr)-Total (mg/L)	47.3	47.5	34.8	34.4	16.9
	Sulfur (S)-Total (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Tellurium (Te)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Thallium (Tl)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Thorium (Th)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Tin (Sn)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2197641-6 GW 12-NOV-18 17:30 ZONE 33				
Grouping	**Analyte**					
SEAWATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	2740				
Total Metals	Aluminum (Al)-Total (mg/L)	0.0126				
	Antimony (Sb)-Total (mg/L)	0.00339				
	Arsenic (As)-Total (mg/L)	0.0038				
	Barium (Ba)-Total (mg/L)	0.0956				
	Beryllium (Be)-Total (mg/L)	<0.00050				
	Bismuth (Bi)-Total (mg/L)	<0.00050				
	Boron (B)-Total (mg/L)	1.19				
	Cadmium (Cd)-Total (mg/L)	<0.000050				
	Calcium (Ca)-Total (mg/L)	1080				
	Cesium (Cs)-Total (mg/L)	<0.00050				
	Chromium (Cr)-Total (mg/L)	0.00674				
	Cobalt (Co)-Total (mg/L)	0.000111				
	Copper (Cu)-Total (mg/L)	<0.00050				
	Gallium (Ga)-Total (mg/L)	<0.00050				
	Iron (Fe)-Total (mg/L)	0.064				
	Lead (Pb)-Total (mg/L)	<0.00030				
	Lithium (Li)-Total (mg/L)	0.850				
	Magnesium (Mg)-Total (mg/L)	1.2				
	Manganese (Mn)-Total (mg/L)	0.0171				
	Mercury (Hg)-Total (mg/L)	<0.000010				
	Molybdenum (Mo)-Total (mg/L)	0.0184				
	Nickel (Ni)-Total (mg/L)	0.00436				
	Phosphorus (P)-Total (mg/L)	<0.050				
	Potassium (K)-Total (mg/L)	39.7				
	Rhenium (Re)-Total (mg/L)	<0.00050				
	Rubidium (Rb)-Total (mg/L)	0.0564				
	Selenium (Se)-Total (mg/L)	<0.0020				
	Silicon (Si)-Total (mg/L)	2.8				
	Silver (Ag)-Total (mg/L)	<0.00010				
	Sodium (Na)-Total (mg/L)	300				
	Strontium (Sr)-Total (mg/L)	17.2				
	Sulfur (S)-Total (mg/L)	<5.0				
	Tellurium (Te)-Total (mg/L)	<0.00050				
	Thallium (Tl)-Total (mg/L)	<0.000050				
	Thorium (Th)-Total (mg/L)	<0.00050				
	Tin (Sn)-Total (mg/L)	<0.0010				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2197641-1 GW 10-NOV-18 17:30 ZONE 2	L2197641-2 GW 10-NOV-18 17:30 ZONE 22	L2197641-3 GW 11-NOV-18 17:30 ZONE 4	L2197641-4 GW 11-NOV-18 17:30 ZONE 44	L2197641-5 GW 12-NOV-18 17:30 ZONE 3
Grouping	**Analyte**					
SEAWATER						
Total Metals	Titanium (Ti)-Total (mg/L)	0.0070	0.0075	<0.0050	<0.0050	<0.0050
	Tungsten (W)-Total (mg/L)	0.0815	0.0854	0.0470	0.0462	0.0736
	Uranium (U)-Total (mg/L)	0.000283	0.000304	<0.000050	<0.000050	0.000160
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Yttrium (Y)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	0.0374	0.0410	0.0625	0.0605	0.0395
	Zirconium (Zr)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0219	0.0176	0.0085	0.0076	0.0126
	Antimony (Sb)-Dissolved (mg/L)	0.00125	0.00128	0.00163	0.00172	0.00308
	Arsenic (As)-Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	0.0034
	Barium (Ba)-Dissolved (mg/L)	0.0986	0.0996	0.466	0.489	0.0902
	Beryllium (Be)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	1.76	1.88	0.90	0.95	1.04
	Cadmium (Cd)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Calcium (Ca)-Dissolved (mg/L)	2510	2510	1970	1970	1040
	Cesium (Cs)-Dissolved (mg/L)	0.00189	0.00195	0.00075	0.00074	<0.00050
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Copper (Cu)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Gallium (Ga)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Iron (Fe)-Dissolved (mg/L)	0.013	0.013	0.112	0.105	0.018
	Lead (Pb)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Lithium (Li)-Dissolved (mg/L)	2.25	2.16	1.42	1.52	0.779
	Magnesium (Mg)-Dissolved (mg/L)	<1.0	<1.0	57.8	53.9	1.2
	Manganese (Mn)-Dissolved (mg/L)	0.0171	0.0164	0.0836	0.0812	0.0184
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	0.0090	0.0093	0.0112	0.0116	0.0154
	Nickel (Ni)-Dissolved (mg/L)	0.00118	0.00122	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	99	98	67	66	38
	Rhenium (Re)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Rubidium (Rb)-Dissolved (mg/L)	0.173	0.174	0.0891	0.0914	0.0549
	Selenium (Se)-Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Silicon (Si)-Dissolved (mg/L)	2.8	2.7	2.3	2.2	3.0

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2197641-6 GW 12-NOV-18 17:30 ZONE 33				
Grouping	**Analyte**					
SEAWATER						
Total Metals	Titanium (Ti)-Total (mg/L)	<0.0050				
	Tungsten (W)-Total (mg/L)	0.0756				
	Uranium (U)-Total (mg/L)	0.000164				
	Vanadium (V)-Total (mg/L)	<0.00050				
	Yttrium (Y)-Total (mg/L)	<0.00050				
	Zinc (Zn)-Total (mg/L)	0.0477				
	Zirconium (Zr)-Total (mg/L)	<0.00050				
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD				
	Dissolved Metals Filtration Location	FIELD				
	Aluminum (Al)-Dissolved (mg/L)	0.0115				
	Antimony (Sb)-Dissolved (mg/L)	0.00300				
	Arsenic (As)-Dissolved (mg/L)	0.0034				
	Barium (Ba)-Dissolved (mg/L)	0.0854				
	Beryllium (Be)-Dissolved (mg/L)	<0.00050				
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050				
	Boron (B)-Dissolved (mg/L)	1.02				
	Cadmium (Cd)-Dissolved (mg/L)	<0.000050				
	Calcium (Ca)-Dissolved (mg/L)	1090				
	Cesium (Cs)-Dissolved (mg/L)	<0.00050				
	Chromium (Cr)-Dissolved (mg/L)	<0.00050				
	Cobalt (Co)-Dissolved (mg/L)	<0.000050				
	Copper (Cu)-Dissolved (mg/L)	<0.00050				
	Gallium (Ga)-Dissolved (mg/L)	<0.00050				
	Iron (Fe)-Dissolved (mg/L)	0.019				
	Lead (Pb)-Dissolved (mg/L)	<0.00030				
	Lithium (Li)-Dissolved (mg/L)	0.749				
	Magnesium (Mg)-Dissolved (mg/L)	1.2				
	Manganese (Mn)-Dissolved (mg/L)	0.0181				
	Mercury (Hg)-Dissolved (mg/L)	<0.000010				
	Molybdenum (Mo)-Dissolved (mg/L)	0.0144				
	Nickel (Ni)-Dissolved (mg/L)	<0.00050				
	Phosphorus (P)-Dissolved (mg/L)	<0.050				
	Potassium (K)-Dissolved (mg/L)	40				
	Rhenium (Re)-Dissolved (mg/L)	<0.00050				
	Rubidium (Rb)-Dissolved (mg/L)	0.0528				
	Selenium (Se)-Dissolved (mg/L)	<0.0020				
	Silicon (Si)-Dissolved (mg/L)	3.0				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2197641-1	L2197641-2	L2197641-3	L2197641-4	L2197641-5
	Description	GW	GW	GW	GW	GW
	Sampled Date	10-NOV-18	10-NOV-18	11-NOV-18	11-NOV-18	12-NOV-18
	Sampled Time	17:30	17:30	17:30	17:30	17:30
	Client ID	ZONE 2	ZONE 22	ZONE 4	ZONE 44	ZONE 3
Grouping	**Analyte**					
SEAWATER						
Dissolved Metals	Silver (Ag)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Sodium (Na)-Dissolved (mg/L)	353	368	309	320	280
	Strontium (Sr)-Dissolved (mg/L)	44.9	45.3	33.6	33.6	16.9
	Sulfur (S)-Dissolved (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Tellurium (Te)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Thallium (Tl)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Thorium (Th)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Tin (Sn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Titanium (Ti)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Tungsten (W)-Dissolved (mg/L)	0.0806	0.0789	0.0455	0.0443	0.0722
	Uranium (U)-Dissolved (mg/L)	0.000235	0.000238	<0.000050	<0.000050	0.000160
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Yttrium (Y)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0030	<0.0030	0.0096	0.0100	<0.0030
	Zirconium (Zr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2197641-6				
	Description	GW				
	Sampled Date	12-NOV-18				
	Sampled Time	17:30				
	Client ID	ZONE 33				
Grouping	**Analyte**					
SEAWATER						
Dissolved Metals	Silver (Ag)-Dissolved (mg/L)	<0.00010				
	Sodium (Na)-Dissolved (mg/L)	301				
	Strontium (Sr)-Dissolved (mg/L)	17.2				
	Sulfur (S)-Dissolved (mg/L)	<5.0				
	Tellurium (Te)-Dissolved (mg/L)	<0.00050				
	Thallium (Tl)-Dissolved (mg/L)	<0.000050				
	Thorium (Th)-Dissolved (mg/L)	<0.00050				
	Tin (Sn)-Dissolved (mg/L)	<0.0010				
	Titanium (Ti)-Dissolved (mg/L)	<0.0050				
	Tungsten (W)-Dissolved (mg/L)	0.0687				
	Uranium (U)-Dissolved (mg/L)	0.000144				
	Vanadium (V)-Dissolved (mg/L)	<0.00050				
	Yttrium (Y)-Dissolved (mg/L)	<0.00050				
	Zinc (Zn)-Dissolved (mg/L)	<0.0030				
	Zirconium (Zr)-Dissolved (mg/L)	<0.00050				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L2197641-1	L2197641-2	L2197641-3	L2197641-4	L2197641-5
	Description	GW	GW	GW	GW	GW
	Sampled Date	10-NOV-18	10-NOV-18	11-NOV-18	11-NOV-18	12-NOV-18
	Sampled Time	17:30	17:30	17:30	17:30	17:30
	Client ID	ZONE 2	ZONE 22	ZONE 4	ZONE 44	ZONE 3
WATER						
Physical Tests	Conductivity (uS/cm)	16700	16800	13900	14000	7530
	pH (pH)	8.13	8.22	6.97	6.94	7.40
	Total Suspended Solids (mg/L)	17.3	32.5	24.3	20.3	7.9
	Total Dissolved Solids (mg/L)	10900	10800	9030	8820	5100
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	61.8	61.2	10.2	10.4	50.5
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	61.8	61.2	10.2	10.4	50.5
	Ammonia, Total (as N) (mg/L)	0.142	0.141	0.157	0.158	0.139
	Bromide (Br) (mg/L)	76.1	76.8	69.7	60.1	32.7
	Chloride (Cl) (mg/L)	5900	5910	5220	4530	2700
	Fluoride (F) (mg/L)	DLDS <1.0	DLDS <1.0	DLDS <1.0	DLDS <1.0	DLDS <1.0
	Nitrate (as N) (mg/L)	DLDS <0.25	DLDS <0.25	DLDS <0.25	DLDS <0.25	DLDS <0.25
	Nitrite (as N) (mg/L)	DLDS <0.050	DLDS <0.050	DLDS <0.050	DLDS <0.050	DLDS <0.050
	Phosphorus (P)-Total (mg/L)	0.0120	0.0132	0.0067	0.0059	0.0061
	Sulfate (SO4) (mg/L)	DLDS <15	DLDS <15	DLDS <15	DLDS <15	DLDS <15

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2197641-6				
	Description	GW				
	Sampled Date	12-NOV-18				
	Sampled Time	17:30				
	Client ID	ZONE 33				
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	7350				
	pH (pH)	7.50				
	Total Suspended Solids (mg/L)	7.5				
	Total Dissolved Solids (mg/L)	4980				
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	50.1				
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0				
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0				
	Alkalinity, Total (as CaCO3) (mg/L)	50.1				
	Ammonia, Total (as N) (mg/L)	0.136				
	Bromide (Br) (mg/L)	32.5				
	Chloride (Cl) (mg/L)	2700				
	Fluoride (F) (mg/L)	DLDS <1.0				
	Nitrate (as N) (mg/L)	DLDS <0.25				
	Nitrite (as N) (mg/L)	DLDS <0.050				
	Phosphorus (P)-Total (mg/L)	0.0082				
	Sulfate (SO4) (mg/L)	DLDS <15				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
WSMD	Water sample(s) for dissolved mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.
WSMT	Water sample(s) for total mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2197641-1, -2, -3, -4, -5, -6
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2197641-1, -2, -3, -4, -5, -6
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2197641-1, -2, -3, -4, -5, -6
Matrix Spike	Calcium (Ca)-Total	MS-B	L2197641-1, -2, -3, -4, -5, -6
Matrix Spike	Lithium (Li)-Total	MS-B	L2197641-1, -2, -3, -4, -5, -6
Matrix Spike	Potassium (K)-Total	MS-B	L2197641-1, -2, -3, -4, -5, -6
Matrix Spike	Rubidium (Rb)-Total	MS-B	L2197641-1, -2, -3, -4, -5, -6
Matrix Spike	Sodium (Na)-Total	MS-B	L2197641-1, -2, -3, -4, -5, -6
Matrix Spike	Strontium (Sr)-Total	MS-B	L2197641-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

ALS Test Code	Matrix	Test Description	Method Reference**
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
CL-L-IC-N-VA	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

ALS Test Code	Matrix	Test Description	Method Reference**
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510

Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.

ALS Test Code	Matrix	Test Description	Method Reference**
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
HARDNESS-CALC-VA	Seawater	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

ALS Test Code	Matrix	Test Description	Method Reference**
HG-DIS-C-CVAFS-VA	Seawater	Diss. Mercury in Seawater by CVAFS	PUGET SOUND PROTOCOLS, EPA 245.7

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedures may involve preliminary sample treatment by filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified seawater sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

ALS Test Code	Matrix	Test Description	Method Reference**
HG-TOT-C-CVAFS-VA	Seawater	Total Mercury in Seawater by CVAFS	PUGET SOUND PROTOCOLS, EPA 245.7

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedure involves a cold-oxidation of the acidified seawater sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

Reference Information

MET-D-L-HRMS-VA Seawater Diss. Metals in Seawater by HR-ICPMS EPA 200.8

Trace metals in seawater are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) based on US EPA Method 200.8, (Revision 5.5). The procedures may involve laboratory sample filtration based on APHA Method 3030B.

MET-T-L-HRMS-VA Seawater Tot. Metals in Seawater by HR-ICPMS EPA 200.8

Trace metals in seawater are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) based on US EPA Method 200.8, (Revision 5.5). The procedures may involve preliminary sample treatment by acid digestion based on APHA Method 3030E.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-LOW-VA Water Low Level TDS (3.0mg/L) by Gravimetric APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) are determined by filtering a sample through a glass fibre filter. TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.
Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-720417

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L2197641-COFC

COC Number: 17 - 720417

Page of

Report To	Contact and company name below will appear on the final report
Company:	Golder Associates Ltd.
Contact:	Dale Holtze
Phone:	613-592-9600
	Company address below will appear on the final report
Street:	1931 Robertson Road
City/Province:	Ottawa, ON
Postal Code:	K2H 5B7
Invoice To	Same as Report To [X] YES [ ] NO
	Copy of Invoice with Report [ ] YES [ ] NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: [X] PDF [X] EXCEL [ ] EDD (DIGITAL)
Quality Control (QC) Report with Report [ ] YES [ ] NO
[ ] Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: [ ] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax: dholtze@golder.com
Email 2: valerie_bertrand@golder.com
Email 3:

Invoice Distribution

Select Invoice Distribution: [X] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax: dholtze@golder.com
Email 2:

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] [X] Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] [ ] ; 3 day [P3-25%] [ ] ; 2 day [P2-50%] [ ]
EMERGENCY: 1 Business day [E-100%] [ ] ; Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] [ ]

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #: Q70283
Job #: 1789310
PO / AFE:
LSD:
ALS Lab Work Order # (lab use only):

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#:
Major/Minor Code: | Routing Code:
Requisitioner:
Location:
ALS Contact: Joanne Lee | Sampler: D. Holtze

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	total metals	dissolved metals	total P	Major ions	TDS, TSS	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	Zone 2	10-Nov-18	17:30	GW	X	X	X	X	X			6
	Zone 22	10-Nov-18	17:30	↓	↓	↓	↓	↓	↓			↓
	Zone 4	11-Nov-18	17:30	↓	↓	↓	↓	↓	↓			↓
	Zone 44	11-Nov-18	17:30	↓	↓	↓	↓	↓	↓			↓
	Zone 3	12-Nov-18	17:30	↓	↓	↓	↓	↓	↓			↓
	Zone 33	12-Nov-18	17:30	↓	↓	↓	↓	↓	↓			↓

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? [ ] YES [X] NO
Are samples for human consumption/ use? [ ] YES [X] NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Elevated Salt concentrations likely (Brine)
EC Zone 2+22 ~ 17.37 mS/cm
Zone 4+44 ~ 14.8 mS/cm Zone 3+33 ~ 7.5 mS/cm

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] ; SIF Observations Yes [ ] No [ ]
Ice Packs [X] Ice Cubes [ ] ; Custody seal intact Yes [X] No [ ]
Cooling Initiated [ ]
INITIAL COOLER TEMPERATURES °C:
FINAL COOLER TEMPERATURES °C: 7

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: [signature]	Date: 2018-11-13	Time: 8:00	Received by:	Date:	Time:	Received by: A4 JC	Date: Nov 16/18	Time: 8:30 AM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY   YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1 If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form

Golder Associates Ltd. (Ottawa)
ATTN: Dale Holtze
1931 Robertson Road
Ottawa ON K2H 5B7

Date Received: 19-NOV-18
Report Date: 22-NOV-18 17:29 (MT)
Version: FINAL

Client Phone: 613-592-9600

Certificate of Analysis

Lab Work Order #: **L2198327**
Project P.O. #: NOT SUBMITTED
Job Reference: 1789310
C of C Numbers: 18-1789310
Legal Site Desc:

Joanne Lee
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2198327-1 Groundwater 13-NOV-18 17:00 ZONE 6	L2198327-2 Groundwater 13-NOV-18 17:00 ZONE 66	L2198327-3 Groundwater 13-NOV-18 15:00 EB	L2198327-4 Groundwater 13-NOV-18 15:30 TB	
Grouping	**Analyte**					
SEAWATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	3630	3620	<4.8	<4.8	
Total Metals	Aluminum (Al)-Total (mg/L)	0.0118	0.0127	<0.0050		
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Arsenic (As)-Total (mg/L)	0.0024	0.0024	<0.0020		
	Barium (Ba)-Total (mg/L)	0.859	0.894	<0.0010		
	Beryllium (Be)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Boron (B)-Total (mg/L)	0.41	0.40	<0.10		
	Cadmium (Cd)-Total (mg/L)	<0.000050	<0.000050	<0.000050		
	Calcium (Ca)-Total (mg/L)	1330	1370	<1.0		
	Cesium (Cs)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Chromium (Cr)-Total (mg/L)	0.00383	0.00381	<0.00050		
	Cobalt (Co)-Total (mg/L)	0.000072	0.000093	<0.000050		
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Gallium (Ga)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Iron (Fe)-Total (mg/L)	0.314	0.322	<0.010		
	Lead (Pb)-Total (mg/L)	<0.00030	<0.00030	<0.00030		
	Lithium (Li)-Total (mg/L)	0.558	0.563	<0.020		
	Magnesium (Mg)-Total (mg/L)	40.6	39.8	<1.0		
	Manganese (Mn)-Total (mg/L)	0.101	0.103	<0.00020		
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Molybdenum (Mo)-Total (mg/L)	0.0279	0.0270	<0.0020		
	Nickel (Ni)-Total (mg/L)	0.00288	0.00262	<0.00050		
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Total (mg/L)	9.7	10.1	<1.0		
	Rhenium (Re)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Rubidium (Rb)-Total (mg/L)	0.0166	0.0164	<0.0050		
	Selenium (Se)-Total (mg/L)	<0.0020	<0.0020	<0.0020		
	Silicon (Si)-Total (mg/L)	2.6	2.5	<1.0		
	Silver (Ag)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Sodium (Na)-Total (mg/L)	232	238	<1.0		
	Strontium (Sr)-Total (mg/L)	18.1	18.6	<0.010		
	Sulfur (S)-Total (mg/L)	<5.0	<5.0	<5.0		
	Tellurium (Te)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Thallium (Tl)-Total (mg/L)	<0.000050	<0.000050	<0.000050		
	Thorium (Th)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Tin (Sn)-Total (mg/L)	<0.0010	<0.0010	<0.0010		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2198327-1	L2198327-2	L2198327-3	L2198327-4	
	Description	Groundwater	Groundwater	Groundwater	Groundwater	
	Sampled Date	13-NOV-18	13-NOV-18	13-NOV-18	13-NOV-18	
	Sampled Time	17:00	17:00	15:00	15:30	
	Client ID	ZONE 6	ZONE 66	EB	TB	
Grouping	**Analyte**					
SEAWATER						
Total Metals	Titanium (Ti)-Total (mg/L)	<0.0050	<0.0050	<0.0050		
	Tungsten (W)-Total (mg/L)	0.0214	0.0223	<0.0010		
	Uranium (U)-Total (mg/L)	<0.000050	<0.000050	<0.000050		
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Yttrium (Y)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Zinc (Zn)-Total (mg/L)	0.109	0.113	<0.0030		
	Zirconium (Zr)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	
	Aluminum (Al)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	0.00050	<0.00050	<0.00050	
	Arsenic (As)-Dissolved (mg/L)	0.0021	0.0024	<0.0020	<0.0020	
	Barium (Ba)-Dissolved (mg/L)	0.818	0.794	<0.0010	<0.0010	
	Beryllium (Be)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Boron (B)-Dissolved (mg/L)	0.36	0.35	<0.10	<0.10	
	Cadmium (Cd)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Calcium (Ca)-Dissolved (mg/L)	1380	1380	<1.0	<1.0	
	Cesium (Cs)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Cobalt (Co)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Copper (Cu)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Gallium (Ga)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Iron (Fe)-Dissolved (mg/L)	0.251	0.256	<0.010	<0.010	
	Lead (Pb)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	
	Lithium (Li)-Dissolved (mg/L)	0.533	0.520	<0.020	<0.020	
	Magnesium (Mg)-Dissolved (mg/L)	42.8	42.8	<1.0	<1.0	
	Manganese (Mn)-Dissolved (mg/L)	0.0961	0.0970	<0.00020	<0.00020	
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Molybdenum (Mo)-Dissolved (mg/L)	0.0257	0.0245	<0.0020	<0.0020	
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	
	Potassium (K)-Dissolved (mg/L)	<20	<20	<20	<20	
	Rhenium (Re)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Rubidium (Rb)-Dissolved (mg/L)	0.0151	0.0146	<0.0050	<0.0050	
	Selenium (Se)-Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	
	Silicon (Si)-Dissolved (mg/L)	2.8	2.7	<1.0	<1.0	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2198327-1	L2198327-2	L2198327-3	L2198327-4	
	Description	Groundwater	Groundwater	Groundwater	Groundwater	
	Sampled Date	13-NOV-18	13-NOV-18	13-NOV-18	13-NOV-18	
	Sampled Time	17:00	17:00	15:00	15:30	
	Client ID	ZONE 6	ZONE 66	EB	TB	
Grouping	**Analyte**					
SEAWATER						
Dissolved Metals	Silver (Ag)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Sodium (Na)-Dissolved (mg/L)	253	250	<20	<20	
	Strontium (Sr)-Dissolved (mg/L)	19.5	19.7	<0.050	<0.050	
	Sulfur (S)-Dissolved (mg/L)	<5.0	<5.0	<5.0	<5.0	
	Tellurium (Te)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Thallium (Tl)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Thorium (Th)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Tin (Sn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Titanium (Ti)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	
	Tungsten (W)-Dissolved (mg/L)	0.0214	0.0208	<0.0010	<0.0010	
	Uranium (U)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Yttrium (Y)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Zinc (Zn)-Dissolved (mg/L)	0.0244	0.0230	<0.0030	<0.0030	
	Zirconium (Zr)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2198327-1 Groundwater 13-NOV-18 17:00 ZONE 6	L2198327-2 Groundwater 13-NOV-18 17:00 ZONE 66	L2198327-3 Groundwater 13-NOV-18 15:00 EB	L2198327-4 Groundwater 13-NOV-18 15:30 TB	
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	8720	8780	<2.0	<2.0	
	pH (pH)	6.58	6.65	5.76	5.98	
	Total Suspended Solids (mg/L)	8.3	9.5	<3.0	<3.0	
	Total Dissolved Solids (mg/L)	5580	5410	<3.0	<3.0	
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	27.2	26.4	<1.0	<1.0	
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	
	Alkalinity, Total (as CaCO3) (mg/L)	27.2	26.4	<1.0	<1.0	
	Ammonia, Total (as N) (mg/L)	0.443	0.437	<0.0050	<0.0050	
	Bromide (Br) (mg/L)	40.9	41.4	<0.050	<0.050	
	Chloride (Cl) (mg/L)	3010	3060	<0.50	<0.50	
	Fluoride (F) (mg/L)	DLDS <1.0	DLDS <1.0	<0.020	<0.020	
	Nitrate (as N) (mg/L)	DLDS <0.25	DLDS <0.25	<0.0050	<0.0050	
	Nitrite (as N) (mg/L)	DLDS <0.050	DLDS <0.050	<0.0010	<0.0010	
	Phosphorus (P)-Total (mg/L)	0.0043	0.0052	<0.0020	<0.0020	
	Sulfate (SO4) (mg/L)	DLDS <15	DLDS <15	<0.30	<0.30	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
WSMD	Water sample(s) for dissolved mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

Qualifiers for Individual Samples Listed:

Sample Numbei	Client Sample ID	Qualifier	Description
L2198327-1	ZONE 6	WSMT	Water sample(s) for total mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.
L2198327-2	ZONE 66	WSMT	Water sample(s) for total mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.
L2198327-3	EB	WSMT	Water sample(s) for total mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2198327-1, -2, -3, -4
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2198327-1, -2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2198327-1, -2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2198327-1, -2, -3, -4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

ALS Test Code	Matrix	Test Description	Method Reference**
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

ALS Test Code	Matrix	Test Description	Method Reference**
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510

Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.

ALS Test Code	Matrix	Test Description	Method Reference**
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
HARDNESS-CALC-VA	Seawater	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

ALS Test Code	Matrix	Test Description	Method Reference**
HG-DIS-C-CVAFS-VA	Seawater	Diss. Mercury in Seawater by CVAFS	PUGET SOUND PROTOCOLS, EPA 245.7

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedures may involve preliminary sample treatment by filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified seawater sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

ALS Test Code	Matrix	Test Description	Method Reference**
HG-TOT-C-CVAFS-VA	Seawater	Total Mercury in Seawater by CVAFS	PUGET SOUND PROTOCOLS, EPA 245.7

This analysis is carried out using procedures adapted from "Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples" prepared for the United States Environmental Protection Agency and the Puget Sound Water Quality Authority, 1995. The procedure involves a cold-oxidation of the acidified seawater sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method

Reference Information

245.7).

MET-D-L-HRMS-VA	Seawater	Diss. Metals in Seawater by HR-ICPMS	EPA 200.8

Trace metals in seawater are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) based on US EPA Method 200.8, (Revision 5.5). The procedures may involve laboratory sample filtration based on APHA Method 3030B.

MET-T-L-HRMS-VA	Seawater	Tot. Metals in Seawater by HR-ICPMS	EPA 200.8

Trace metals in seawater are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) based on US EPA Method 200.8, (Revision 5.5). The procedures may involve preliminary sample treatment by acid digestion based on APHA Method 3030E.

NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-LOW-VA	Water	Low Level TDS (3.0mg/L) by Gravimetric	APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.
Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

18-1789310

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

L2198327-COFC

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # 18-1789310

Report To		Report Format / Distribution	
Company:	GOLDER ASSOCIATES LTD	☑ Standard ☐ Other	
Contact:	Dale Holtze	☑ PDF ☑ Excel ☐ Digital ☐ Fax	
Address:	1931 Robertson Road	Email 1:	dholtze@golder.com
	Ottawa, ON K2H 5B7	Email 2:	valerie_bertrand@golder.com
Phone:	613-592-9600 Fax: 613-592-9601	Email 3:	
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information	
Hardcopy of Invoice with Report?	☐ Yes ☐ No	Job #:	1789310
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #:	Q70883
Lab Work Order # (lab use only)		ALS Contact: Joanne Lee	Sampler: Dale Holtze

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ◯ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ◯ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ◯ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	DISSOLVED METALS (F)	TOTAL METALS	TOTAL PHOSPHORUS (P)	MAJOR IONS, TDS, TSS	pH	EC	NH3	Anions	Number of Containers
	Zone 6 } 2 DAY RUSH	13-Nov-18	17:00	Groundwater									4
	Zone 66 }	13-Nov-18	17:00	Groundwater									4
	EB } Routine 5 days	13-Nov-18	15:00	Water									4
	TB }	13-Nov-18	15:30	Water									3

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

SAMPLES 'ZONE 6' AND 'ZONE 66' HAVE ELEVATED TDS/CONDUCTIVTY. FIELD MEASURED CONDUCTIVITY RANGES BETWEEN 9 AND 9.1 mS/cm.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Dale Holtze	14-Nov-18	8:00	PAVL	NOV 19	08:30	9.8 °C				

APPENDIX D

2016 Laboratory Certificate of Analysis – Brine Fluid

Multilab Val-d'Or

Certificat d'analyse

Client : **Agnico-Eagle CSD - Amaruq Study**

Responsable : Mme Odrée-Maude Vachon
Adresse : CSD

tél.: (819) 759-3555 ()
fax.: (000) 000-0000

Numéro de projet : V-52584

Lieu de prélèvement : Brine Fluid

Échantillon : Brine Fluid

Nom du préleveur : N/D

Type d'échantillon : Eau surface

Réseau:

Date de prélèvement : 17 avril 2016

Heure de prélèvement : N/D

Date de réception : 19 avril 2016

Certificat corrigé, remplace le certificat V-52584 émis le 09 mai 2016

Les résultats ne se rapportent qu'aux échantillons soumis pour analyse.

Les échantillons seront conservés pendant 30 jours à partir de la date du rapport à moins d'avis écrit du client.

Sauf indication contraire, tous les échantillons ont été reçus en bon état.

900, 5ième avenue
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Fax / Téléc: (819) 874-0360
E-mail: valdor@multilab-direct.com
Site web: www.multilab-direct.com

Multilab Val-d'Or

Certificat d'analyse

Numéro de projet : V-52584

Échantillon : Brine Fluid

Lieu de prélèvement : Brine Fluid

Date de prélèvement : 17 avril 2016

Heure de prélèvement : N/D

Paramètres	Résultats	Méthode d'analyse	Date d'analyse
Aluminium (Al)	0.498 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Antimoine (Sb)	0.0354 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Argent (Ag)	<0.0001 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Arsenic (As)	0.7662 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Baryum (Ba)	0.1126 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Béryllium (Be)	<0.0005 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Bicarbonate (HCO3)	27 mg CaCO3/L	M-TIT-1.0	19 avril 2016
Bismuth (Bi)	<0.0005 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Bore (B)	13.2 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Bromures	1066 mg/L	Sous-traitance\Multilab Direct	22 avril 2016
Cadmium (Cd)	<0.00002 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Calcium (Ca)	42266 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Carbone inorganique total (C.I.T.	2.1 mg/L	M-COT-1.0	19 avril 2016
Carbone organique total (C.O.T.)	28.5 mg/L	M-COT-1.0	19 avril 2016
Chlorure (Cl)	83700 mg/L	Sous-traitance\Multilab Direct	29 avril 2016
Chrome (Cr)	<0.0006 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Cobalt (Co)	0.0406 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Conductivité	55420 µmhos/cm	M-TIT-1.0	19 avril 2016
Cuivre (Cu)	0.0039 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Dureté	105554 mg CaCO3/L	Sous-traitance\Multilab Direct	20 avril 2016
Étain (Sn)	<0.001 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Fer (Fe)	2.60 mg/L	Sous-traitance\Multilab Direct	22 avril 2016
Fluorures (F)	0.06 mg/L	Sous-traitance\Multilab Direct	27 avril 2016
Lithium (Li)	34.52 mg/L	Sous-traitance\Multilab Direct	22 avril 2016
Magnésium (Mg)	3.92 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Manganèse (Mn)	<0.0005 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Mercure (Hg)	0.00039 mg/L	Sous-traitance\Multilab Direct	21 avril 2016
Molybdene (Mo)	<0.0005 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
NH3 (NH3 non-ionisé)	1.52 mg N/L	Sous-traitance\Multilab Direct	20 avril 2016
NH4	0.67 mg N/L	Sous-traitance\Multilab Direct	20 avril 2016
Nickel (Ni)	1.350 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Nitrates (NO3)	0.54 mg N/L	Sous-traitance\Multilab Direct	19 avril 2016
Nitrites (NO2)	0.06 mg N/L	Sous-traitance\Multilab Direct	21 avril 2016
pH	10.02	M-TIT-1.0	19 avril 2016
Plomb (Pb)	<0.0003 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Potassium (K)	1717 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Radium (RA 226)	<0.066 Becquerels/L	M-RA-2.0	02 mai 2016
Sélénium (Se)	3.83 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Silice (Si)	2.93 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Sodium (Na)	838 mg/L	Sous-traitance\Multilab Direct	20 avril 2016

Sauf indication contraire, tous les échantillons ont été reçus en bon état.

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F-02-06
Version 3ième: 26/10/2005

Multilab Val-d'Or

Certificat d'analyse

Numéro de projet : V-52584

Échantillon : Brine Fluid — Date de prélèvement : 17 avril 2016

Lieu de prélèvement : Brine Fluid — Heure de prélèvement : N/D

Paramètres	Résultats	Méthode d'analyse	Date d'analyse
Solides dissous	36946 mg/L	M-TIT-1.0	19 avril 2016
Solides totaux	149736 mg/L	M-SOLI-1.0	27 avril 2016
Strontium (Sr)	656 mg/L	Sous-traitance\Multilab Direct	22 avril 2016
Tellure (Te)	<0.0005 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Thallium (Tl)	<0.002 mg/L	Sous-traitance\Multilab Direct	22 avril 2016
Titane (Ti)	45.2 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Uranium (U)	<0.001 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Vanadium (V)	<0.0005 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Zinc (Zn)	<0.001 mg/L	Sous-traitance\Multilab Direct	20 avril 2016
Alcalinité	145 mg CaCO3/L	M-TIT-1.0	20 avril 2016
Sulfate (SO4)	<0.6 mg SO4/L	Sous-traitance\Multilab Direct	12 mai 2016

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Multilab Val-d'Or

Limite de détection rapportée

Numéro de projet : V-52584

Échantillon : Brine Fluid — Date de prélèvement : 17 avril 2016

Lieu de prélèvement : Brine Fluid — Heure de prélèvement : N/D

Paramètre	Valeur	Unité	Méthode	Accréditation
Aluminium (Al)	0.006	mg/L	Sous-traitance	
Antimoine (Sb)	0.0001	mg/L	Sous-traitance	Oui
Argent (Ag)	0.0001	mg/L	Sous-traitance	Oui
Arsenic (As)	0.0005	mg/L	Sous-traitance	Oui
Baryum (Ba)	0.0005	mg/L	Sous-traitance	Oui
Béryllium (Be)	0.0005	mg/L	Sous-traitance	
Bicarbonate (HCO3)	2	mg CaCO3/L	M-TIT-1.0	
Bismuth (Bi)	0.0005	mg/L	Sous-traitance	
Bore (B)	0.01	mg/L	Sous-traitance	Oui
Bromures	0.01	mg/L	Sous-traitance	
Cadmium (Cd)	0.00002	mg/L	Sous-traitance	Oui
Calcium (Ca)	0.03	mg/L	Sous-traitance	Oui
Carbone inorganique total (C.I.T.	0.2	mg/L	M-COT-1.0	--
Carbone organique total (C.O.T.)	0.2	mg/L	M-COT-1.0	Oui
Chlorure (Cl)	0.5	mg/L	Sous-traitance	Oui
Chrome (Cr)	0.0006	mg/L	Sous-traitance	Oui
Cobalt (Co)	0.0005	mg/L	Sous-traitance	
Conductivité	1	µmhos/cm	M-TIT-1.0	Oui
Cuivre (Cu)	0.0005	mg/L	Sous-traitance	Oui
Dureté	1	mg CaCO3/L	Sous-traitance	
Étain (Sn)	0.001	mg/L	Sous-traitance	Oui
Fer (Fe)	0.01	mg/L	Sous-traitance	Oui
Fluorures (F)	0.02	mg/L	Sous-traitance	Oui
Lithium (Li)	0.005	mg/L	Sous-traitance	
Magnésium (Mg)	0.02	mg/L	Sous-traitance	Oui
Manganèse (Mn)	0.0005	mg/L	Sous-traitance	Oui
Mercure (Hg)	0.00001	mg/L	Sous-traitance	Oui
Molybdene (Mo)	0.0005	mg/L	Sous-traitance	Oui
NH3 (NH3 non-ionisé)	0.01	mg N/L	Sous-traitance	-
NH4	0.01	mg N/L	Sous-traitance	-
Nickel (Ni)	0.0005	mg/L	Sous-traitance	Oui
Nitrates (NO3)	0.01	mg N/L	Sous-traitance	Oui
Nitrites (NO2)	0.01	mg N/L	Sous-traitance	Oui
pH			M-TIT-1.0	Oui
Plomb (Pb)	0.0003	mg/L	Sous-traitance	Oui
Potassium (K)	0.05	mg/L	Sous-traitance	
Radium (RA 226)	0.002	Becquerels/L	M-RA-2.0	Oui
Sélénium (Se)	0.001	mg/L	Sous-traitance	Oui
Silice (Si)	0.01	mg/L	Sous-traitance	
Sodium (Na)	0.05	mg/L	Sous-traitance	Oui

Sauf indication contraire, tous les échantillons ont été reçus en bon état.

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Multilab Val-d'Or

Limite de détection rapportée

Numéro de projet : V-52584

Échantillon : Brine Fluid

Lieu de prélèvement : Brine Fluid

Date de prélèvement : 17 avril 2016

Heure de prélèvement : N/D

Paramètre	Valeur	Unité	Méthode	Accréditation
Solides dissous	1	mg/L	M-TIT-1.0	
Solides totaux	2	mg/L	M-SOLI-1.0	Oui
Strontium (Sr)	0.005	mg/L	Sous-traitance	
Tellure (Te)	0.0005	mg/L	Sous-traitance	
Thallium (Tl)	0.002	mg/L	Sous-traitance	
Titane (Ti)	0.01	mg/L	Sous-traitance	
Uranium (U)	0.001	mg/L	Sous-traitance	
Vanadium (V)	0.0005	mg/L	Sous-traitance	Oui
Zinc (Zn)	0.001	mg/L	Sous-traitance	Oui
Alcalinité	2	mg CaCO3/L	M-TIT-1.0	
Sulfate (SO4)	0.6	mg SO4/L	Sous-traitance	Oui

Sauf indication contraire, tous les échantillons ont été reçus en bon état.

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Multilab Val-d'Or

Certificat contrôle qualité

Numéro de projet : V-52584

Échantillon :	Brine Fluid	Date de prélèvement :	17 avril 2016
Lieu de prélèvement :	Brine Fluid	Heure de prélèvement :	N/D

Paramètres		
Alcalinité mg CaCO3/L	Nom Standard	STD alcalinité
	Valeur obtenue	144
	Justesse	99.3%
	Intervalle	123 - 167
Aluminium (Al) mg/L	Blanc	<0.006
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	6.82
	Justesse	92.9%
	Intervalle	5.10 - 7.64
Antimoine (Sb) mg/L	Blanc	<0.0001
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	0.2049
	Justesse	92.3%
	Intervalle	0.178 - 0.266
Argent (Ag) mg/L	Blanc	<0.0001
	Nom Standard	DMR-0009-2016-Ag
	Valeur obtenue	0.6004
	Justesse	82.9%
	Intervalle	0.579 - 0.869
Arsenic (As) mg/L	Blanc	<0.0005
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	0.2700
	Justesse	95.4%
	Intervalle	0.198 - 0.368
Baryum (Ba) mg/L	Blanc	<0.0005
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	2.572
	Justesse	94.2%
	Intervalle	1.94 - 2.92
Béryllium (Be) mg/L	Blanc	<0.0005
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	1.900
	Justesse	88.2%
	Intervalle	1.36 - 2.04
Bismuth (Bi) mg/L	Blanc	<0.0005
Bore (B) mg/L	Blanc	<0.01
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	3.43
	Justesse	83.7%
	Intervalle	2.36 - 3.54

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Numéro de projet : V-52584

Échantillon : Brine Fluid — Date de prélèvement : 17 avril 2016

Lieu de prélèvement : Brine Fluid — Heure de prélèvement : N/D

Paramètres		
Bromures mg/L	Blanc	<0.01
	Nom Standard	DMR-0123-2016-Br
	Valeur obtenue	5.39
	Justesse	95.7%
	Intervalle	4.50 - 6.76
Cadmium (Cd) mg/L	Blanc	<0.00002
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	0.89802
	Justesse	99.8%
	Intervalle	0.720 - 1.080
Calcium (Ca) mg/L	Blanc	<0.03
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	17.1
	Justesse	98.3%
	Intervalle	13.9 - 20.9
Chlorure (Cl) mg/L	Blanc	<0.5
	Nom Standard	DMR-0175-2016-Cl
	Valeur obtenue	53.7
	Justesse	96.7%
	Intervalle	46 - 58
Chrome (Cr) mg/L	Blanc	<0.0006
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	4.115
	Justesse	98.4%
	Intervalle	3.24 - 4.86
Cobalt (Co) mg/L	Blanc	<0.0005
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	1.549
	Justesse	99.9%
	Intervalle	1.24 - 1.86
Conductivité µmhos/cm	Nom Standard	STD cond maison
	Valeur obtenue	1407
	Justesse	99.4%
	Intervalle	1203 - 1627
Cuivre (Cu) mg/L	Blanc	<0.0005
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	1.379
	Justesse	94.7%
	Intervalle	1.05 - 1.57
Étain (Sn) mg/L	Blanc	<0.001

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Certificat contrôle qualité

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Lieu de prélèvement : Brine Fluid | Heure de prélèvement : N/D

Paramètres		
Fer (Fe) mg/L	Blanc	<0.01
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	16.0
	Justesse	88.1%
	Intervalle	11.4 - 17.2
Lithium (Li) mg/L	Blanc	<0.005
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	0.827
	Justesse	97.8%
	Intervalle	0.677 - 1.015
Magnésium (Mg) mg/L	Blanc	<0.02
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	8.04
	Justesse	89.4%
	Intervalle	5.82 - 8.72
Manganèse (Mn) mg/L	Blanc	<0.0005
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	3.781
	Justesse	97.2%
	Intervalle	3.11 - 4.67
Mercure (Hg) mg/L	Blanc	<0.00001
	Nom Standard	DMR-0123-2016-HgEu
	Valeur obtenue	0.00062
	Justesse	93.9%
	Intervalle	0.00040 - 0.00092
Molybdene (Mo) mg/L	Blanc	<0.0005
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	0.6382
	Justesse	90.1%
	Intervalle	0.566 - 0.850
Nickel (Ni) mg/L	Blanc	<0.0005
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	1.110
	Justesse	98.2%
	Intervalle	0.90 - 1.36
Nitrates (NO3) mg N/L	Blanc	<0.01
Nitrites (NO2) mg N/L	Blanc	<0.01
	Nom Standard	DMR-0175-2016-NO2
	Valeur obtenue	1.97
	Justesse	97.5%

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Lieu de prélèvement : Brine Fluid — Heure de prélèvement : N/D

Paramètres		
	Intervalle	1.72 - 2.32
pH	Nom Standard	STD pH 7.0
	Valeur obtenue	7.01
	Justesse	99.9%
	Intervalle	6.96 - 7.04
Plomb (Pb) mg/L	Blanc	<0.0003
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	0.9397
	Justesse	96.6%
	Intervalle	0.727 - 1.091
Potassium (K) mg/L	Blanc	<0.05
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	20.2
	Justesse	89%
	Intervalle	14.6 - 21.8
Radium (RA 226) Becquerels/L	Blanc	<0.002
	Nom Standard	STD 45462
	Valeur obtenue	0.0700
	Justesse	85%
	Intervalle	0.0700 - 0.0948
Sélénium (Se) mg/L	Blanc	<0.001
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	1.33
	Justesse	98.5%
	Intervalle	1.08 - 1.62
Sodium (Na) mg/L	Blanc	<0.05
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	29.0
	Justesse	91%
	Intervalle	21.3 - 31.9
Solides totaux mg/L	Blanc	<2
	Nom Standard	DMR-0124-2016-3
	Valeur obtenue	289
	Justesse	99%
	Intervalle	243 - 329
Strontium (Sr) mg/L	Blanc	<0.005
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	1.25
	Justesse	97.7%
	Intervalle	1.02 - 1.54

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Lieu de prélèvement : Brine Fluid — Heure de prélèvement : N/D

Paramètres		
Sulfate (SO4) mg SO4/L	Blanc	<0.6
	Nom Standard	DMR-0175-2016-SO4
	Valeur obtenue	71.2
	Justesse	93.7%
	Intervalle	60.3 - 73.7
Tellure (Te) mg/L	Blanc	<0.0005
Thallium (Tl) mg/L	Blanc	<0.002
	Nom Standard	TI-S140909023-1000ppm
	Valeur obtenue	989
	Justesse	98.9%
	Intervalle	800 - 1200
Titane (Ti) mg/L	Blanc	<0.01
Uranium (U) mg/L	Blanc	<0.001
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	1.93
	Justesse	90.3%
	Intervalle	1.41 - 2.11
Vanadium (V) mg/L	Blanc	<0.0005
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	2.023
	Justesse	98.3%
	Intervalle	1.59 - 2.39
Zinc (Zn) mg/L	Blanc	<0.001
	Nom Standard	DMR-0009-2016-Eu
	Valeur obtenue	4.67
	Justesse	97.7%
	Intervalle	3.82 - 5.74

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Informations supplémentaires

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Échantillon : Brine Fluid

Lieu de prélèvement : Brine Fluid

Date de prélèvement : 17 avril 2016

Heure de prélèvement : N/D

Méthode laboratoire	Méthode de référence
M-MET-3.0	MA.200-Mét. 1.2
M-TIT-1.0	MA.303-Titr Auto 2.0
M-CL-2.0	MA.300-Ions 1.3
M-CI-1.0	MA.300-Anions 1.0
M-NITR-2.0	MA.300-NO3 2.0
M-RA-2.0	APHA 7500-Ra B et EPA P.13 (EMSL-CI)
M-SOLI-1.0	MA.104-S.S. 1.1
M-SULF-2.0	MA.300-Ions 1.3

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