

Appendix C.11

**Thor Lake Project – 2010 Phase I Site Investigation Results and Recommendations.
Report NB10-00556**

MEMORANDUM

To:	David Swisher	Date:	January 25, 2011
Copy To:	Bill Mercer	File No.:	NB101-390/2-A.01
From:	Cara Stapley	Cont. No.:	NB10-00556
Re:	Thor Lake Project - 2010 Phase I Site Investigation Results and Recommendations		

Introduction

This memorandum provides a summary of the Phase 1 site investigation for the Avalon Rare Metals Inc. (Avalon) Thor Lake Project site for the Nechalacho Mine. The results of the site investigation are presented and an updated site geotechnical assessment is provided taking into account previous work including desktop work completed for the Pre-feasibility Study. The findings from the *Environmental Baseline Report: Volume 4 – Terrain, Soils and Permafrost, Interim Report* by Stantec (Stantec, 2009) have also been correlated with the results from the KPL site investigation work, where applicable. Using this information, recommendations have been made for additional site investigations to confirm the geotechnical and permafrost conditions in specific project facility areas of interest for the Feasibility Study.

Phase 1 Site Investigation Methodology

The Phase I site investigation was completed by Knight Piésold (KPL) as part of the 2010 Feasibility Study assistance. Engineers from KPL were at the Project site from late June to early July, 2010 to characterize the surface conditions in relation to the proposed Tailings Management Facility (TMF) and related infrastructure, and included identifying/verifying exposed bedrock limits, near surface soil conditions and the presence and condition of permafrost, where possible.

The investigations focused on the following main regions of the Project site as shown on Figure 1:

- **Tailings Facility Construction Areas** – Including proposed dam areas for tailings basin and potential polishing pond, localized access road and pipeline routes
- **Tailings Access / Pipeline Corridor** – Including the proposed alignment of access road with tailings delivery and recycle water pipelines
- **Potential Excess Water Discharge Corridor** – Including alignment for potential excess water transfer pipeline from Drizzle to Thor Lake
- **Potential Local Borrow Areas** – Including areas with overburden within the Tailings Facility and adjacent to the Tailings Access / Pipeline Corridor

The KPL site investigations included site reconnaissance, hand excavated test probes and surficial bedrock outcrop mapping. The methodologies employed by KPL to assess the surficial conditions at the Thor Lake Site are described below. Motor boat, all-terrain vehicle, and foot access were used to travel in and around the Thor Lake project site. KPL was assisted by one of Avalon's First Nation's partners from the Lutsel K'e Dene.

An initial site reconnaissance program was undertaken between June 21 and 24 to review field conditions in various areas of the site. Information gathered from the initial site reconnaissance outings was used to develop a location plan for the proposed sub-surface probes. Handheld GPS tracks for the various site

reconnaissance outings completed are shown on Figure 2. Photos from the site reconnaissance outings are provided in Appendix A.

Sub-surface probes conducted in the main areas of the Project site were identified according to the general purpose/intent of the holes, summarized as follows:

- Pipeline Probe (PP) – for the assessment of conditions along the proposed access route to include tailings delivery and water reclaim pipelines, located along the Pipeline Corridor
- Tailings Probe (TP) – for probes used to assess conditions along access roads, dam alignments, and other ancillary works located in the TMF area
- Borrow Probe (BP) – for potential borrow source identification, located mainly in the TMF area and in the northern portion of the Pipeline Corridor

During the Phase I site investigation conducted by KPL, a total of 92 sub-surface probes were completed and their locations are shown on Figure 1. A shovel and hand-auger were used to probe the surficial soil conditions at each of the investigation sites. KPL conducted logging of the soil conditions in accordance with the Universal Soil Classification System (USCS). The presence of ground water, permafrost or bedrock was also reported if encountered. Details of the test probes for each general area are provided on Tables 1 to 3. Select photos taken during the completion of the test probes are provided in Appendix B.

Samples of near surface overburden soils were classified, bagged, and labelled for laboratory analysis. Selected soil samples from the test probes were delivered to EBA Engineering Consultants Ltd. (EBA) in Yellowknife, Northwest Territories. EBA conducted moisture content and grain size analyses on select samples as directed by KPL. Results of the EBA test work are provided in Appendix C.

Surficial bedrock outcrop mapping was conducted using two methods: 1) GPS waypoints were marked where transitions from rock outcrop to areas without rock exposure occurred, and 2) GPS tracking of the outer perimeter of the outcrops by traversing around the perimeter of the outcrop at the transition boundary. Numerous points of bedrock exposure were recorded across the entire Project site while large rock outcrops located to the south of Ring and Buck Lakes were assessed in detail for comparison with interpretation of satellite imagery.

Phase 1 Site Investigation Results

Site Reconnaissance

As noted above, an initial site reconnaissance program was undertaken to develop a general understanding of the ground conditions around the Thor Lake Flotation Concentrator Site between June 20 and June 24, 2010. This included traverses along proposed road and pipeline routes as well as walking the perimeter of the Tailings Management Facility as shown on Figure 2. Select photos taken during the site reconnaissance (and subsequent test probe / bedrock mapping outings) are shown in Appendix A, while locations of the photos are shown on Figure 2.

As result of the site reconnaissance, the following general comments are provided:

- The Rim Syenite forms a significant natural barrier along the north side of the proposed TMF within the Ring and Buck Lake Basin. Photos P1, P2, P3, P19, P22, P23, P24, P25, and P26 in

Appendix A provide views of the conditions along the Rim Syenite and looking into basin area from the Rim Syenite.

- The south side of the Ring and Buck Lake basin consists of mostly outcropping bedrock knobs with areas of relatively shallow overburden in between bedrock ridges. Photos P17, P27, P31, P32, P33, P34, P35, and P36 in Appendix A show exposures of bedrock within the area south of the Ring and Buck Lake basin.
- The shore lines around Ring and Buck Lakes varies from marshy (Photos P4 and P28 in Appendix A) to bedrock (Photos P29 and P31 in Appendix A). Based on the results of the reconnaissance and interpretation of satellite imagery, it is judged that the Ring and Buck Lake Basin is contained by bedrock.
- The outlet to the Ring and Buck Lake basin is to the southeast end of Buck Lake as shown on Photos P5, P21, and P22 in Appendix A. There was no distinctive channel found between Buck and Drizzle Lakes. It appears that drainage from Buck to Drizzle Lake occurs as surface flow/seepage through the vegetation.
- It is quite Marshy between Drizzle and Murky Lakes as shown in Photos P11 and P12 in Appendix A. A relatively shallow stagnant channel was found that connects the lakes at least during higher runoff periods.
- The south side of Murky Lake consists of mostly overburden (Photos P13, P14, P15, and P16) although a bedrock ridge was encountered at P14. In addition, a permafrost feature thought to be a Palsa was encountered as shown on Photo P15. A flowing stream was encountered connecting Murky Lake to Thor Lake.
- The proposed site for the Fresh Water Intake on the shore of Thor Lake is shown on Photo P37. The site consists of bedrock shoreline which should be suitable for the intake.
- Reconnaissance was conducted along the north portion of proposed access road and pipeline corridor between the Flotation Plant and the TMF on June 22 as shown on Figure 2. The proposed access road pipeline route follows the existing road to the T-Zone from the crossing at the outlet of Fred Lake and north of the bedrock ridge parallel to Cressy Lake. The proposed pipeline route will continue northeast where the road to the T-Zone turns north and continue through a slight trough between two bedrock outcrops until it reaches the southwest end of the TMF. Observations along the north portion of the route indicate that there is potential for borrow material (till) along the north side of the road (some existing borrow pits have been opened here for original road construction).
- The south portion of the proposed access road and pipeline corridor was inspected on June 24 as shown on Figure 2. Two potential alignments were considered as follows:
 - Follow existing road adjacent to Thor Lake which turns west and runs south of Fred Lake.
 - An alternative route turning north at the east end of the airstrip to stay away from Thor Lake and crossing the outflow from Fred Lake further west than the existing crossing. This alignment provides flatter grading and keeps the Pipeline route out of the Thor Lake watershed.

Sub-surface Probes

As noted above, sub-surface investigations were completed for the general areas of the Pipeline Corridor (PP), Tailings Management Facility (TP) and potential Borrow Sources (BP). The investigations were carried out primarily through the use of a shovel, hand-held auger and temperature probe. The sub-surface probes ranged in depth from 0.1 m to 2.0 m, with an average depth of 0.6 m.

The following provides a summary of the sub-surface probe results by project area, as shown on Figure 1.

Tailings Access / Pipeline Corridor

A total of 30 sub-surface probes were conducted along the proposed Pipeline corridor between the Flotation Plant Site Area and the TMF as described above. Results for the probes are summarized on Table 1 and summarized on Figure 3. Of the 30 probes completed, 18 were completed along the south portion of the corridor south of the Fred Lake outlet stream crossing and 12 were completed along the north portion of the corridor to the north of the Fred Lake outlet stream crossing.

South Portion

The south portion of the pipeline corridor extends from the proposed Flotation Plant site, northward to south of the stream crossing at the outlet from Fred Lake. The probes completed in this area were located directly south of the Plant Site Area and to the west of the existing road to the north of the airstrip where an alternative alignment for the pipeline corridor is being considered as noted above. In this area the ground is typically hummocky, with the exception of the flat area close to the Plant site location. The test probes ranged in depth from 0.3 to 1.8 m and encountered generally thick organic cover (greater than or equal to 0.3 m deep). The overburden was generally silt or silty sand with low plasticity (ML-SM). In all but one probe hole, permafrost was confirmed or suspected at depth. The water table was encountered at some locations. Samples were collected and tested from four probe holes and moisture content of the soil ranges from 17.4 to 21.8 %.

North Portion

The north portion of the pipeline corridor extends in a north-easterly direction from the stream crossing for the outlet from Fred Lake, towards the proposed Tailings Management Facility (TMF). The area is generally open with several rock outcrops and thin overburden cover. The probes completed in this area ranged in depth from 0.1 to 2.0 m and generally encountered limited organics (< 0.2 m) except for some low-lying areas with thicker organics (PP21 and PP28). Generally, the most north-easterly portion of the corridor consists of shallow overburden over bedrock with minimal organics. Where encountered, the overburden underlying the organics is silt/sand rich (SM) which included gravel and cobbles (till) at some locations (PP22, PP23, PP24). Permafrost was confirmed in one test probe, PP19, just north of the stream crossing. Most of the probe holes confirmed bedrock. The water table was intersected at PP24 only. Samples were collected and tested from four probe holes and moisture content of the soil ranges from 7.8 to 18.4 %.

Tailings Management Facility (TMF)

Investigations to date at the TMF include some condemnation drilling by Avalon during the 2009/2010 winter program and the sub-surface probe program by KPL in mid-2010. A total of 33 sub-surface probes were completed in areas where overburden is present within proposed infrastructure footprint areas associated with the TMF. Details of the probes for the TMF are provided on Table 2 while results are summarized on Figure 4.

Under-Lake Investigations

During the winter of 2009/2010, Avalon completed condemnation drillholes within the Ring and Buck Lake basin (L10-231, L10-233, L10-235 and L10-239 as per information provided in email from David Swisher on September 9, 2010). Two drillholes were completed at Ring Lake where 1 to 3.5 m of water/ice was encountered followed by 4.8 to 6 m of overburden. Two drillholes were completed at Buck Lake where 1 to 1.5 m of water/ice was found, followed by 4.9 to 8 m of overburden. The locations of these drillholes are shown on Figure 1.

Buck Lake Outlet Area

The Buck Lake outlet area is in the eastern portion of the TMF, to the southeast of Buck Lake. The area includes a swampy low lying area between a low southwest northeast trending bedrock ridge present to the north and south. The probes completed in this area ranged in depth from 0.4 to 1.0 m and encountered organics up to 0.5 m in depth overlying mostly silty soil (ML). The area was quite swampy and permafrost was confirmed or thought to likely occur in all but one of the probe holes conducted here. It was noted that TP3 was the only probe hole that encountered sandy material. The water table was encountered at TP1, TP2 and TP4. Samples were collected and tested from two probe holes and moisture content of the soil ranges from 11.4 to 21.3 %.

Decant Outlet Area

The decant outlet area is located south of Buck Lake in the TMF area and includes a corridor from a pond to the northwest to the north end of Drizzle Lake to the southeast. The probes completed in this area ranged in depth from 0.3 to 1.4 m and encountered a generally thin veneer of organic soil and overburden overlying shallow bedrock. Generally the soil underlying the organics was silty sand to sandy silt (SM-ML), with trace cobbles encountered at TP7. Permafrost was confirmed in TP12 within the peat near surface, and suspected within TP8 at a depth of 1.4 m. The water table was encountered at TP8 and TP11. One sample was collected and tested from this area, and it had a moisture content of 21 %.

North Saddle Area

The north saddle area is located on the north side of Ring Lake and includes a low area within the Rim Syenite. The probes completed in this area ranged in depth from 0.3 to 0.4 m, with thin organic cover at TP16 and thicker (>0.2 m) cover at the other locations. The overburden is sand/silt (SM) with some gravel. Permafrost was encountered at TP17 and TP18, and bedrock was encountered at TP16. The water table was not encountered in this area and no samples were tested from this region.

Permanent Polishing Pond Area

The permanent polishing pond area is located in the area southeast of the proposed TMF where the Polishing Pond embankments may be constructed (if necessary). This area is relatively low-lying and is surrounded by bedrock outcrops. The probes completed in this area ranged in depth from 0.3 to 0.8 m and encountered mainly thick (up to 0.7 m) organic cover, with thin organic veneers found in the vicinity of TP18(002) and TP19 only. The soil is mainly organic/silt-rich (OL-ML), with much peat encountered as well. All holes terminated in confirmed permafrost, except for TP19 which encountered bedrock at 0.8 m. The water table was encountered at TP24 only. One sample was collected and tested from this area, and it had a moisture content of 17.3 %.

Separator Dyke Area

The separator dyke area is located between Ring and Buck Lakes in the centre of the proposed TMF. During Phase 1 of operations of the TMF, a separator dyke will be constructed here to contain the tailings in Ring Lake. The area is swampy in places, with wetland surrounding two of the probe locations. The probes completed in this area ranged in depth from 0.2 to 0.7 m and encountered mainly organic soil (up to 0.7 m depth). At TP30 silt, some sand, with trace cobbles was found underlying organics. Permafrost was confirmed or likely in all but one probe hole, where bedrock was encountered (TP30). The water table was encountered at TP26 and TP28. No samples were tested from this region.

South Perimeter Area

The south perimeter area is located south of Ring Lake on the west side of Murky Lake, in the southwestern area of the proposed TMF. The area is open with sparse vegetation and occasional bedrock outcrops. The probes completed in this area ranged in depth from 0.4 to 1.7 m and encountered thick organic soil (up to 0.4 m) in the low-lying area (TP32) and a thin veneer of organics in the higher areas. The non-organic overburden was mainly silt and sand with some cobbles/gravel found at TP33. Permafrost was confirmed or likely in the holes completed in the low-lying areas (TP31 and TP32) and bedrock was encountered at TP33 and TP34. The water table was also encountered in the soil at TP34. Four samples were collected and submitted to laboratory testing from this region. The moisture content of the samples ranges from 7.2 to 21.9 %. One particle size analysis was completed for the soil in TP33 which revealed that the soil was sand and silt, gravelly, trace clay, with organic material.

Bedrock Outcrop Mapping

Large rock outcrops located to the south of Ring and Buck Lakes were mapped in detail to confirm satellite imagery interpretation. The findings from the KPL site investigation match closely with the bedrock mapping done previously from the satellite imagery analysis as shown on Figure 4. Based on the good agreement, bedrock outcrop mapping earlier conducted from satellite imagery is judged to be reasonably accurate.

Potential Borrow Areas

Potential borrow areas were identified and investigated in areas near the proposed project infrastructure. These areas were investigated using probe holes to gain an understanding of the type of overburden present. A total of 28 probe holes were completed in these areas. Details of the borrow area probes are provided on Table 3 and results summarized on Figures 3 and 4. The investigated areas have been divided into regions as discussed below.

South Ring Area

The south Ring area is located on the south side of Ring Lake in the interior of the proposed TMF. This area is open with some rock outcrops visible. The probes completed in this area ranged in depth from 0.3 to 1.7 m and encountered mainly thick (>0.3 m) organic soil, with a thin veneer of organics at BP4, BP7 and BP8. The soil underlying organics was mainly silt with some sand and cobbles found at BP4 and BP7. Permafrost was confirmed or likely in all but one probe hole, where suspected bedrock was encountered (at BP4). The water table was encountered at BP1, BP5 and BP6. One sample was collected and tested from this area, and it had a moisture content of 12.9 %.

North Ring Area

The north Ring area is located on the north side of Ring Lake in the interior of the proposed TMF. This is a low-lying area compared to the bedrock outcrops surrounding it. The probes completed in this area ranged in depth from 0.3 to 2.0 m and encountered mainly thin veneers of organics overlying sandy/silty soil (ML-SM). Permafrost was confirmed at two locations (BP9 and BP11A) and bedrock was encountered at BP10. The water table was found at BP12. One sample was collected and submitted to laboratory testing from this region. The moisture content of the sample is 12.5 % and a particle size analysis was completed for the soil in BP12 which revealed that the soil was sand and silt, trace gravel, trace clay, with organic material.

South Buck Area

The south Buck area is located on the south side of Buck Lake in the interior of the proposed TMF. The area is located in a densely wooded area. The probes completed in this area ranged in depth from 0.45 to 0.8 m and encountered a thin veneer of organic soil overlying mainly sandy soil. Permafrost was confirmed in two of the locations (BP15 and BP17), while bedrock was encountered at BP16. The water table was not encountered during these investigations. The material from BP16 was subjected to laboratory testing, indicating a moisture content of 12.6 % and a particle size description of sand and silt, some gravel, trace clay, with organic material.

East Buck Area

The east Buck area is located on the eastern side of Buck Lake in the interior of the proposed TMF. The area is low-lying and open with some bedrock outcrops visible. The two probes completed in this area ranged from 0.4 to 0.8 m depth and encountered thick organics (up to 0.4 m depth). The probe hole at BP19 encountered sandy/gravelly soil underlying organics, and permafrost was confirmed here. At BP20, organic soil was encountered only. The water table was not encountered during these investigations. One sample from BP19 was subject to laboratory testing and produced a moisture content of 15 %.

East Cressy Area

The east Cressy area is located on the northeast side of Cressy Lake, near the proposed pipeline corridor. This area has mixed topography with some forest stands and some open areas with bedrock outcrops. The probes completed in this area ranged in depth from 0.2 to 1.5 m and encountered some to no organic cover (0 to 0.4 m) overlying mainly sandy soils. Permafrost was confirmed or likely in four of the test holes (BP21, BP22, BP25 and BP26), while bedrock was encountered at one location (BP24). The water table was encountered at BP22. Two samples (BP26 and BP27) were submitted to laboratory testing and the moisture contents range from 6.5 to 16.9 %. Particle size analysis was conducted on the sample submitted from BP27 and revealed that the soil is classified as sand, some gravel, some fines, with organic material.

West Cressy Area

The west Cressy area is located on the northwest side of Cressy Lake, near the proposed pipeline corridor. This is a low lying area surrounded by bedrock outcrops. The probes completed in this area ranged from 0.2 to 0.4 m depth and encountered peat only. Permafrost was encountered at all three hole locations. The water table was encountered at BP28 and BP29. No samples were collected to be tested since these materials were primarily organic and deemed unsuitable to be used as borrow.

Suitability as Borrow Material

Generally speaking, the following should be considered when determining if overburden materials encountered are suitable for borrow:

- Physical nature of material – materials that are organic in nature are not suitable for fill material, fine grained inorganic soils may be suitable for general fills or low permeability type embankment zones while coarser grained soils may be suitable for zones where higher structural strength is required.
- Presence of permafrost – Typically materials that are frozen make poor borrow due to difficulty of excavation and potential for high ice or moisture content upon thawing.

- Presence of ground water – If the material is in a low lying area and saturated, it will not be good borrow.
- Depth and extents of deposit – Larger consistent deposits with depths greater than 1.5 m are more economical to utilize than smaller deposits of limited depth.

Based on the probe results discussed above, there were no deposits found that would be considered to be good borrow sources due to frequent presence of permafrost, groundwater and limited depths. Typically, areas containing fine grained soils occur in lower lying poorly drained areas with significant permafrost. Locations where coarser grained soils were found tend to be better drained and have less permafrost. The two most promising locations for potential borrow areas are the North Ring and East Cressy areas. In particular BP11 and BP12 at the North Ring area, and BP23 and BP27 at the East Cressy Area suggest the presence of permafrost free till. A sample of till from BP12 was found to consist of sandy silt with trace gravel and a moisture content of 12.6 percent, while a sample of till from BP27 had a moisture content of 6.5 Percent and consists of a sand with some silt and gravel.

Plant Site Area

The Plant and Camp Site location is relatively flat, with a significant amount of exposed bedrock as shown on Figure 3. The large outcrops of bedrock are partially covered by moss and sparse vegetation. The overburden deposits overlying the bedrock are expected to be quite thin, based on observations during the site visit and the general topography. Due to the relatively flat topography, the area is expected to include some marshy areas (with fine grained and organic soils) with poor drainage.

Three sub-surface probes completed for the Pipeline Corridor are near the Plant and Camp Site location. The two test probes to the north of the site encountered likely permafrost at depth. The test probe near the centre of the Plant and Camp Site location intersected shallow bedrock. One test probe (TP18(001)) at the eastern side of the site (shown as the East of Plant Site region on Figure 1) indicated the presence of shallow bedrock. A soil sample was collected from TP18(001) and subjected to laboratory testing, which yielded a moisture content of 12.2 %.

Phase 1 Site Investigations Summary

The following summarizes the general findings from the probing program:

- Peat or otherwise organic-laden soil was encountered in most areas located away from exposed bedrock. In many cases due to presence of permafrost, it was difficult to penetrate through the organic horizon to expose inorganic soil or bedrock. The organic layer was confirmed to range in thickness from 0.05 m to greater than 0.8 m.
- Silty sand (SM) and inorganic silt (ML) were the most common soil types encountered either in lieu of or below the organic soil. These materials tend to be deposited in low lying poorly drained areas and are likely glacial-lacustrine type deposits. Permafrost was generally associated with the glacio-lacustrine materials. Moisture contents (see Appendix C) ranged from 7.2 percent to 21.9 percent for this material.
- Glacial till and fluvial (washed till) type deposits were also found typically along higher sloped areas adjacent to bedrock ridges. Based on testing of selected samples (see Appendix C), this material ranges from a sandy silt with some gravel (till) to a sand with some silt and gravel (washed till). Moisture contents for the till are generally higher (11.4 to 12.6 percent) and lower for the washed till material (6.5 percent).

- Bedrock or suspected bedrock was encountered in 24 probe locations, primarily located in the northern portion of the Pipeline Corridor and throughout the TMF area. Areas where bedrock was encountered are indicated on Figures 3 and 4.
- Permafrost was suspected or confirmed at approximately 40% of the KPL test probe locations and was primarily encountered along the Pipeline Corridor, and discontinuously across the TMF area as shown on Figures 3 and 4.

Recommendations for Phase II Site Investigations

Based on the review of the available geotechnical information from the previous site investigations, and an inspection of the superficial ground conditions of the Project site, additional site investigations (Phase 2) are recommended to:

1. Confirm overburden conditions in proposed embankment footprint areas and at other significant infrastructure locations where bedrock was not confirmed during the Phase 1 program.
2. Characterize bedrock and hydrogeological conditions around the TMF basin including in-situ permeability testing and installation of monitoring wells to facilitate sampling and groundwater quality testing.

The following outlines the recommended Phase 2 site investigation techniques.

Phase 2 Drilling

Drilling should be conducted to investigate the sub-surface conditions at the planned locations of various infrastructure (i.e. buildings, embankments, crossings, etc) and at potential borrow and quarry sites. The purpose of the drilling is to:

- Confirm presence of permafrost at depth.
- Collect representative samples to confirm permafrost ice content/characteristics and overburden depth and composition (both permafrost and non-permafrost).
- Perform SPT tests in non-permafrost soils.
- Confirm the depth to bedrock and quality of bedrock.
- Install instrumentation as required in select drillholes (i.e. thermistors, standpipes/piezometers).
- Perform hydrogeological classification of bedrock (i.e. packer testing).

It is recommended that drilling be carried out using methods to ensure the collection of representative soil samples in permafrost. If a regular diamond drill is to be used, and the use of refrigerated brine is not possible, it is recommended that all drilling take place during the winter months using cold water. Standard Penetration Tests (SPT) should be conducted wherever possible (i.e. non-permafrost soils), particularly where recovery of representative soil samples for index testing is required.

Proposed Phase 2 Drilling Program Details

The following summarizes the drillholes recommended for Phase II site investigations during early 2011:

Tailings Management Facility

- Seven (7) geotechnical drillholes within the TMF perimeter embankment areas to determine depth to bedrock and overburden materials present. Proposed geotechnical drillhole locations are

shown on Figure 5. Thermistors should be installed to characterize permafrost depths where present.

- Six (6) hydrogeological drillholes to characterize hydrogeological conditions and for installation of groundwater monitoring wells.

Pipeline Corridor(s)

- Two (2) geotechnical drillholes near the crossing downstream of Fred Lake to characterize overburden foundation conditions for design of the crossing.

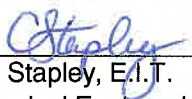
Plant and Camp Location

- Two (2) geotechnical drillholes at the proposed Flotation Plant and Fuel Storage areas, where bedrock is not exposed at surface.
- One (1) hydrogeological drillhole to characterize hydrogeological conditions and for installation of a groundwater monitoring well.

It is recommended that thermistors be installed to collect information on the thermal regime at the TMF area and Plant Site area. It is recommended that at least one thermistor be installed at the Plant Site location and 3 to 4 thermistors be installed in the TMF area. These should be installed in select drillholes and in locations to cover the range of conditions present. The thermistors should be monitored regularly following installation.

Upon your review of the information provided herein, we would be pleased to discuss any comments you may have and the details of the proposed Phase 2 Program.

Signed:


Cara Stapley, E.I.T.
Geological Engineering

Approved:


Matthew Parfitt, P.Eng.
Project Manager



References:

1. Stantec, Environmental Baseline Report: Volume 4 – Terrain, Soils and Permafrost, Interim Report, December 23, 2009.
2. Trupak, N. G., Construction of earth dams on permafrost soils, Journal Power Technology and Engineering (formerly Hydrotechnical Construction), Springer New York, Volume 4, Number 9, September, 1970
3. Biyanov G. F., Experience in construction and operation of low-head dams on permafrost soils, Journal Power Technology and Engineering (formerly Hydrotechnical Construction), Springer New York, Volume 4, Number 9, September, 1970

Attachments:

Table 1 Rev 0	Thor Lake Site - Pipeline Probe Investigations
Table 2 Rev 0	Thor Lake Site - Tailings Probe Investigations
Table 3 Rev 0	Thor Lake Site - Borrow Probe Investigations
Figure 1 Rev 0	Phase 1 Site Investigation Program – Test Probe Plan

Figure 2 Rev 0	Phase 1 Site Investigation Program – Site Reconnaissance Plan
Figure 3 Rev 0	Phase 1 Site Investigation Program – Pipeline Route and Plant Site Plan
Figure 4 Rev 0	Phase 1 Site Investigation Program – Tailings Management Facility Plan
Figure 5 Rev 0	Proposed Phase 2 Site Investigation Program – Drillhole Locations Plan
Appendix A	Site Reconnaissance Photos
Appendix B	Test Probe Photos
Appendix C	Laboratory Testing Results

/cls

TABLE 1
AVALON RARE METALS INC.
THOR LAKE PROJECT
THOR LAKE SITE
PIPELINE PROBE INVESTIGATIONS

Region Name	Pipeline Probe Name	Coordinates		Elevation (m)	Total Depth [m]	Depth of Organics [m]	Completion Date	Location Description	Base Soil Description	Permafrost Present	Water Table Encountered	Notes	Samples	Laboratory Testing Performed
		Easting	Northing											
South Portion	PP1	415,540	6,887,097	235	0.4	0.3	24-Jun	•Hummocky moss; near open water	Low plasticity silt (ML), some cobbles, light brown, moist	Confirmed		Permafrost	0.35 m - 0.4 m	
	PP2	415,507	6,887,054	237	0.35	0.1	24-Jun	•Broken, hummocky ground-bog grass and peat, sparse black spruce and shrubbery •North side of haul road, west of creek	Silt (ML), light brown, frozen	Confirmed		Permafrost		
	PP3	415,560	6,886,896	239	0.4	0.3	24-Jun	•Spongy, hummocky moss •Sparse black spruce and low shrubbery •30 m from haul road	Silt (ML), light brown, frozen	Confirmed	Yes	Permafrost	0.3 m - 0.4 m	
	PP4	415,500	6,887,145	237	0.35	0.15	24-Jun	•Hummocky, mossy area with stunted black spruce- well spread •Stagnant water 2 m away from test pit	Low plasticity silt (ML), light brown, moist. Ice at base of hole	Confirmed	Yes	Permafrost	0.2 m - 0.3 m	
	PP5	415,618	6,886,953	239	1.1	0.2	24-Jun	•Hummocky moss, broken areas at surface •Sparse black spruce and low shrubbery •15-20 m south of rock outcrop	Silt (ML/MH), somewhat plastic, light brown, moist	Likely		Likely permafrost at depth		
	PP6	415,459	6,887,038	237	0.3	0.3	29-Jun	•Hummocky moist moss, spongy ground •Thinned out spruce	Peat (Pt), fibrous, black, saturated	Confirmed	Yes	Permafrost		
	PP7	415,420	6,886,935	239	0.7	0.12	29-Jun	•Hummocky, damp moss •Well-thinned forest with black spruce to 10-15 cm diameter •Limited understory vegetation (Labrador tea) •South facing rock outcrop ~10 m north of the site	ML, low to moderate plasticity, moist	Likely		Likely permafrost at depth	0.3 m - 0.6 m	Moisture Content
	PP8	415,495	6,886,919	239	0.5	0.1	29-Jun	•Hummocky ground; mossy, wet to south of probe location •Thin tree cover	ML, trace sand, low plasticity, light brown, moist	Confirmed		Permafrost		
	PP9	415,475	6,886,842	239	0.5	0.45	29-Jun	•Hummocky area •Lots of deadfall •Thin tree cover (black spruce)	ML, light brown, frozen	Confirmed		Permafrost		
	PP10	415,410	6,886,851	239	0.4	0.1	29-Jun	•Hummocky area, mossy, spongy •Thin tree cover-black spruce •Willow/Labrador tea/Leather leaf in area	ML/MH, moderate plasticity, light brown, soft, wet to saturated	Likely	Yes	Likely permafrost at depth	0.2 - 0.4 m	
	PP11	415,520	6,886,784	241	0.8	0.12	29-Jun	•Hummocky mossy terrain, spongy •10-15 m north of small rock outcrop •Thin black spruce trees to 8 cm diameter •Minimal low shrub	SM-ML, low plasticity, light brown, moist to SM, light brown, loose to compact, moist	Likely		Likely permafrost at depth	0.2 m - 0.3 m	
	PP12	415,447	6,886,771	241	0.4	0.15	29-Jun	•Hummocky mossy area, spongy terrain	ML, some sand, low to moderate plasticity, firm, moist	Confirmed		Permafrost	0.2 m - 0.4 m	
	PP13	415,362	6,886,673	243	0.7	0.1	29-Jun	•Flat wooded area (black spruce) •North of rock outcrop •Little understory vegetation	SM, light brown, compact, moist	Confirmed		Permafrost	0.5 m - 0.7 m	Moisture Content
	PP14	415,352	6,886,501	241	0.5	0.5	29-Jun	•South of quad trail •Open-flat terrain •Well-spaced black spruce	Mixed OL+ML, low plasticity, light brown, saturated	Confirmed	Yes	Permafrost		
	PP15	415,309	6,886,430	243	1.8	0.3	29-Jun	•4-5 m west of quad trail •Hummocky/spongy area •Well-spaced black spruce •Limited bunches of willow and Labrador tea	ML-SM, non to low plasticity, light brown, soft to firm, saturated	Likely	Yes	Likely permafrost at depth	1.4 m - 1.6 m	Moisture Content
	PP16	415,270	6,886,237	251	0.5	0.3	29-Jun	•Hummocky area, moss, open water •Mostly sparse tree cover, some black spruce •Little low vegetation	SM, saturated	Likely	Yes	Likely permafrost at depth		
	PP17	415,304	6,886,127	253	1.1	0.1	29-Jun	•Flat area •Thin trees (black spruce) •Willow and Labrador tea in area	SM-ML, non to low plasticity, light brown SM, light brown, compact, moist	Likely		Likely permafrost at depth	0.8 m - 0.9 m	Moisture Content

TABLE 1
AVALON RARE METALS INC.
THOR LAKE PROJECT
THOR LAKE SITE
PIPELINE PROBE INVESTIGATIONS

Region Name	Pipeline Probe Name	Coordinates		Elevation (m)	Total Depth [m]	Depth of Organics [m]	Completion Date	Location Description	Base Soil Description	Permafrost Present	Water Table Encountered	Notes	Samples	Laboratory Testing Performed
		Easting	Northing											
	PP18	415,244	6,885,888	257	0.45	0.3	29-Jun		SM, some cobbles, light brown, wet to saturated		Yes	Bedrock		
North Portion	PP19	415,558	6,887,242	241	0.3	0.2	29-Jun	<ul style="list-style-type: none"> Thinned out stand of black spruce Labrador tea and willow understorey 8 m south of rock outcrop 	ML, low-plasticity, light brown, frozen	Confirmed		Permafrost		
	PP20	415,669	6,887,294	246	0.6	0.02	29-Jun	<ul style="list-style-type: none"> Relatively open area ~4 m south of quad trail Well-thinned black spruce White lichen and moss floor Labrador tea present 	SM, some gravel, trace cobbles, light brown to ML, some sand, non-plastic, tan-brown, firm, dry			Bedrock	0.4 m - 0.6 m	
	PP21	415,706	6,887,418	245	2	0.8	28-Jun	<ul style="list-style-type: none"> Open hummocky moss Sparse, low shrubbery and occasional small diameter trees 10-15 m north of quad track 	SW, some silt, compact, light brown, moist to ML-MH, some sand, moderate plasticity, firm to stiff	Possible			1.4 m - 2.0 m	Moisture Content
	PP22	415,801	6,887,477	249	1.2	0.02	28-Jun	<ul style="list-style-type: none"> 25 m from haul road Mossy clearing; dry yellow-white moss Some spruce to 20 cm diameter 	SM, many cobbles, some gravel, light brown, compact, moist	Possible			0.8 m - 1.1 m	Moisture Content
	PP23	415,866	6,887,567	250	0.6	0.2	28-Jun	<ul style="list-style-type: none"> North of haul road and bedrock outcrop Wet low area to north, many horsetails under tree canopy 	SM, some gravel, red-brown, compact, moist			Bedrock	0.2 m - 0.6 m	Moisture Content
	PP24	416,337	6,887,903	257	0.6	0.05	28-Jun	<ul style="list-style-type: none"> 4-5 m south of rock outcrop Hummocky green moss Well spaced black spruce Some low shrubbery 	SM, some gravel, trace cobbles, compact, saturated		Yes	Likely bedrock	0.4 m - 0.6 m	Moisture Content
	PP25	416,423	6,887,937	259	0.1	0.05	28-Jun	<ul style="list-style-type: none"> Open rocky area Located to south of bedrock outcrop 	Organic soil (OL), moss			Bedrock		
	PP26	416,536	6,887,982	262	0.25	0.25	28-Jun	<ul style="list-style-type: none"> Mossy, flat, dry Rocky terraces on south-facing slope Some mature timber 	Organic soil (OL), moss			Bedrock		
	PP27	416,680	6,888,004	258	0.3	0.15	28-Jun	<ul style="list-style-type: none"> Rocky terraces on south-facing slope Some mature timber 	SM, trace gravel, compact, light brown, moist			Bedrock	0.15 m - 0.3 m	
	PP28	416,812	6,888,113	249	0.6	0.6	28-Jun	<ul style="list-style-type: none"> Open area ~ 5 m east of haul road Some large diameter spruce (400 mm diameter) and poplars well spaced Rock outcrop 10 m to the east 	Organic soil (OL), fibrous, dark brown, moist			Bedrock		
	PP29	416,898	6,888,169	255	0.4	0.03	28-Jun	<ul style="list-style-type: none"> Rocky plateau Well-spaced spruce to 20 cm diameter Some low rock vegetation (ie. Juniper) Occasional poplars 	SM, some gravel, trace cobbles, compact, moist			Bedrock	0.03 m - 0.4 m	
	PP30	416,972	6,888,203	257	0.25	0.02	28-Jun	<ul style="list-style-type: none"> Vegetated area on elevated rock terrace Black spruce to 15 cm diameter Some low understorey vegetation 	SM, some gravel, roots throughout, compact, light brown, moist			Bedrock	0.02 m - 0.25 m	

I:\1101\00390\02\A\Correspondence\NB10-00556 - Phase 1 and 2 SI\Tables 1-3.xlsx|Table 1

1. THE COORDINATES PRESENTED WERE COLLECTED USING HAND-HELD GPS IN DATUM WGS84, ZONE 12.
2. LABORATORY TEST RESULTS ARE PROVIDED IN APPENDIX A.

REV	DATE	DESCRIPTION	PREP'D	CHECK'D	APP'D
0	25JAN11	ISSUED WITH MEMO NB10-00556	CMA	CLS	MSP

TABLE 2
AVALON RARE METALS INC.
THOR LAKE PROJECT
THOR LAKE SITE
TAILINGS PROBE INVESTIGATIONS

Region Name	Tailings Probe Name	Coordinates		Elevation (m)	Total Depth [m]	Depth of Organics [m]	Completion Date	Location Description	Base Soil Description	Permafrost Present	Water Table Encountered	Notes	Samples	Laboratory Testing Performed
		Easting	Northing											
Buck Lake Outlet Area	TP1	418,471	6,889,076	247	1	0.5	25-Jun	<ul style="list-style-type: none"> Swamp with open standing water Horse tails and muck Swamp, suspected flood zone from lake 	ML, light brown, saturated	Likely	Yes	Swamp	0.3 m - 0.5 m	
	TP2	418,510	6,889,054	245	0.4	0.4	25-Jun	<ul style="list-style-type: none"> Numerous channel braids and standing water Hummocky with grass and cattails Semi-dense black spruce 	Organic soil (OL), black, saturated	Likely	Yes	Swamp		
	TP3	418,602	6,889,090	246	0.65	0.05	25-Jun	<ul style="list-style-type: none"> Open patch amidst dense black spruce Mossy cover on ground, some dessicated and broken 	SM with gravel, trace cobbles, root throughout, compact			Possible till source	0.4 m - 0.6 m	Moisture Content
	TP4	418,506	6,889,114	247	0.4	0.3	25-Jun	<ul style="list-style-type: none"> Swamp fringe Standing water, hummocky 	ML, frozen	Confirmed	Yes	Swamp		
	TP6	418,570	6,889,191	249	0.9	0.2	25-Jun	<ul style="list-style-type: none"> East side of Buck Lake South of major rocky ridge Sparse black spruce and low shrubbery Moss matting 	ML, low plasticity, light brown, moist to frozen	Confirmed		Permafrost	0.8 m - 0.9 m	Moisture Content
Decant Outlet Area	TP7	418,147	6,888,975	248	0.45	0.3	26-Jun	<ul style="list-style-type: none"> Dense stand of black spruce Mossy forest floor 10 m south of rock outcrop 	ML, trace cobbles, trace sand, non-plastic			Bedrock	0.3 m - 0.45 m	
	TP8	417,993	6,888,894	249	1.4	0.15	23-Jun	<ul style="list-style-type: none"> Hummocky, spongy surface Sparse pine snags 	SM, some sand, light brown, soft, saturated	Likely	Yes		1 m - 1.4 m	Moisture Content
	TP9	418,023	6,888,943	249	0.7	0.05	23-Jun	<ul style="list-style-type: none"> Dry at surface Jack pines in area 	Sandy silt (SM), some gravel, light brown, moist			Bedrock		
	TP10	418,063	6,888,896	246	1.1	0.1	23-Jun	<ul style="list-style-type: none"> Hummocky with sparse vegetation Some nearby boulders at surface 	Silty sand (SM), plastic, light brown, soft to firm			Bedrock		
	TP11	417,940	6,888,900	249	0.5	0.08	23-Jun	<ul style="list-style-type: none"> Hummocky moss in sparse jack pine 	Silt, trace sand (SM), brown, saturated		Yes	Bedrock	0.4 m - 0.5 m	
	TP12	418,181	6,888,886	245	0.3	0.3	26-Jun	<ul style="list-style-type: none"> Hummocky moss meadow Sparse low vegetation and trees (black spruce) 	Peat (Pt), decaying wood matter, reddish to dark brown, moist	Confirmed		Permafrost		
North Saddle Area	TP16	417,216	6,889,152	249	0.4	0.05	24-Jun	<ul style="list-style-type: none"> Rock outcrop to north, likely small pocket of till Stand of black spruce to south Limited vegetation at TP site 	SM, some cobbles, some gravel, some silt, reddish brown, dry			Bedrock	0.2 m - 0.4 m	
	TP17	417,277	6,889,162	251	0.4	0.2	24-Jun	<ul style="list-style-type: none"> Small opening in a stand of black spruce, small shrubbery Mossy mat on surface 25 m south of rock outcrop 	Silt, some gravel (SM), red-brown, compact, moist	Confirmed		Permafrost	0.2 m - 0.4 m	
	TP18	417,234	6,889,123	249	0.3	0.3	24-Jun	<ul style="list-style-type: none"> Hummocky moss; rock outcrop 20 m to northwest Sparse black spruce and low shrubbery in area Spongy surface at TP 	Organic soil, with roots, black	Confirmed		Permafrost		
	TP13	418,348	6,888,893	245	0.3	0.3	26-Jun	<ul style="list-style-type: none"> Open area meadow 15 m southeast of bedrock outcrop 	Peat (Pt), with ice, frozen	Confirmed		Permafrost		

TABLE 2
AVALON RARE METALS INC.
THOR LAKE PROJECT
THOR LAKE SITE
TAILINGS PROBE INVESTIGATIONS

Region Name	Tailings Probe Name	Coordinates		Elevation (m)	Total Depth [m]	Depth of Organics [m]	Completion Date	Location Description	Base Soil Description	Permafrost Present	Water Table Encountered	Notes	Samples	Laboratory Testing Performed
		Easting	Northing											
Permanent Polishing Pond Area	TP18 (002)	418,347	6,888,977	247	0.7	0.03	26-Jun	<ul style="list-style-type: none"> • 8 m south of bedrock outcrop • Stand of black spruce of moderate density • Moss mat on floor 	Silt (ML), trace sand, low plasticity, light brown, firm, moist	Confirmed		Permafrost		
	TP19	418,375	6,888,940	245	0.8	0.02	26-Jun	<ul style="list-style-type: none"> • 5 m from rock outcrop • Dense black spruce • Minimal understory vegetation • Moss mat 	Silt (ML), some sand, low plasticity, firm			Likely bedrock		
	TP19 (001)	418,377	6,888,828	245	0.3	0.3	25-Jun	<ul style="list-style-type: none"> • Hummocky moss • Broken with water • Sparse trees (black spruce) • Boggy 	Peat (Pt), moist	Confirmed		Permafrost		
	TP20	418,407	6,888,787	245	0.5	0.5	25-Jun	<ul style="list-style-type: none"> • Hummocky dessicated moss (yellow and white), spongy • Sparse trees and low vegetation 	Peat (Pt), light brown, frozen	Confirmed		Permafrost		
	TP21	418,440	6,888,685	249	0.6	0.3	25-Jun	<ul style="list-style-type: none"> • Dense stand of black spruce • Many snags • Mossy forest floor • 15 m south of rock outcrop 	ML/SM, reddish brown, frozen	Confirmed		Permafrost	0.4 m - 0.6 m	Moisture Content
	TP22	418,329	6,888,575	245	0.6	0.6	25-Jun	<ul style="list-style-type: none"> • Hummocky dessicated moss • Yellow and white moss meadow • Sparse trees (black spruce) and low vegetation 	Organic silt (OL), non-plastic, dark brown, frozen	Confirmed		Permafrost		
	TP23	418,266	6,888,577	245	0.6	0.6	25-Jun	<ul style="list-style-type: none"> • Hummocky, dessicated moss • Yellow and white moss meadow • Sparse trees and shrubs 	Organic peat (Pt), silt inclusions, red-brown, frozen	Confirmed		Permafrost		
	TP24	418,205	6,888,532	245	0.7	0.7	25-Jun	<ul style="list-style-type: none"> • Hummocky moss area, spongy • Dessicated and broken on surface • Sparse vegetation 	Organic soil (OL), some silt inclusions, dark brown, frozen	Confirmed	Yes	Permafrost		
	TP25	418,123	6,888,508	245	0.6	0.6	25-Jun	<ul style="list-style-type: none"> • Hummocky moss area, spongy • Sparse black spruce and low vegetation • Rock outcrop ~ 15-20 m to west 	ML with organic soil, reddish brown, wet	Confirmed		ML w/ organic inclusions		
Separator Dyke Area	TP26	417,577	6,888,953	247	0.5	0.02	27-Jun	<ul style="list-style-type: none"> • Boggy area • 25 m south of rock outcrop • Spongy, hummocky surface 	Organic peat (Pt), black, wet	Confirmed	Yes			
	TP27	417,615	6,888,915	247	0.7	0.7	27-Jun	<ul style="list-style-type: none"> • Open wetland, east of Ring Lake • Broken hummocks • Open water • Grass and willow in area 	Peat (Pt), black, wet	Likely		Wetland area		
	TP28	417,616	6,888,872	247	0.4	0.4	27-Jun	<ul style="list-style-type: none"> • Wetland/ bog fringe • Near creek between Buck Lake and Ring Lake • 20 m east of Ring Lake 	Peat (Pt), black, saturated	Confirmed	Yes	Wetland area		

TABLE 2
AVALON RARE METALS INC.
THOR LAKE PROJECT
THOR LAKE SITE
TAILINGS PROBE INVESTIGATIONS

Region Name	Tailings Probe Name	Coordinates		Elevation (m)	Total Depth [m]	Depth of Organics [m]	Completion Date	Location Description	Base Soil Description	Permafrost Present	Water Table Encountered	Notes	Samples	Laboratory Testing Performed
		Easting	Northing											
	TP29	417,596	6,888,979	247	0.2	0.2	27-Jun	●Hummocky ●Wet bog ●15 m from rock outcrop	Peat (Pt), frozen	Confirmed				
	TP30	417,656	6,888,817	249	0.5	0.03	27-Jun	●Immediately north of a rock outcrop (mapped) ●Southeast of Ring Lake ●Stand of black spruce ●Dry mossy forest floor	ML, some sand, trace cobbles, roots throughout, non to low plasticity, light brown, firm, moist			Bedrock; possible borrow	0.3 m - 0.5 m	
Ring South Perimeter Area	TP31	417,860	6,888,472	251	0.8	0.04	27-Jun	●Dense stand of black spruce ●30-40 m north of bedrock outcrop ●Some understory vegetation ●Mossy forest floor	Silt (ML), some sand, low plasticity, soft	Likely			0.6 m - 0.8 m	Moisture Content
	TP32	417,290	6,888,154	256	0.4	0.4	27-Jun	●Very dense spruce, many snags ●Open mossy area at TP ●Some understory shrubbery	Organic soil (OL), black, moist	Confirmed				
	TP33	417,539	6,888,221	255	0.5	0.05	26-Jun	●Dense stand of black spruce ●Many snags ●Little understory vegetation ●Moss mat on floor	SM, some cobbles, trace gravel,			Bedrock; possible borrow	0.4 m - 0.5 m	Particle Size Analysis Moisture Content
	TP34	417,059	6,888,187	255	1.7	0.1	28-Jun	●5 m south of west quad track to Ring Lake ●Track runs between two higher elevation rock outcrops ●Open with some low vegetation	ML, some sand, low plasticity, soft to firm, light brown		Yes	Likely bedrock	0.3 m - 0.7 m	Moisture Content
								SM, non-plastic, firm, light brown, saturated	1.6 m - 1.7 m				Moisture Content	
East of Plant Site	TP18 (001)	415,802	6,885,978	256	0.5	0.02	29-Jun	●Open rolling rock with moss ●Sparse vegetation	SM, some gravel, light brown, compact, moist			Bedrock	0.3 m - 0.5 m	Moisture Content

I:\1\01\00390\02\A\Correspondence\NB10-00556 - Phase 1 and 2 SI\Tables 1-3.xlsx\Table 2

NOTES:

1. THE COORDINATES PRESENTED WERE COLLECTED USING HAND-HELD GPS IN DATUM WGS84, ZONE 12.
2. LABORATORY TEST RESULTS ARE PROVIDED IN APPENDIX A.

0	25JAN11	ISSUED WITH MEMO NB10-00556	CMA	CLS	MRP
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APPD

TABLE 3
AVALON RARE METALS INC.
THOR LAKE PROJECT
THOR LAKE SITE
BORROW PROBE INVESTIGATIONS

Region Name	Borrow Probe Name	Coordinates		Elevation (m)	Total Depth [m]	Depth of Organics [m]	Completion Date	Location Description	Base Soil Description	Permafrost Present	Water Table Encountered	Notes	Samples	Laboratory Testing Performed
		Easting	Northing											
South Ring Area	BP1	417,087	6,888,346	249	0.4	0.4	27-Jun	●Adjacent to cut path to Ring Lake ●Dense black spruce ●Hummocky moss in open areas	Organic soil (OL), black, moss cap, saturated	Confirmed	Yes	Not borrow candidate		
	BP2	417,142	6,888,291	253	0.3	0.3	27-Jun	●Gently sloping (south to north) area ●Thin spruce (small diameter) ●Open dessicated moss floor ●Minor understory vegetation	ML, light brown, frozen	Confirmed		Possible borrow source		
	BP3	417,335	6,888,353	250	0.5	0.5	27-Jun	●Hummocky area, moss ●Thin vegetation- some spruce and understory vegetation	Peat (Pt), frozen	Confirmed		Not borrow candidate		
	BP4	417,481	6,888,344	251	1.7	0.08	26-Jun	●Open area in thin stand of black spruce ●Dry moss at surface ●Some understory shrubs nearby	ML, some sand, trace cobbles, low plasticity, moist to wet			Likely bedrock	0.4 m - 0.6 m	
									ML, some sand, some cobbles, low plasticity, moist to wet				1.1 m - 1.2 m	Moisture Content
	BP5	417,726	6,888,364	251	0.7	0.7	27-Jun	●Hummocky; some pockets of open water ●Sparse tree cover (black spruce) ●Dense low vegetation and small trees	Peat (Pt), black, saturated	Likely	Yes			
	BP6	417,603	6,888,404	249	0.6	0.3	26-Jun	●Hummocky moss, spongy ●Numerous areas with open water ●Well-spaced black spruce ●Frequent-low shrubbery	Silt (ML/MH), plastic, light brown, saturated	Likely	Yes		0.3 m - 0.6 m	
	BP7	417,650	6,888,548	251	0.6	0.02	26-Jun	●Dense black spruce ●Some understory shrubbery ●Dry moss mat on forest floor	ML, some sand, trace cobbles, non-plastic, firm	Likely			0.3 m - 0.5 m	
BP8	417,650	6,888,643	251	1.0	0.03	26-Jun	●Dense black spruce ●Some understory vegetation ●Dry, mossy forest floor ●10 m south of rock outcrop	ML, low-plasticity, some and, light brown, stiff, moist	Likely					
North Ring Area	BP9	417,284	6,889,051	249	0.3	0.3	24-Jun	●Mossy area with sparse vegetation ●20 m south of rock outcrop	Organic soil (OL), black	Confirmed		Refusal due to permafrost; not likely good borrow		
	BP10	417,477	6,889,008	249	0.6	0.03	27-Jun	●5 m northwest of bedrock outcrop ●Fringe of black spruce stand ●Limited understory vegetation ●Number of exposed boulders in area	ML/SM, trace cobbles, non-plastic, light brown, compact, moist			Likely bedrock	0.4 m - 0.6 m	
	BP11	417,512	6,889,052	250	0.6	0.05	24-Jun	●Dense black spruce, many snags ●Hummocky moss mat on ground	SM, some gravel, brown, moist			Potential borrow	0.5 m - 0.6 m	
	BP11(A)	417,518	6,889,038	250	0.8	0.03	27-Jun	●20 m south of bedrock outcrop ●Dense black spruce; moss mat ●Minimal understory vegetation	ML, trace cobbles, low-plasticity, light brown, firm, moist	Confirmed		Permafrost	0.6 m - 0.8 m	
	BP12	417,468	6,889,134	249	2.0	0.05	24-Jun	●Stand of black spruce ●Spongy moss matting ●Near local wet area	Sandy silt (SM), trace gravel, reddish brown, saturated		Yes	Potential borrow	0.9 m	Particle Size Analysis Moisture Content
South Buck Area	BP15	418,040	6,889,070	250	0.7	0.05	26-Jun	●Dense stand of black spruce ●Many snags ●Mossy forest floor	SM, trace cobbles, grave gravel, light brown, compact	Confirmed				
	BP16	418,122	6,889,141	250	0.8	0.02	26-Jun	●20 m south of Buck Lake in dense wooded area (black spruce)	SM, many cobbles, light brown, dry			Bedrock refusal; likely good borrow	0.4 m - 0.5 m	Particle Size Analysis Moisture Content
	BP17	418,274	6,889,150	249	0.45	0.05	26-Jun	●Located on edge of dense stand of black spruce ●Small diameter spruce, well spaced in immediate area ●Moss mat on forest floor	ML, sandy, trace gravel, non-plastic	Confirmed			0.3 m - 0.45 m	

TABLE 3
AVALON RARE METALS INC.
THOR LAKE PROJECT
THOR LAKE SITE
BORROW PROBE INVESTIGATIONS

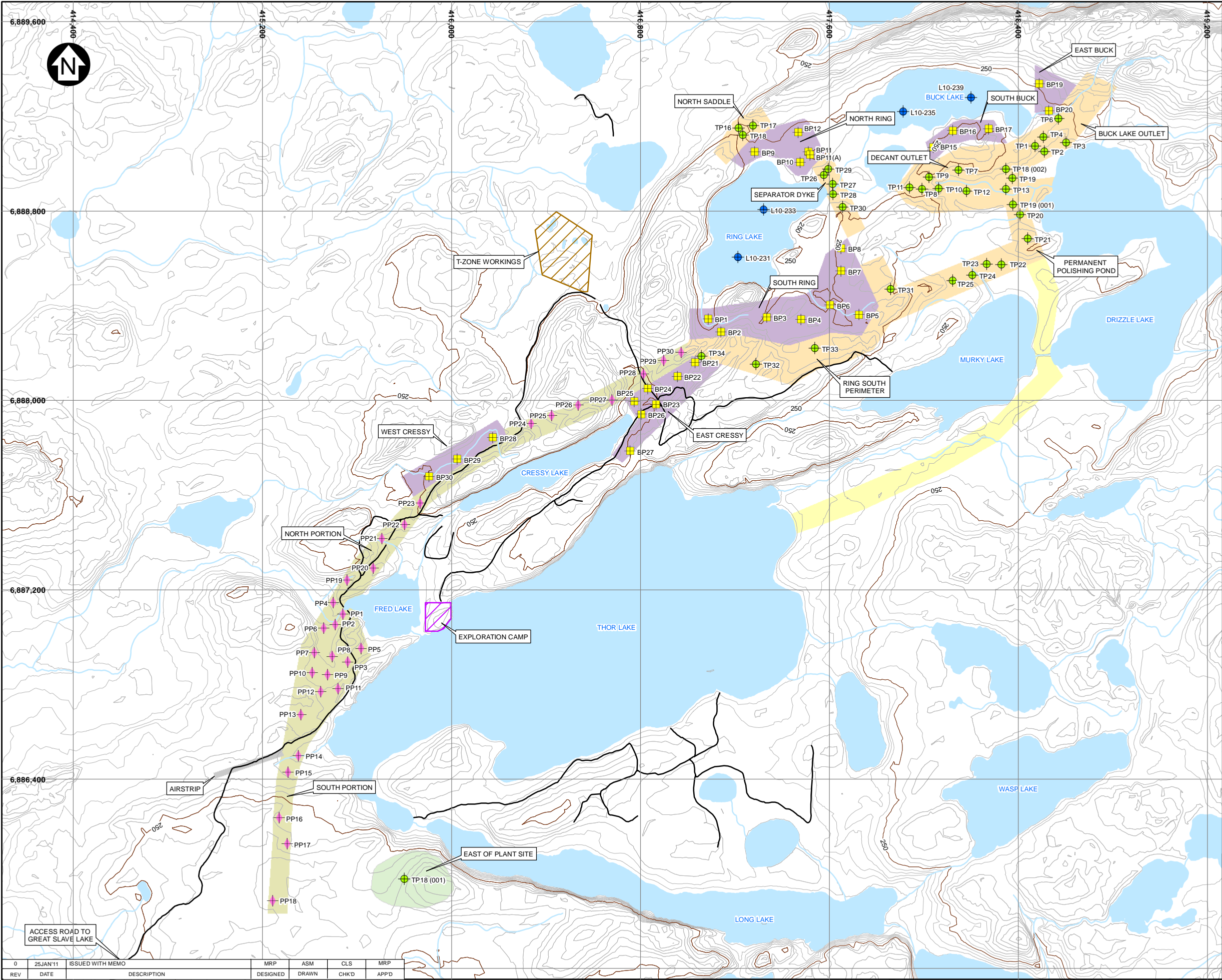
Region Name	Borrow Probe Name	Coordinates		Elevation (m)	Total Depth [m]	Depth of Organics [m]	Completion Date	Location Description	Base Soil Description	Permafrost Present	Water Table Encountered	Notes	Samples	Laboratory Testing Performed
		Easting	Northing											
East Buck Area	BP19	418,489	6,889,339	251	0.8	0.2	25-Jun	<ul style="list-style-type: none"> Open area amidst black spruce stand (dense) Low shrubby and willow in clearing (dense) 	SM with gravel, roots throughout, brown, compact, moist	Confirmed		Potential borrow	0.4 m - 0.8 m	Moisture Content
	BP20	418,529	6,889,226	249	0.4	0.4	25-Jun	<ul style="list-style-type: none"> Mossy meadow, spongy ground Open, sparse tree cover and shrubs 15 m south of rock outcrop 	Organic peat (Pt), moss			Not borrow candidate		
East Cressy Area	BP21	417,032	6,888,162	254	0.5	0.4	28-Jun	<ul style="list-style-type: none"> 5 m south of quad track to Ring Lake Low area between two outcrops Sparse trees (spruce) Some low vegetation 	ML/SM, light brown, frozen	Confirmed		Permafrost		
	BP22	416,957	6,888,102	253	0.3	0.3	28-Jun	<ul style="list-style-type: none"> 2 m east of obvious foot path Dense small diameter black spruce Heavy low vegetation 	Peat (Pt), fibrous, black, saturated	Confirmed	Yes	Permafrost		
	BP23	416,867	6,887,985	250	0.5	0	28-Jun	<ul style="list-style-type: none"> Open area adjacent to haul road intersection Willows and alders 	SM, some gravel, light brown, loose to compact, moist			Potential borrow		
	BP24	416,832	6,888,052	248	0.4	0	28-Jun	<ul style="list-style-type: none"> 3 m west of haul road Dense mixed vegetation/spruce No moss cover 	SW, some silt, dark brown, compact, moist			Bedrock refusal	0.2 m - 0.4 m	
	BP25	416,775	6,887,996	247	0.2	0.2	28-Jun	<ul style="list-style-type: none"> Hummocky moss West of haul road Near open water courses 50 m east of small lake 	Peat (Pt), fibrous, red-black	Confirmed		Permafrost; not borrow candidate		
	BP26	416,804	6,887,943	247	0.7	0.08	28-Jun	<ul style="list-style-type: none"> 4 m south of haul road 50 m east of Lake Small diameter trees in area 	SM/ML, low plasticity, some gravel, increasing coarseness with depth, light brown	Likely			0.4 m - 0.5 m	Moisture Content
	BP27	416,757	6,887,786	250	1.5	0	28-Jun	<ul style="list-style-type: none"> Area on fringe of haul road/ beach access 	SM/SW, some silt, trace cobbles, light brown, compact, dry			Borrow candidate	0.7 m - 1.0 m	Particle Size Analysis Moisture Content
West Cressy Area	BP28	416,176	6,887,844	251	0.4	0.4	28-Jun	<ul style="list-style-type: none"> Hummocky, broken, with open water, spongy Well-spaced black spruce to 8 cm diameter 	Peat (Pt), fibrous, black, saturated	Confirmed	Yes	Permafrost		
	BP29	416,025	6,887,752	251	0.3	0.3	28-Jun	<ul style="list-style-type: none"> Boggy, broken, hummocky Open water Limited tree cover 	Peat (Pt), black, saturated	Confirmed	Yes	Permafrost		
	BP30	415,906	6,887,679	251	0.2	0.2	28-Jun	<ul style="list-style-type: none"> Broken, hummocky ground Open water Sparse tree cover Frequent low growing vegetation 	Peat (Pt), roots throughout, fibrous, black, moist	Confirmed		Permafrost		

C:\Documents and Settings\TEMP\KPL\Application Data\Microsoft\Excel\CVT296 (version 1).xls\Table 3

NOTE:

1. THE COORDINATES PRESENTED WERE COLLECTED USING HAND-HELD GPS IN DATUM WGS84, ZONE 12.
2. LABORATORY TEST RESULTS ARE PROVIDED IN APPENDIX A.

0	25JAN11	ISSUED WITH MEMO NB10-0056	CMA	CLS	MRP
REV	DATE	DESCRIPTION	PREPD	CHKD	APPD



LEGEND:

INVESTIGATION AREAS

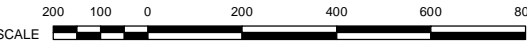
- TAILINGS FACILITY CONSTRUCTION AREA
- POTENTIAL EXCESS WATER DISCHARGE ACCESS / PIPELINE ROUTE
- POTENTIAL LOCAL BORROW AREA
- TAILINGS ACCESS / PIPELINE ROUTE
- EAST OF PLANT SITE
- T-ZONE WORKINGS
- EXPLORATION CAMP

SITE INVESTIGATION TYPE

- BP - BORROW PROBE
- PP - PIPELINE PROBE
- TP - TAILINGS PROBE
- AVALON DRILLHOLE

NOTES:

- BASE MAP 1:50,000 © HER MAJESTY THE QUEEN IN RIGHTS OF CANADA. DEPARTMENT OF NATURAL RESOURCES (2010). ALL RIGHTS RESERVED.
- CO-ORDINATE GRID IS IN METRES.
DATUM: WGS84
PROJECTION: UTM ZONE 12
- CONTOURS PROVIDED BY PLAN BASED ON INFORMATION PROVIDED BY AVALON RARE METALS INC.
- CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 2m.



AVALON RARE METALS INC.

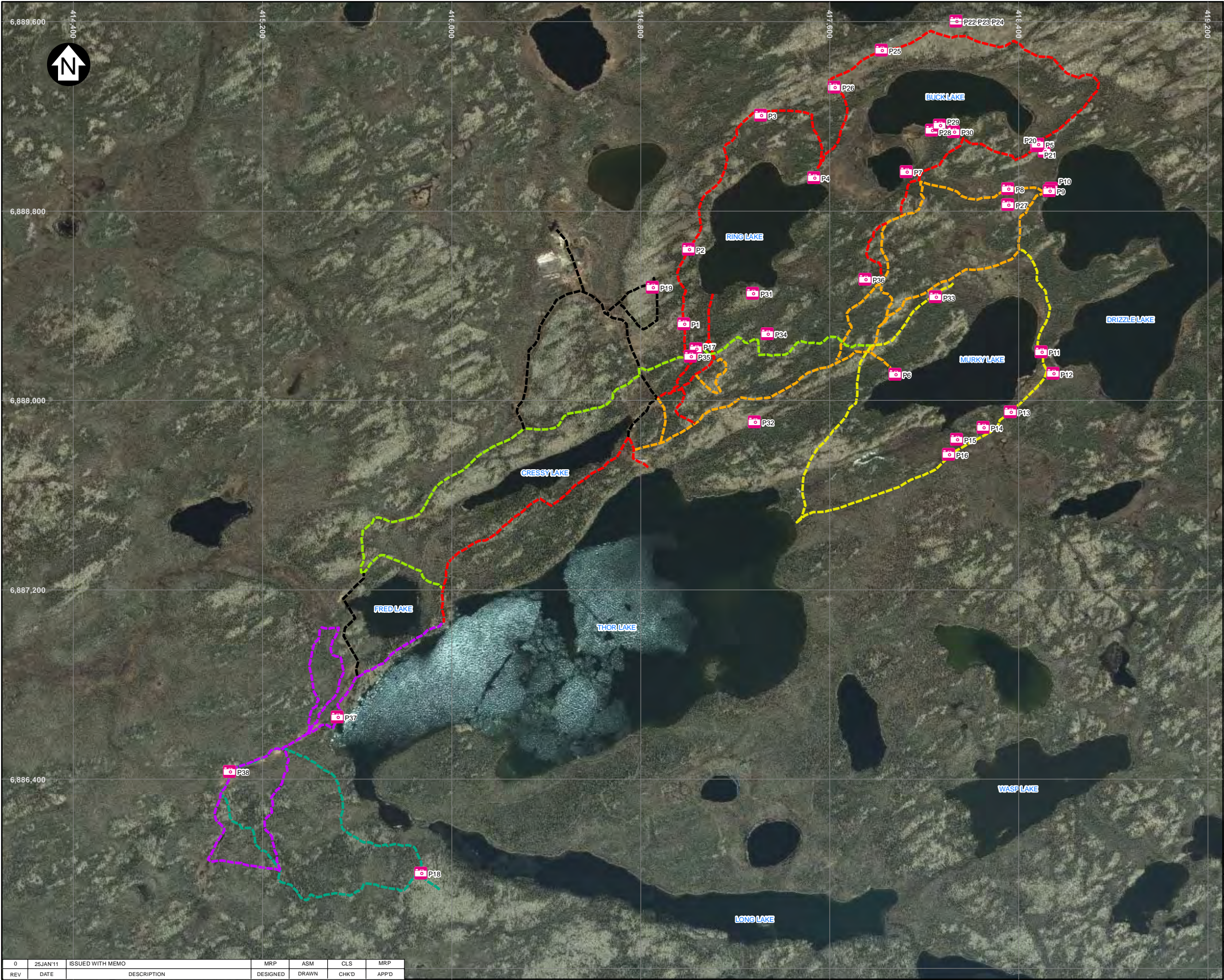
THOR LAKE PROJECT

PHASE 1 SITE INVESTIGATION PROGRAM
TEST PROBE PLAN

Knight Piésold
CONSULTING

P/A NO.	REF. NO.
NB101-390/2	NB10-00556
FIGURE 1	
REV 0	

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
0	25JAN'11	ISSUED WITH MEMO	MRP	ASM	CLS	MRP



LEGEND:

PHOTO LOCATION

SITE RECONNAISSANCE

JUNE 20 PM

JUNE 21 AM

JUNE 21 PM

JUNE 22 AM

JUNE 22 PM

JUNE 23 PM

JUNE 24 PM

NOTES:
1. BASE MAP: IKONOS 1m IMAGE.
2. CO-ORDINATE GRID IS IN METRES.
DATUM: WGS84
PROJECTION: UTM ZONE 12

2001000

SCALE

800 m

AVALON RARE METALS INC.

THOR LAKE PROJECT

PHASE 1 SITE INVESTIGATION PROGRAM
SITE RECONNAISSANCE PLAN

P/A NO.
NB101-390/2

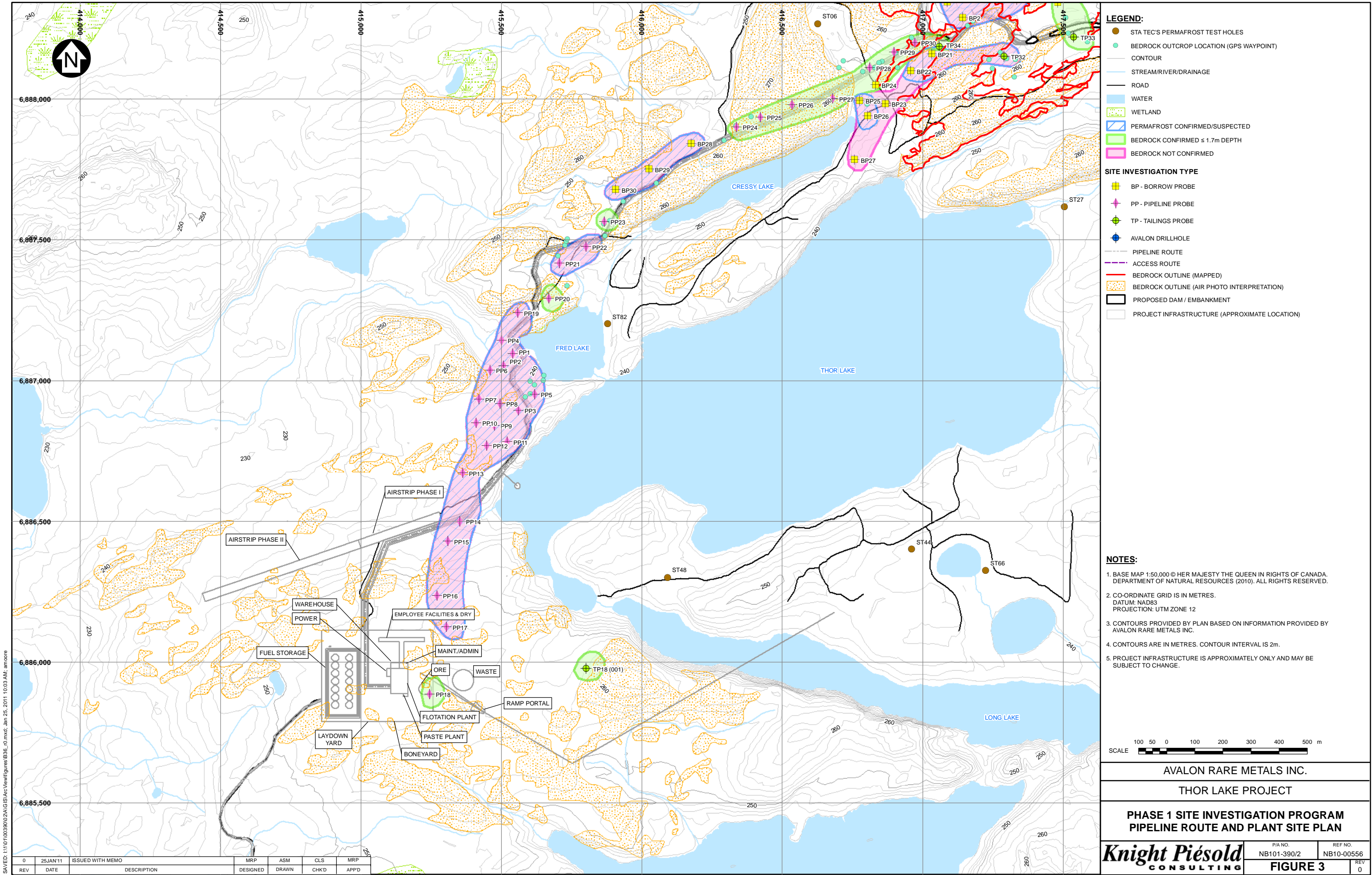
REF NO.
NB10-00556

FIGURE 2

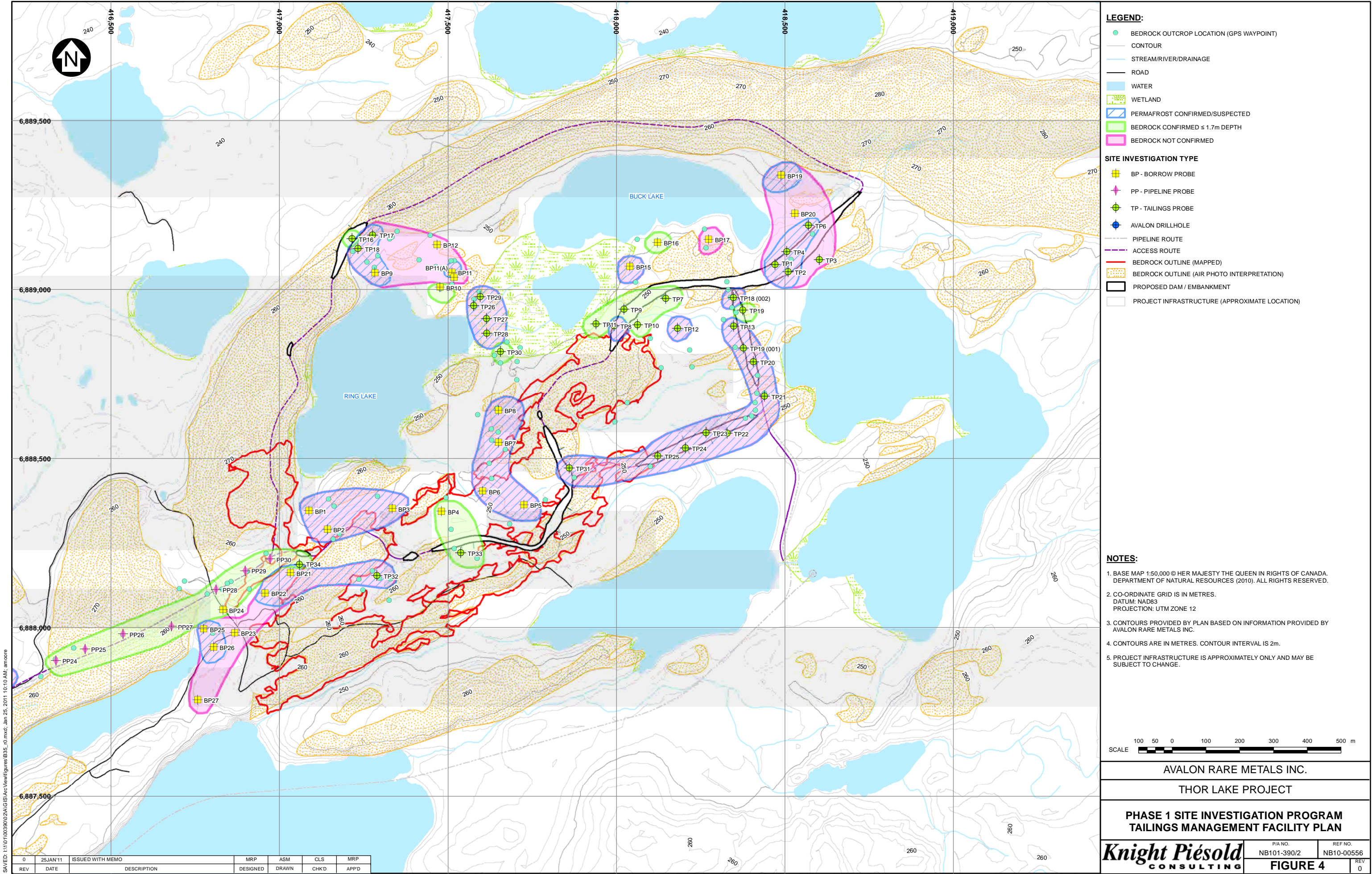
REV
0

0	25JAN'11	ISSUED WITH MEMO	MRP	ASM	CLS	MRP
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D

SAVED: I:\101\00390\02\A\GIS\ArcView\figures\B33_10.mxd Jan 25, 2011 10:15 AM; amore

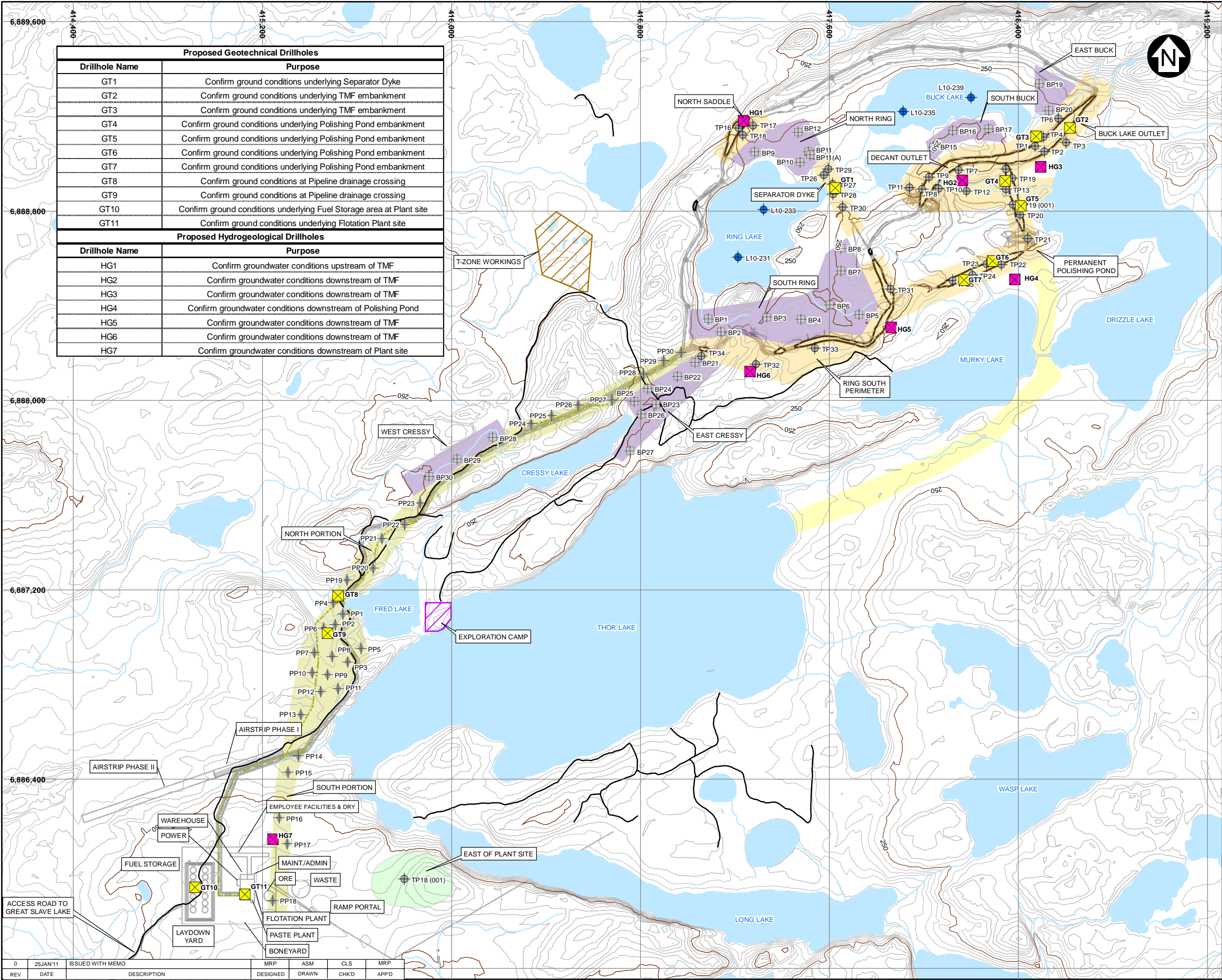


SAVED: I:\10100390\02\AG\ISAcView\figures\B36_10.mxd, Jan 25, 2011 10:03 AM; amcore



SAVED: I:\10100390\02\A\GIS\AcView\figures\B35_00.mxd Jan 25, 2011 10:10 AM; amore

0	25JAN'11	ISSUED WITH MEMO	MRP	ASM	CLS	MRP
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D



Proposed Geotechnical Drillholes	
Drillhole Name	Purpose
GT1	Confirm ground conditions underlying Separator Dyke
GT2	Confirm ground conditions underlying TMF embankment
GT3	Confirm ground conditions underlying TMF embankment
GT4	Confirm ground conditions underlying Polishing Pond embankment
GT5	Confirm ground conditions underlying Polishing Pond embankment
GT6	Confirm ground conditions underlying Polishing Pond embankment
GT7	Confirm ground conditions underlying Polishing Pond embankment
GT8	Confirm ground conditions at Pipeline drainage crossing
GT9	Confirm ground conditions at Pipeline drainage crossing
GT10	Confirm ground conditions underlying Fuel Storage area at Plant site
GT11	Confirm ground conditions underlying Flotation Plant site
Proposed Hydrogeological Drillholes	
Drillhole Name	Purpose
HG1	Confirm groundwater conditions upstream of TMF
HG2	Confirm groundwater conditions downstream of TMF
HG3	Confirm groundwater conditions downstream of TMF
HG4	Confirm groundwater conditions downstream of Polishing Pond
HG5	Confirm groundwater conditions downstream of TMF
HG6	Confirm groundwater conditions downstream of TMF
HG7	Confirm groundwater conditions downstream of Plant site

LEGEND:

INVESTIGATION AREAS

TAILINGS FACILITY CONSTRUCTION AREA

POTENTIAL EXCESS WATER DISCHARGE ACCESS / PIPELINE ROUTE

POTENTIAL LOCAL BORROW AREA

TAILINGS ACCESS / PIPELINE ROUTE

EAST OF PLANT SITE

T-ZONE WORKINGS

EXPLORATION CAMP

PROPOSED DAM / EMBANKMENT

PROJECT INFRASTRUCTURE (APPROXIMATE LOCATION)

PIPELINE ROUTE

ALTERNATIVE PIPELINE ROUTE

ACCESS ROUTE

SITE INVESTIGATION TYPE

BP - BORROW PROBE

PP - PIPELINE PROBE

TP - TAILINGS PROBE

AVALON DRILLHOLE

PROPOSED GEOTECHNICAL DRILLHOLE

PROPOSED HYDROGEOLOGY DRILLHOLE

NOTES:

1. BASE MAP 1:50,000 © HER MAJESTY THE QUEEN IN RIGHTS OF CANADA. DEPARTMENT OF NATURAL RESOURCES (2010). ALL RIGHTS RESERVED.

2. CO-ORDINATE GRID IS IN METRES. DATUM: WGS84 PROJECTION: UTM ZONE 12

3. CONTOURS PROVIDED BY PLAN BASED ON INFORMATION PROVIDED BY AVALON RARE METALS INC.

4. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 2m.

200100200400600800m

SCALE

SAVED: I:\10100390\02\AG\ISAcView\figures\B37_10.mxd Jan 25, 2011 1:53 PM: ammore

0	25JAN'11	ISSUED WITH MEMO	MRP	ASM	CLS	MRP
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D

AVALON RARE METALS INC.

THOR LAKE PROJECT

PROPOSED PHASE 2 SITE INVESTIGATION PROGRAM
DRILLHOLE LOCATIONS PLAN

Knight Piésold

CONSULTING

P/A NO.
NB101-390/2

REF NO.
NB10-00556

FIGURE 5

REV
0

Appendix A

Site Reconnaissance Photos

P1 –Ring Lake Looking NE



January 25, 2011

NB10-00556 - Appendix A

2

P2 Ring Lake Looking East



January 25, 2011

NB10-00556 - Appendix A

3

P3 Rim Syenite Looking East



January 25, 2011

NB10-00556 - Appendix A

4

P4 Ring Lake Looking South



January 25, 2011

NB10-00556 - Appendix A

5

P5 – Buck Lake Outlet Looking SW



January 25, 2011

NB10-00556 - Appendix A

6

P6 Murky Lake Looking South



January 25, 2011

NB10-00556 - Appendix A

7

P7 Decant Intake Looking North



January 25, 2011

NB10-00556 - Appendix A

8

P8 Decant Outlet Area



January 25, 2011

NB10-00556 - Appendix A

9

P9 Drizzle Lake Looking East



January 25, 2011

NB10-00556 - Appendix A

10

P10 Drizzle Lake Looking SE



January 25, 2011

NB10-00556 - Appendix A

11

P11 Murky Lake Looking SW



January 25, 2011

NB10-00556 - Appendix A

12

P12 – Drizzle Lake Looking East



January 25, 2011

NB10-00556 - Appendix A

13

P13 – Excess Water Line Area



January 25, 2011

NB10-00556 - Appendix A

14

P14 Excess Water Line Looking SW



January 25, 2011

NB10-00556 - Appendix A

15

P15 Permafrost Feature



January 25, 2011

NB10-00556 - Appendix A

16

P16 – Surface Water Pond



January 25, 2011

NB10-00556 - Appendix A

17

P17 Bedrock Looking East



January 25, 2011

NB10-00556 - Appendix A

18

P18 Portal Area Looking East



January 25, 2011

NB10-00556 - Appendix A

19

P19 T-Zone Looking NW



January 25, 2011

NB10-00556 - Appendix A

20

P20 Buck Lake Outlet Area



January 25, 2011

NB10-00556 - Appendix A

21

P21 Buck Lake Outlet Area



January 25, 2011

NB10-00556 - Appendix A

22

P22 Buck and Drizzle Lake Looking SE



January 25, 2011

NB10-00556 - Appendix A

23

P23 Buck Lake Looking South



January 25, 2011

NB10-00556 - Appendix A

24

P24 Buck and Ring Lake Looking SW



January 25, 2011

NB10-00556 - Appendix A

25

P25 Rim Syenite Looking SW



January 25, 2011

NB10-00556 - Appendix A

26

P26 Rim Syenite Looking NE



January 25, 2011

NB10-00556 - Appendix A

27

P27 Bedrock Frost Jacking



January 25, 2011

NB10-00556 - Appendix A

28

P28 Buck Lake Looking NW



January 25, 2011

NB10-00556 - Appendix A

29

P29 Buck Lake Looking NE



January 25, 2011

NB10-00556 - Appendix A

30

P30 South of Buck Lake



January 25, 2011

NB10-00556 - Appendix A

31

P31 Ring Lake Looking North



January 25, 2011

NB10-00556 - Appendix A

32

P32 Bedrock Mapping



January 25, 2011

NB10-00556 - Appendix A

33

P33 Bedrock Mapping



January 25, 2011

NB10-00556 - Appendix A

34

P34 Bedrock Mapping



January 25, 2011

NB10-00556 - Appendix A

35

P35 Bedrock Mapping



January 25, 2011

NB10-00556 - Appendix A

36

P36 Bedrock Mapping



January 25, 2011

NB10-00556 - Appendix A

37

P37 Thor Lake Water Source



January 25, 2011

NB10-00556 - Appendix A

38

P38 Phase 1 Airstrip



January 25, 2011

NB10-00556 - Appendix A

39