AVALON RARE METALS INC.

DEVELOPER'S ASSESSMENT REPORT
THOR LAKE PROJECT, NWT





APPENDICES - VOLUME 3

SUBMITTED TO:
MACKENZIE VALLEY ENVIRONMENTAL IMPACT REVIEW BOARD

MAY 2011
MVEIRB FILE: EA1011-001

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A TETRA TECH COMPANY

Avalon Rare Metals Inc.

DEVELOPER'S ASSESSMENT REPORT
THOR LAKE PROJECT
NORTHWEST TERRITORIES

APPENDICES
VOLUME 3

Submitted To:
MACKENZIE VALLEY ENVIRONMENTAL IMPACT REVIEW BOARD

May 2011

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Thor Lake Site Visit and Project Layout Options. Report NB09-00493. July 2009

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MEMORANDUM

To:	Mr. Bill Mercer	Date:	July 28, 2009
Copy To:	Steve Aiken, Jason Cox, Paul Schmidt	File No.:	NB101-390/1-A.01
From:	Matthew Parfitt	Cont. No.:	NB09-00493
Re:	July 2009 Thor Lake Site Visit and Project Layout Options		

BACKGROUND

A site visit was conducted by Knight Piesold Ltd. (KPL) staff (Matt Parfitt, P.Eng. Project Manager and Craig Hall, P.Eng. Project Engineer) to the Thor Lake Project from July 5 to 7, 2009. The purpose of the site visit was two fold; 1)to provide training to site geology staff for geomechanical logging techniques, and 2)to conduct site reconnaissance for scoping out potential locations for tailings facilities and other mine infrastructure. The facilities will be evaluated as part of the Pre-feasibility Study (PFS) for an underground Rare Earth Element (REE) mine being proposed by Avalon Rare Metals Inc. (Avalon). KPL's scope is mainly associated with siting and development of PFS design for tailings, waste rock and water management facilities for the project. Potential locations for other components of the project have also been proposed for consideration by Avalon and other project team members.

GENERAL SITE CONDITIONS

The Thor Lake Project is located in the Mackenzie Mining District of the Northwest Territories, about 5 km north of the Hearne Channel of Great Slave Lake and approximately 100 km southeast of the City of Yellowknife, as shown on Figure 1. The Thor Lake ore body is located at the southern margin of the Archean Slave Province of the Canadain Shield within the Blatchford Lake complex[1]. The Blatchford Lake complex is a relatively large subcircular high-level plutonic complex as described by Davidson 1978, as shown on Figure 2. The mineralized zone occurs for the most part within the western part of the Thor Lake Syenite but does cross into the Grace Lake Granite to the northwest. The principal rock types in the intrusion are syenites, granites and gabbros and associated pegmatitic phases hosting rare metal mineralization.

The Thor Lake project site is located within the Great Slave Upland High Boreal Ecoregion which is a part of the Taiga Sheild[2]. The dominant landscape in the area consists of fractured bedrock plain with subdued topography about 200-300 mASL. Most of the area was covered by Glacial Lake McConnell which reached a maximum elevation of about 280 mASL about 10,000 BP[3]. A combination of wave-washed tills, variable-textured glaciolacustrine sediments and glaciofluvial materials occur as thin, discontinuous deposits between rock outcrops and in fractures over much of the area.

Forests are discontinuous and occur between or on rock outcrops where there is a sufficiently thick mineral or organic substrate. Trembling aspen, jack pine, paper birch and spruce occur as forested patches separated by rock exposures. Small peat plateaus, shore fens and floating fens are common throughout the Ecoregion in wet depressions and along lakeshores[2].

The Thor Lake project site is located in the zone of widespread discontinuous permafrost as shown on Figure 3. Based on work conducted by Jacques Whitford to date, it is understood that discontinuous permafrost has been found at site particularly in sheltered low lying areas with overburden.

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SITE RECONASSAINCE

While at site, several traverses were completed and discussions held with Avalon staff to gain an understanding of site conditions including overburden and bedrock outcrop conditions, vegetation coverage, condition of existing site roads and access from Great Slave Lake and local hydrology conditions. In particular, potential locations were scouted for the Ramp Portal, Process Plant and Tailings Areas. Select photos taken during site reconnaissance traverses are attached. Prior to leaving site, a preliminary plan was provided to Avalon with potential locations for noted infrastructure. An updated plan showing potential project facility options and site photo locations is provided on Figure 4. The following summarizes potential locations for infrastructure along with comments on site conditions based on site reconnaissance and follow-up review of satellite imagery and topographic mapping.

Ramp Portal Location

In order to access the ore body, it is proposed that a ramp be driven from surface. Potential locations for a ramp portal were selected based on areas where bedrock was exposed and/or topographic highs occur as shown on Figure 4. Out of the 4 areas shown, locations R1 and R4 are judged to be the two most attractive as both are located where bedrock outcrop occurs and there is adequate topography for a portal to be developed into a hillside to maintain surface drainage away from the portal area.

Process Plant Area

Considerations for selection of potential process plant areas include proximity to the underground mine and relatively flat topography with good ground conditions (i.e. bedrock or no permafrost). While at site, two prospective areas were selected as potential areas for development of the Process Plant Area as shown on Figure 4. In addition, a third area (P3) was selected based on further review of imagery and mapping after the site visit. Out of the three areas selected, P1 is considered the best option for the following reasons:

- Area is quite flat and with abundant bedrock outcrop so site development should be relatively straight forward for grading and foundations.
- Location P1 is located between the ore zone and existing access road, minimizing ore and concentrate transportation distances and new road construction.
- Location P1 is setback at least 200 m or so from major water bodies, providing a buffer.
- Location P1 has the largest surface area and room for expansion to the west, south or east for additional stockpile areas etc.

Waste Rock Storage

No information is yet available on waste rock storage requirements for the project. There will be initial waste rock generated from the Ramp development, which will require a storage location. The estimated ramp configuration is 1,200 m long (15% grade to get to depth of 180 m) and assuming a 6m x 6m area will generate approximately 100,000 m^3 of waste rock. It is likely that a significant portion or all of the waste rock from the ramp development will be used as fill for site infrastructure construction (roads, foundations, tailings starter dam, airstrip, etc.). Waste rock storage required for operations is expected to be minimal due to underground backfill requirements. Assuming a maximum waste rock stockpile for 100,000 m^3 and a 6 m average depth of placement requires an area of about 150x150 m. Based on the selection of Process Plant Site P1, Ramp Portal location R1 would likely be developed. Potential waste rock storage locations in close proximity to Ramp Portal R1 would be to the north and east of Process Plant area P1 as shown on Figure 4.

Water Supply

A reliable water supply will be required for processing and potable water. The most likely water source will be from one of the local lakes. A pump intake will need to developed on the lakeshore where there is suitable topography to establish a pump house and adequate depth (minimum 6 m) near shore for winter operations. Based on review of available information including imagery and copies of preliminary lake bathemetry provided by Jaques Whitford three potential locations for water intakes have been identified as shown on Figure 4. Of the three locations shown, WS1 located on Thor Lake is recommended for the following reasons.

- It is located adjacent to the existing access road from Great Slave Lake
- WS1 is close to PS1 the preferred Process Plant area
- The drainage area (Thor Lake basin) reporting to the WS1 location is greater than the other two locations so water availability will be more reliable

Tailings Management Area

Tailings throughput from the Thor Lake project is expected to consist of an estimated 800 dry tonnes per day (dtpd) of relatively fine grained tailings (80 % minus 0.075 mm). It is proposed that the tailings will be transported to a Tailings Management Area (TMA) in slurry form through a pipeline and discharged at appropriate locations to form a tailings beach. Entrained process water released from the slurry will be contained with site runoff and will be recycled to the maximum extent possible for process use to minimize fresh water supply requirements. Based on a projected mine life of 10 years and throughput of 800 dtpd, containment for up to approximately 3 million tonnes of tailings will be required. Based on an assumed in-situ settled density for the tailings of 1.5 t/m^3, a solids storage volume of 2 million m^3 will be required. An additional 25% or 500,000 m^3 should be included for water storage and freeboard at this stage for a total preliminary storage requirement of 2.5 million m^3.

During the site visit, an assessment was made of the available detailed topographical mapping to identify possible areas for development of a TMA. Six potential areas were identified while at site and subsequently a seventh area was identified upon further assessment, as shown on Figure 4. The areas were selected on the basis of providing natural containment and/or minimizing impact to existing water courses and drainages. In order to minimize impacts to drainage patterns, a TMA is normally placed within the upper or top part of a watershed to minimize runoff management requirements within the contained area. Local watershed boundaries are also shown on Figure 4 for reference. Currently, no potential sites have been identified beyond the extents of the detailed topographical mapping. The following provides a brief description of each of the potential TMA sites.

Site T1A & T1B

Sites T1A and T1B include the Cressy Lake Basin and a small valley located to the west. The development concept for this site would be to construct a starter dam at the outlet of Cressy Lake. As the facility is raised, additional saddle dams would need to be constructed along the southeast side of the basin towards Thor Lake to provide containment. In order to provide 2.5 million m^3 of storage, valley T1B may need to be developed in the later years of operations to at least provide water storage and freeboard.

Site T1A is attractive as it offers good natural containment minimizing dam construction requirements and has a small watershed minimizing runoff reporting to the TMA. Sites T1A and T1B are also relatively close to the P1 Process Plant area and adjacent to existing access roads. The filling of Cressy Lake with tailings will need to be addressed from an environmental impact point of view. Studies to date by Jacques Whitford suggest that there are no fish in Cressy Lake which would simplify permitting requirements.

Site T2

Site T2 is located to the northwest of Cressy Lake and consists of the upstream portion of a watershed that flows to the west and ultimately north towards Blatchford Lake. Development of site T2 for a TMA would require the construction of starter dams at the outlet to the west and along a low ridge to the north for initial containment. A saddle dam would also be required along the south side. In order to provide 2.5 million m^3 of storage, site T2 would need to be raised to about El. 250 mASL.

Potential concerns with site T2 include the higher amount of dam building required and the fact that it lies within the Blatchford Lake watershed and will extend the impact assessment area to the north.

Site T3

Site T3 is located north of Thor Lake where the T-Zone workings have been developed. Development of site T3 for a TMA would involve constructing dams along the north perimeter to provide containment. A small lake (Den Lake) would be filled in as part of this development. In order to provide 2.5 million m^3 of storage, site T3 would need to be developed to approximately El. 245 mASL. This would likely leave the T-Zone Ramp Portal still exposed to the south side of the area.

Concerns with site T3 include the higher amount of dam construction, potential future impacts on development of the T-Zone and the fact that it lies within the Blatchford Lake drainage area.

Site T4

Site T4 consists of a natural basin northeast of Thor Lake bounded on the north by the Rim Syenite ridge and on the south by some hummocky bedrock knolls. The T4 basin includes Ring Lake and Buck Lake, two small lakes. The T4 basin drains south into Drizzle Lake then Murky Lake before entering Thor Lake. Development of site T4 for a TMA would require the construction of up to four relatively small dams, one to the north across a saddle in the Rim Syenite ridge and two or three dams to the south in saddles between bedrock knolls. In order to provide 2.5 million m^3 of storage, the T4 dams would need to be constructed to approximately EL. 250 mASL.

Site T4 provides a high degree of natural containment and therefore, dam construction requirements would be very minimal. The site T4 TMA option is the furthest away from the P1 Process Plant area (about 3 km), and would require new access for construction and operations requirements. In addition, environmental impacts associated with filling of Ring Lake and Buck Lake would need to be considered including, potential loss of fish habitat.

Site T5

Site T5 would be located immediately south of Process Plant area P1 on a relatively flat undulating bedrock plain. Containment would be created by constructing an embankment around almost the entire perimeter to approximately El. 258 m. Development of site T5 would include limited new access construction and negate the need for a tailings pipeline corridor if Process Plant area P1 is chosen. However, embankment or dam construction requirements will be significant as there is very little natural containment at site T5.

Site T6

For site T6, a TMA would be developed by constructing a dam across the entrance to a long narrow bay on the west side of Elbow Lake. Review of satellite imagery indicates that there is a shallow reef across the bay entrance. In order to provide 2.5 million m^3 of storage, the dam would need to be constructed to approximately El. 252 mASL. Development of site T6 for a TMA in conjunction with a Process Plant at location P1 would require limited access construction and a short tailings delivery pipeline (approximately. 0.5 km).

The main concern with site T6 would be related to environmental permitting associated with loss of potential fish habitat in the affected portion of Elbow Lake.

Site T7

Site T7 is located west of Fred Lake and Cressy Lake. Development of site T7 would involve construction of dams to the west, south and east to provide containment. A small lake would filled as part of the site development. The main drawback with site T7 is that the main drainage from Thor Lake via Fred Lake flows through it and this would need to be diverted around the site if developed. A potential diversion alignment would be to the south or in a southwest direction from Fred Lake through a saddle area within the P3 Process Plant area. In order to provide 2.5 million m^3 of storage, the T7 site would need to be developed to approximately El. 245 mASL.

Submarine Tailings Deposition

A brief review of potential for submarine tailings deposition was completed by assessing bathymetry for three local lakes including Thor Lake, Long Lake and Elbow Lake. Thor Lake is quite shallow over most of its area and would not be suitable. Long Lake does not have enough volume to contain the estimated volume of tailings for 10 years of operations (2 million m^3). There is a relatively large deep area within the north portion of Elbow Lake which appears to have enough volume to contain 2 million m^3 of tailings.

The use of Elbow Lake for submarine tailings disposal would likely require construction of low dams at the north and south ends to control water levels and discharge rates. The main concerns associated with submarine deposition of tailings into Elbow Lake would be associated with environmental permitting due to loss of fish habitat and impacts on the aquatic ecosystem.

STAFF ACCOMODATIONS

While at site, there was some discussion about where to place staff accommodations. One suggestion was to pace staff quarters on the northeast shore of Thor Lake (Location S1 as shown on Figure 4). An alternative location (S2 on Figure 4) on the northwest side of Thor Lake would be closer to existing access. Both sites are located on relatively flat areas with expected good foundations (outcropping bedrock). Due to the northern location of the project and possible extreme inclement weather in the winter, placement of staff accommodations adjacent to the Process Plant area will likely be required. Location S3 shown on Figure 4 would satisfy this concern. Alternatively, staff accommodations could be placed to the south of the project site or towards Great Slave Lake.

SITE ACCESS

There are two options for access to the Thor Lake Project. The first option is to upgrade the existing access road to Great Slave Lake and rely on seasonal transport by barge (summer) and ice road (winter) over Great Slave Lake for bringing in supplies and shipping concentrate out. Alternatively, an all season road approximately 70 km long could be constructed north to connect to an existing road from Yellowknife. At this stage of the project, the first option seems more likely as it requires significantly less capital and has a lower environmental footprint. Site access facilities that will need to be considered include:

- Upgrade access road to Great Slave Lake. This will include some straightening of the road, installation of culverts at all drainage crossings, widening of the road and placement of additional fill including sub base and a granular road topping.
- Construction of a pier on Great Slave Lake for barge load transfer of incoming supplies and outgoing concentrate. This will likely be placed at the current beach location.
- Construction of an airstrip for personnel and supply transport. An airstrip length of 1600 m has been assumed at this stage as adequate. Based on a wind rosette for Thor Lake site provided by Avalon (shown on Figure 4) the alignment of the airstrip will likely be in a southwest / northeast orientation. One potential location for the airstrip southwest of Elbow Lake as shown on Figure 4 was suggested during the site visit. Two other potential locations have been selected since the site visit including south and east of Thor Lake as shown on Figure 4. Option A1 for the airstrip would be favourable as it is close to the existing access road to Great Slave Lake.

CONSTRUCTION MATERIALS

Construction materials that will be required for site development and comments on possible sources are provided below.

- General fill for laydown areas and embankment construction. Overburden not abundant in the Thor Lake area. Useable sources of overburden for general fill are generally limited to small pockets of sandy till similar to those used to construct the access road from Great Slave Lake. Based on discussion with Avalon staff and review of overburden depths from exploration drilling, there is a potential large deposit of till located within a ridge along the south side of Thor Lake. A preliminary assessment of topography and drillhole overburden depths indicates that there may be as much as 1 million m^3 of overburden available for use as fill from this ridge. Removal of the ridge may also make this area a more suitable candidate for an airstrip.
- Granular fills for foundations, concrete aggregate and road surfacing. As there is no evidence of any local gravel deposits, granular fills will likely need to be processed from local bedrock. Waste rock from the ramp development will likely be a primary source for rockfill. Alternatively, a small quarry could be developed in local outcrop areas if required. There is a small amount of crushed rockfill stockpiled at the T-Zone.

RECOMMENDATIONS

Based on findings of the site visit and subsequent assessment of satellite imagery and available mapping, the following recommendations are provided.

- A project layout needs to be agreed upon to allow PFS investigations and design to start. Based on our assessment, the preferred site layout involves the Ramp Portal being developed from location R1 and placement of Process Plant Facilities at location P1 with adjacent Staff Accommodations at S3 and adjacent waste rock storage areas W1 and W2 strategically located near the Ramp Portal. This arrangement keeps surface development to the west of the ore body and close to existing access minimizing new access construction and additional impacts. This arrangement also works well with the preferred water supply location (WS1) on Thor Lake. From

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an access and foundation cost point of view, airstrip option A1 southwest of Elbow is judged to be the best option at this stage.

- Out of the potential TMA sites identified, T1, T4, T7, T5 and T6 should be analysed in more detail to understand site development costs and impacts in more detail before making a final selection. Concerns related to high dam construction costs and expansion of the project footprint into the Blatchford Lake watershed associated with TMA Sites T2 and T3 indicate that they should be removed from consideration. If the detailed mapping is extended to the west by Avalon as shown on Figure 5, other potential TMA sites may be identified. The use of Elbow Lake for submarine disposal should also be assessed in more detail to determine feasibility for permitting.

Upon review and consideration of the information presented herein, we would be pleased to set-up a web based presentation to facilitate discussion and agreement between team members to help finalise a project layout for the PFS. In the meantime, we will initiate a more detailed assessment of potential TMA sites as noted above.

Signed: Matthew Parfitt, P.Eng.
Project Manager

LICENSED PROFESSIONAL ENGINEER
M. R. PARFITT
JUL 28 2009
PROVINCE OF ONTARIO

Approved: Ken D. Embree, P.Eng.
Managing Director

Attachments:
Figure 1 – Property Location Map
Figure 2 – Regional Geology Plan
Figure 3 – Permafrost Distribution in Canada
Figure 4 – Project Layout Options
Figur 5 – Regional Watershed Plan

Photos 1 through 16 Thor Lake Project

References

1. Cerny and Thompson, 1985, Polylithinite from the rare-metal deposits of the Blachford Lake alkaline complex, N.W.T. Canada.
2. http://www.enr.gov.nt.ca/_live/documents/documentManagerUpload/Taiga_Shield_high_boreal.pdf - 3.4.6.1 - Great Slave Upland HB Ecoregion.
3. Kerr and Wilson, 2000, Preliminary surficial geology studies and mineral exploration considerations in the Yellowknife area, Northwest Territiroies

/mrp

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PHOTO 1 – View showing typical ground conditions (relatively flat bedrock outcrop) at Process Plant area P1 .

PHOTO 2 – View showing ground conditions at Process Plant Area P2 consisting of hummocky bedrock outcrop.

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PHOTO 3 – View looking east near potential Ramp Portal location R3 showing DH-09-08 in foreground..

PHOTO 4 – View looking east at inlet to Thor Lake from Long Lake showing staff gauge for hydrology monitoring in front of boat.

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PHOTO 5 – View looking north near potential Ramp Portal location R1 near DH-08-134 with groundwater monitoring well.

PHOTO 6 – View looking southeast showing beach area where pier or landing would be constructed on Great Slave Lake.

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PHOTO 7 – View showing staff gauge for hydrology monitoring at outlet to Fred Lake..

PHOTO 8 – View looking east into potential tailings area T4 showing Ring Lake in foreground and Buck Lake in background.

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PHOTO 9 – View looking east showing northwest arm of Elbow Lake which is potential tailings site T5.

PHOTO 10 – View showing conditions near potential Airstrip location A1 southwest of Elbow Lake.

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PHOTO 11– View looking south showing outlet area for Cressy Lake where starter dam would be built for Tailings area T1A.

PHOTO 12 – View showing outflow from Cressy Lake near potential starter dam alignment for Tailings area T1A.

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PHOTO 13 – View looking north showing Cressy Lake from outlet area of Tailings area T1A where starter dam would be built..

PHOTO 14 – View typical access road conditions between project site and Great Slave Lake .

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PHOTO 15– View looking south showing ground conditions on top of till ridge south of Thor Lake.

PHOTO 16 – View looking east showing ground conditions near crossing from R1 Ramp Portal location to P1 Process Plant location.

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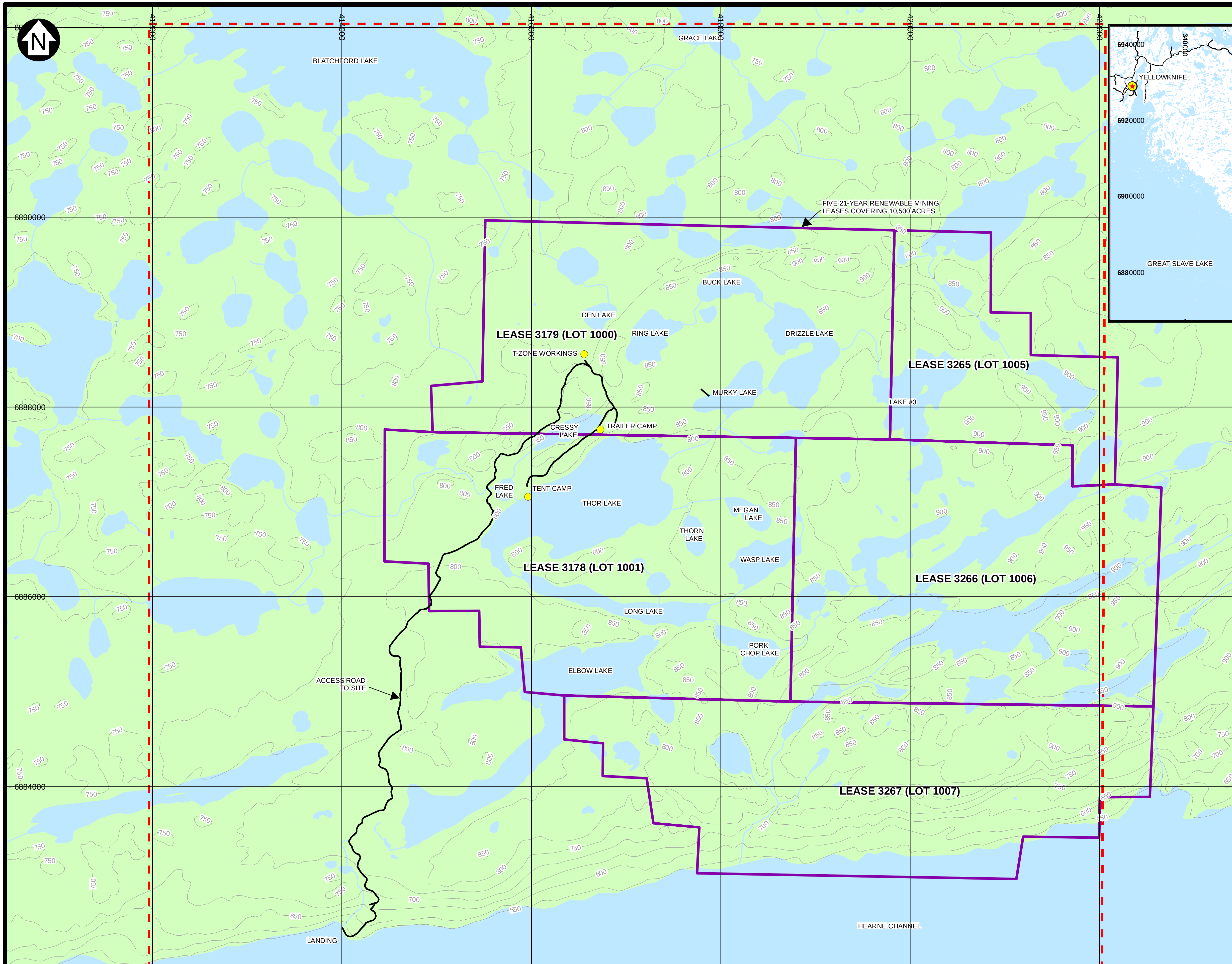

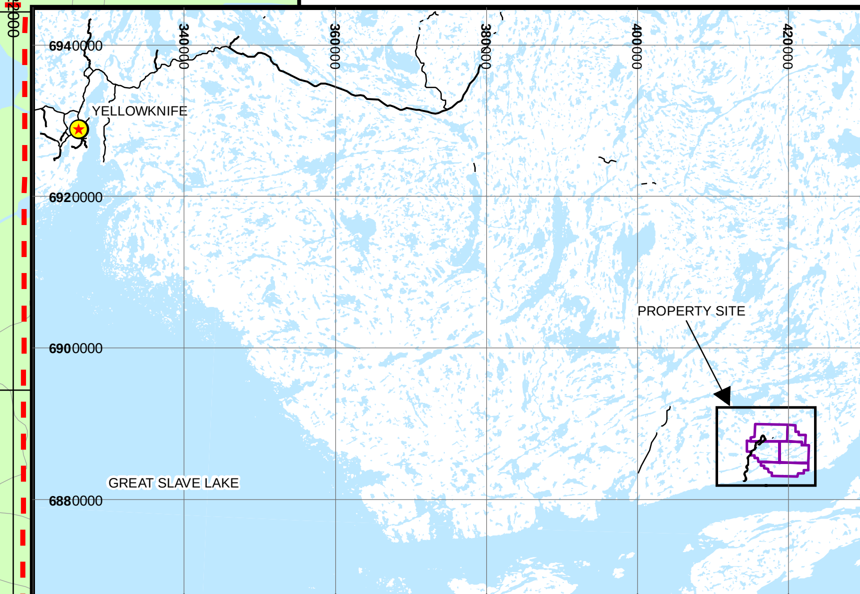

LEGEND:

- WATER
- PROPERTY BOUNDARY (APPROXIMATE)
- RIVER/STREAM/DRAINAGE
- ROAD
- LIMITS OF SATELLITE IMAGERY

NOTES:

1. BASE MAP: © HER MAJESTY THE QUEEN IN RIGHTS OF CANADA, DEPARTMENT OF NATURAL RESOURCES (2004). ALL RIGHTS RESERVED.
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 12 AND IS IN METRES.
3. CONTOUR INVTERVAL IS IN METRES. CONTOUR INTERVAL IS 50 METRES.

FOR INFORMATION ONLY

SCALE 400 200 0 400 800 1,200 1,600 2,000 m

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THOR LAKE PROJECT

PROPERTY LOCATION MAP

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P/A NO.	REF. NO.
NB101-390/01	NB09-00493

FIGURE 1 — REV 0

REV	DATE	DESCRIPTION	DESIGN	DRAWN	CHK'D	APP'D
0	28JUL'09	ISSUED WITH SITE VISIT MEMO	MRP	ASM	MRP	MRP

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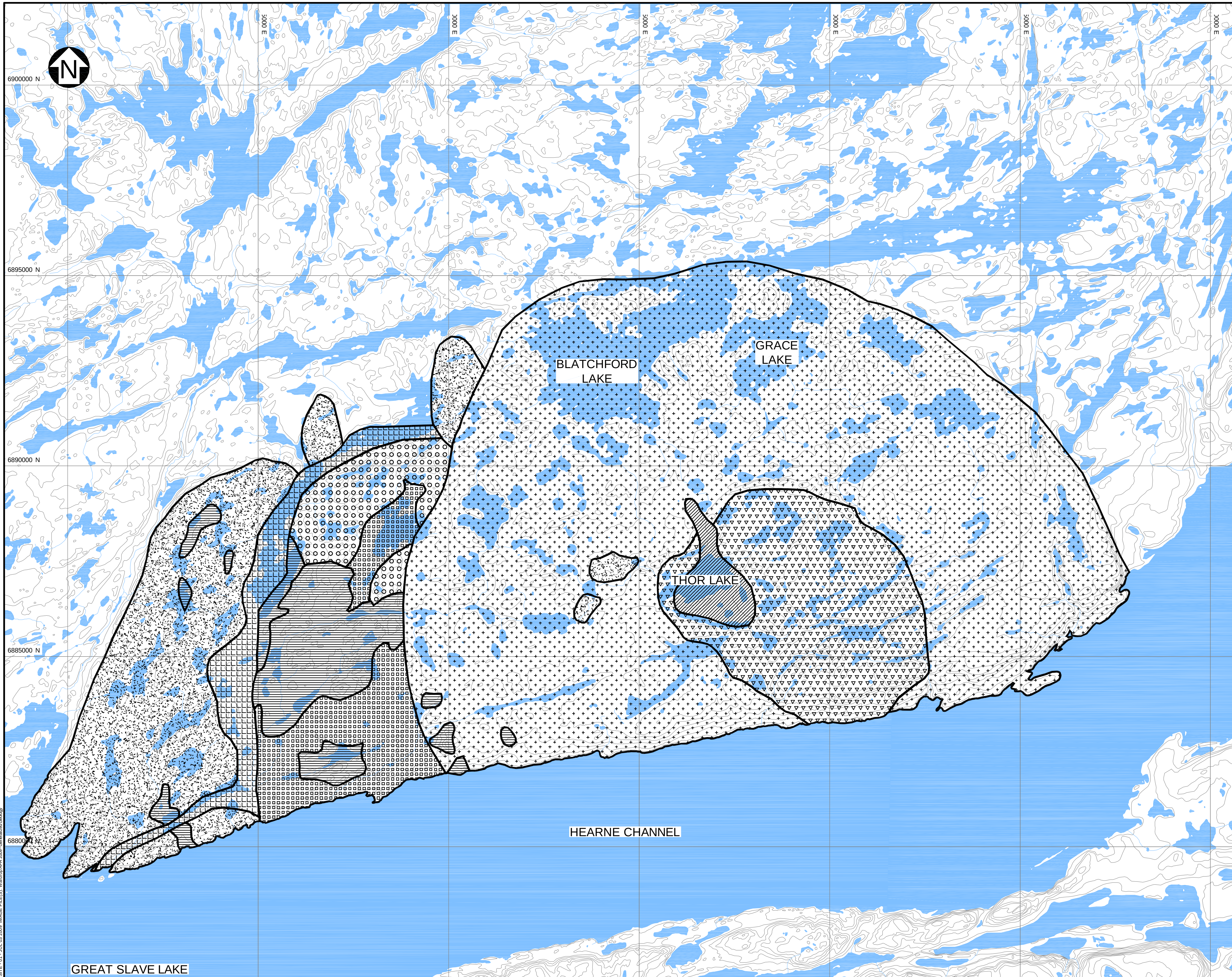

REV	DATE	DESCRIPTION	PREPARED	DRAWN	CHK'D	APP'D
0	28JUL'09	ISSUED WITH SITE VISIT MEMO	MRP	SIR	MRP	MRP

GEOLOGY LEGEND:

- MINERALIZED ALTERATION
- THOR LAKE SYENITE
- GRACE LAKE GRANITE
- HEARNE CHANNEL AND MAD LAKE GRANITES
- WHITEMAN LAKE QUARTZ SYENITE
- CARIBOU LAKE GRABBRO, LEUCEFERRODIORITE
- GRANITE, GRANODIORITE
- YELLOWKNIFE SUPERGROUP

LEGEND:

- WATER

NOTES:

1. COORDINATE GRID IS UTM (NAD83) ZONE 12N AND IS IN METRES.
2. PLAN BASED ON INFORMATION PROVIDED BY AVALON RARE METALS INC.
3. GEOLOGY BASED ON WARDROP REPORT 0851530201-REP-R0002-01 FIGURE 2.2 ENTITLED "GENERALIZED GEOLOGY OF THE THOR LAKE AREA (AFTER DAVIDSON, 1978).

FOR INFORMATION ONLY

SCALE 1 0.5 0 1 2 3 4 5 km

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THOR LAKE PROJECT

REGIONAL GEOLOGY PLAN

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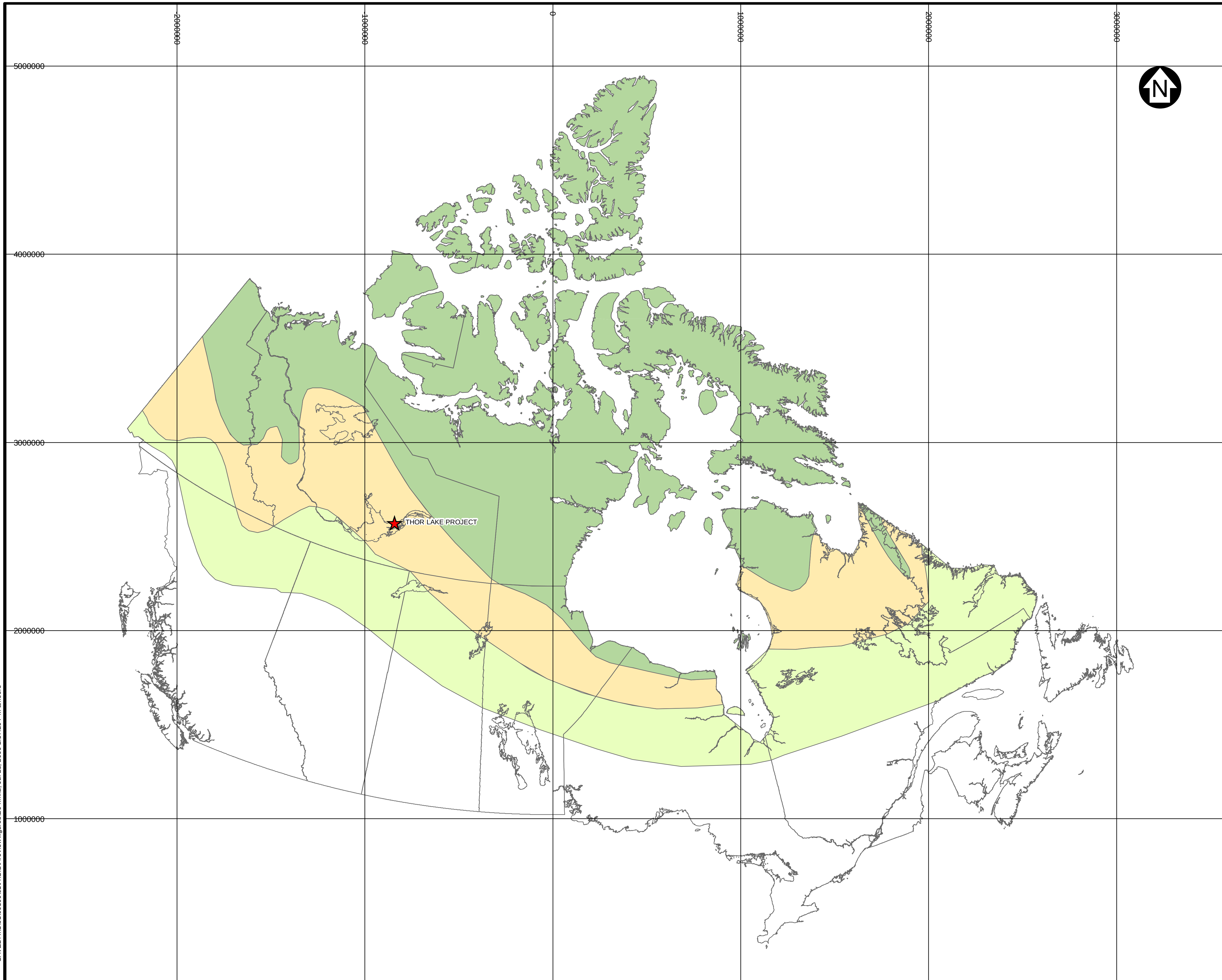
P/A NO. NB101-390/01 | REF NO. NB09-00493

FIGURE 2 | REV 0



LEGEND:

- CONTINUOUS PERMAFROST
- WIDESPREAD DISCONTINUOUS PERAMFROST
- SPORADIC DISCONTINUOUS PERMAFROST

NOTES:

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2. PERMAFROST DISTRIBUTION DIGITIZED FROM BURNS 2004.

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SCALE 200 100 0 200 400 600 800 1,000 km

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PERMAFROST DISTRUBTION IN CANADA

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P/A NO.	REF. NO.
NB101-390/01	NB09-00493

FIGURE 3 REV 0

0	28JUL'09	ISSUED WITH SITE VISIT MEMO	MRP	ASM	MRP	MRP
REV	DATE	DESCRIPTION	DESIGN	DRAWN	CHK'D	APP'D

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