

Prepared for:

TMAC RESOURCES

MADRID ADVANCED EXPLORATION PROGRAM

Type B Water Licence Application Supplemental Information Report

December 2014

ERM

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TMAC Resources Inc.

MADRID ADVANCED EXPLORATION PROGRAM

Type B Water Licence Application Supplemental Information Report

December 2014

Project #0194097-0007

Citation:
ERM Rescan. 2014. *Madrid Advanced Exploration Program: Type B Water Licence Application Supplemental Information Report*. Prepared for TMAC Resources Inc. by ERM Consultants Canada Ltd.: Vancouver, British Columbia.

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MADRID ADVANCED EXPLORATION PROGRAM

Type B Water Licence Application Supplemental Information Report

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GLOSSARY AND ABBREVIATIONS

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

Active layer	The relatively thin layer of soil/overburden above continuous permafrost that thaws during the summer months.
ANFO	Ammonium Nitrate and Fuel Oil
BHP	BHP Minerals Canada Ltd. (BHP Billiton)
CCME	Canadian Council of Ministers of the Environment
Contact Water	The part of precipitation that comes in contact with the Madrid Advanced Exploration Program activities and infrastructure. Contact water is collected and directed to the Pollution Control Ponds for re-use, or transport to Doris North Project TIA for disposal.
Culverts	Within the Hope Bay Belt, these are constructed drains or tunnels under roads or infrastructure to allow the passage of water to maintain fish/fish habitat and/or prevent ponding of water. Culverts within the Belt are typically corrugated steel pipe that may have a bottom section removed (arched culvert) or are intact (closed culvert) over the pipe length.
Deep groundwater	The deep groundwater regime is laterally continuous and found in bedrock below the permafrost at approximately 300 m below ground surface (m-bgs) depth. Because of the thick, low permeability permafrost; there is generally little to no hydraulic connection between the shallow and deep groundwater flow regimes.
DFO	Department of Fisheries and Oceans (Fisheries and Oceans Canada)
ELC	Ecosystem Land Classification
Freshet	In channels, the relatively high annual peak water discharge period resulting from spring/summer meltwater runoff of the winter snowpack.
HBML	Hope Bay Mining Ltd.
ISQG	Interim Sediment Quality Guidelines
ITK	Inuit Traditional Knowledge
IQ	Inuit Qaujimajatuqangit
MMER	Metal Mine Effluent Regulations
NAD83	North American Datum 1983, based on the spheroid (GRS80)
NIRB	Nunavut Impact Review Board
NCLA	Nunavut Land Claims Agreement

DNLUP	Draft Nunavut Land Use Plan
NPC	Nunavut Planning Commission
NWB	Nunavut Water Board
NWNSRT Act	*Nunavut Waters and Nunavut Surface Rights Tribunal Act*
Runoff	The part of precipitation that appears at surface and is a measure of hydrologic response of a watershed, commonly presented as a depth of water over an entire watershed in mm.
Salinity	Salinity is the total of all non-carbonate salts dissolved in water, usually expressed in parts per thousand (1 ppt = 1,000 mg/L) and is a measure of the *total* salt concentration. Even though there are smaller quantities of other ions in seawater (e.g., K, Mg, or SO_4), sodium (Na) and chloride (Cl) ions represent about 91% of all seawater ions. The salinity level in seawater is fairly constant, at about 35 ppt (35,000 mg/L), while brackish estuaries may have salinity levels between 1 and 10 ppt. Salinity can be determined from chloride concentration using the formula: $$salinity\ (ppt) = 0.0018066 \times 5\ Cl–\ (mg/L)$$
Shallow groundwater	The shallow groundwater regime consists of the active layer above the permanent permafrost. This is an ephemeral system that in winter time is primarily frozen and is only active in the summer months.
SIG or SIG MM2	Mining and Milling Supplemental Information Guidelines for Advanced Exploration
Talik	A layer of year-round unfrozen ground that lies in permafrost areas. In regions of continuous permafrost, taliks often occur underneath shallow thermokarst lakes and rivers, where the deep water does not freeze in winter, and thus the soil underneath will not freeze either. Sometimes closed, open and through talik are distinguished. These terms refer to whether the talik is completely surrounded by permafrost, is open to the top (e.g., a thermokarst lake), or open to both top and unfrozen layers beneath the permafrost, respectively.
the Project	Madrid Advanced Exploration Program
TIA	Tailings Impoundment Area
TMAC	TMAC Resources Inc.
TSS	Total Suspended Solids
UTM	Universal Transverse Mercator
Watershed	The entire geographical area drained by a river and its tributaries; an area characterized by all runoff being conveyed to the same outlet.
WKRLUP	West Kitikmeot Regional Land Use Plan (unapproved)

1. INTRODUCTION

The objective of this document is to provide supplemental information on the Madrid Advanced Exploration Program (the Project) to support the Madrid Advanced Exploration Program Type B Water Licence Application submitted to the NWB in accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (NWNSRT Act) and *Nunavut Waters Regulations*.

1.1 DOCUMENT OUTLINE

The Nunavut Water Board (NWB) *Mining and Milling Supplemental Information Guidelines for Advanced Exploration* (SIG MM2) has been used to develop the information provided within this report is presented in Appendix 2.

A concordance table as per the requirements of the SIG MM2 is provided in Appendix 2. This document also follows the NWB's *Guide 4: Completing and Submitting a Water Licence Application for a New Licence.*

This document is structured to provide easy cross-reference with the SIG with the format following:

- Preamble: General Water Licence Application;
- Section 1: Introduction;
- Section 2: Minimum Application Requirements;
- Section 3: General Water Licence Application;
- Section 4: Detailed Description of the Undertakings;
- Section 5: Baseline Environmental Conditions;
- Section 6: Water Use and Water Management;
- Section 7: Waste Disposal and Management;
- Section 8: Monitoring;
- Section 9: Reclamation and Closure;
- Section 10: Environmental Effects; and
- Section 11: Public Consultation.

Should the Nunavut Impact Review Board (NIRB) determine that a screening pursuant to the Nunavut Land Claim Agreement (NLCA) is required, this document also includes the information required by NIRB Part 1 Form Project Proposal Information Requirements as well as the NIRB Part 2 Form PSIR Requirements (Appendix 10).

2. MINIMUM APPLICATION REQUIREMENTS

Section 2 of this Technical Report addresses Section 2.0 – "Minimum Application Requirements (Application Checklist)" of the **Nunavut Water Board information Requirements for a Type B General Water Licence Application**.

2.1 GENERAL WATER LICENCE APPLICATION

The application form for a Type B Water Licence is presented as a preamble to this document.

2.1.1 Scope of the Type B Water Licence

This Licence will authorize TMAC to use water and deposit waste in support of an advanced exploration program for the Madrid area.

The Project includes all bulk sample infrastructure and exploration activities at the Madrid area. The exploration plan for the Project is an estimated 10 years and includes diamond drilling on surface and underground, bulk sampling through underground mining methods, field mapping, airborne/ ground/downhole geophysics and associated air and road access and associated transportation of goods, supplies and mined material, and support infrastructure such as access portals, ramps, waste and ore stockpiles, water and waste management structures.

The Madrid area is located at the general geographical coordinates shown in Table 2.1-1 and Figure 3.5-2.

Table 2.1-1. Geographic Coordinates of Madrid Advanced Exploration Program

	Latitude / Longitude		UTM	
NE	68° 06' 34" N	106° 32' 22" W	7555864	435954
NW	68° 08' 07" N	106° 37' 44" W	7555840	432309
SE	68° 00' 13" N	106° 29' 00" W	7544000	438000
SW	68° 00' 07" N	106° 40' 29" W	7544000	430000

Under this Madrid Advanced Exploration Program Type B water licence, TMAC will be allowed to undertake construction, operations, and closure including reclamation, of exploration drilling and bulk sampling. The activities and facilities under the scope of this Type B Water Licence will include the following:

- water supply for domestic uses and industrial purposes including water uses such as diamond drilling underground and surface, construction and maintenance of roads, emergency and temporary camp, water crossings, diversions and storage;
- site drainage, surface water management, and underground water management for Madrid North and Madrid South and surficial drilling as warranted;

- oily water treatment facilities for wastewater and oily storm water treatment for maintenance facilities and fuel storage berms at Madrid North and Madrid South;
- contact water collected in Pollution Control Ponds, will be discharged to the tundra at a distance greater than, or equal to, 31m from local waterways;
- temporary storage and management of hazardous materials at Madrid North and Madrid South;
- fuel tanks, dispensing storage facilities and associated containment areas or berms for the Bulk Fuel Storage Facilities and day tanks at Madrid North and Madrid South;
- containment for fuel storage and hazardous materials (if any) at Madrid North and Madrid South;
- containment areas for temporary storage of hazardous/nonhazardous waste (waste transfer areas) and new product storage for drums and totes at Madrid North and Madrid South;
- waste sorting facilities and temporary storage facilities for hazardous wastes at Madrid North and Madrid South;
- waste rock storage areas for permanent storage of mine waste and waste rock pile runoff management at Madrid North and Madrid South;
- ore stockpile for temporary storage and runoff management at Madrid North and Madrid South;
- minor watercourse crossings, culverts and associated erosion control;
- diversions, alteration of flow or storage by means of dykes or dams at Madrid North and Madrid South;
- regular inspection and maintenance of all watercourse crossings and associated infrastructure;
- construction and ongoing maintenance of all-weather roads within Madrid North and Madrid South areas;
- ongoing advanced exploration diamond drilling subsurface and on surface;
- ongoing activities in support of engineering and scientific studies for the Madrid area;
- ongoing maintenance to project infrastructure; and
- construction and operation of winter ice roads.

While the Project is a stand-alone project from the Doris North Project, in order to limit footprint and to enhance Belt-wide effienciency, the Project will utilize some of the existing Doris North Project infrastructure and systems as follows. Test milling and processing of ore will be undertaken at the Doris North Project mill. Portable toilets and/or Pacto units with waste will be transported to Doris North Project camp for inclusion in its sewage treatment plant. Any contact water not meeting discharge criteria will be transported for disposal in Doris North Project – Tailings Impoundment Area (TIA). Hydrocarbon contaminated snow and soil/overburden will be transported to Doris North Project camp for treatment and/or backhaul offsite for appropriate treatment/disposal. Explosives will be managed at the existing Doris North Project storage facility. Wastes will be

disposed of as appropriate at the Doris North Project waste management facilities. Hazardous wastes will be transferred to designated areas at Doris North Project and disposed of offsite in accordance with currently approved waste management plans.

2.2 INFORMATION REQUIRED TO SATISFY THE REQUIREMENTS OF THE SIG

The information required to satisfy the requirement of the Supplemental Information Guideline (SIG) is presented the following Sections and Appendices to this Volume.

The Madrid Advanced Exploration Program is an advanced stage of exploration to establish feasibility of the Project. The design information for the Project is preliminary at this stage. Issued for construction drawings will be submitted to the NWB at least sixty (60) prior to commencement of construction of facilities. Once construction is completed, Construction Summary Reports including as-built drawings will be submitted to the Board within ninety (90) of start-up of the facility. Issued for construction documents and construction summary report will be stamped by a Professional Engineer licenced to practice in Nunavut.

2.3 EXECUTIVE SUMMARY

2.3.1 Executive Summary (English)

TMAC Resources Inc. (TMAC) is proposing to undertake an advanced exploration program within the Madrid area of the Hope Bay Greenstone Belt (the Hope Bay Belt) in the Kitikmeot Region Nunavut. The Madrid area is located approximately 130 km southwest of Cambridge Bay.

Over the past twenty years, the Hope Bay Belt has undergone considerable exploration and development activities by TMAC and previous operators. The Hope Bay Belt has significant existing infrastructure including air strips, roads, fuel storage, a port facility, power plants, administration, geology and lab buildings, and underground development at the Doris and Boston areas.

The Doris North Project (Doris) is known as Phase 1 of the Hope Bay Belt development with gold production planned from an underground mine located near Doris Lake. Doris North is currently fully permitted and partially constructed. TMAC is requesting authorizations for the Madrid Advanced Exploration Program to allow additional work to: further define the Madrid North and South mineral resources; understand deposit variability; support mine planning; and to validate economic feasibility.

The proposed Madrid Advanced Exploration Program includes extracting approximately 50,000 tonne bulk ore samples from each of the Madrid North and Madrid South using underground mining methods that will be trucked to the Doris North Mill for processing. The 10 year Advanced Exploration Program will also include infrastructure and support activities such as diesel power generation, waste rock and ore storage areas, surface and groundwater management, explosives use and storage, quarry activities, all-weather and winter roads, and underground and surface diamond drilling. Camp facilities at Doris North will be used to accommodate the approximately 70 personnel required for the Madrid Advanced Exploration Program. Solid, hazardous and non-hazardous waste

generated as part of the Madrid Advanced Exploration Program will be transported to Doris North for inclusion in its existing management facilities.

Freshwater for the program will be sourced primarily from Patch and Windy Lakes and used for industrial (mainly surface and subsurface drilling) and domestic uses with a daily peak rate of 295 m^3/day. Use of existing infrastructure and access corridors associated with Doris North, and underground mining methods at Madrid, minimizes the affected footprint. The potential for environmental effects from the Madrid Advanced Exploration Program to the physical, biological and traditional resources can be mitigated through incorporation of design considerations and accepted management practices.

2.3.2 Executive Summary (Inuktitut)

To be provided once available.

2.3.3 Havaamik Naetomik Okaohik

TMAC-kon (TMAC) havaakagumayun nalvakheokhimaklotik Madrid-mi Kapihiliktumi Oyagaktaakhanik Nunagiyaoyumi (Kapihiliktuk) Kitikmeoni, Nunavumi. Madrid nuna kanitoani 130 kilamitamik ugahiknikaktok hivugaata oalikheani Ikaloktuteam.

Atukhimayoni 20-ni ukeon, Kapihiliktumi Oyagaktakvikhak nalvakheokveokhaaktok havakveohimalikhonilo TMAC-kunin hivoanilo oyagakheoktinin. Kapihiliktuk pikaktok agiyonik taya napaktikhimayoni ilalo milviknik, apkotinik, okhokyoakakviknik, tulaktakvikhamik, alguyaktutinun ignikotinik, titigakviknik, nunalikiven ilitokhaevelo iglukpaknik, nunan iloanilo oyagaktakviknik Doris-mi Boston-milo.

Doris-mi kaoyimayaoyok Havaak 1-mi Kapihiliktumi Oyagaktakvikhami kulmik nunan iloanun hitileoklotik oyagaktakvikhaan haneani Doris Tatim. Doris Oyagaktakvik taya havakveoginageaniktok ilagalo hanayaohimalikhoni. TMAC-kon tukhiktun agitutinik Madrid-mi Nalvakheogeamikni ila havaligeamikni: naonaeteageagani Madrid-mi Tunungani Hivogaanilo oyagaktaakhanik; tukihealogin oyagaktaakhan kanoginigin; ikayoktoklogo oyagaktakvikhak opalogaeyageagani; nalunaegeaganilo manikhakheogutaoteaknikhaa.

Atoktaoyomayok Madrid-mi Nalvaakheokveokhaaktok Havaak ilakaktok ahivaeyaagani 50-taosan tansnik ukumaetilaagani oyagaktaanik ilitokhagakhanik atuni Madrid Tununganin, Madrid Hivugaanilo nunan iloanun hitileoklotik oyagaktakneaktun akhalutikulo akyaktaolotik Doris-mi Oyakikivikmun hikuptiktaoyaagani. Kulini ukeoni Nalvaakheokveokhaakvikhak Havaak ilakakneaktok pikotinik ikayutiniklo havaanik ila alguyaktutinun ignikotinik, ikagunik oyakanik ileogaevikhak, kaagani nunan iloanilo imavaloen monaginiginik, kagaktitaotinik atoknigin tutkumavelo, oyagaktakvikmi havaan, ukeogaalok apkotikhan, nuna iloanilo kaaganilo hitiyonik kigutikaktonik ikutakveoyun. Iglukpakakvikmi pikotin Doris-mi hiniktakveoneaktun 70-nin inuknin havageakaktonin Madrid-mi Nalvaakheokveokhaaktukhami. Hitiyun, aneagutaolaktulo aneaknaetulu ikagun Madrid-mi Nalvaakheokveokhaaktukhami akyaktaoneaktun Doris-mun ilaleotiyagani taya monagivoeyoni pikotini.

Imiktaakhan havakvikmi piyaovakneakun Patch-min Windy-milo Tatinin atoktaolotiklo havaami (ila nunami iloanilo ikutaktonin) inuknilo atoktaoyukhak uplotoagaagan 295 m^3/uplotoagaagan. Atoknigin taya iglukpaen apkotilo Doris-mi, nunam iloanilo oyagaktaotin Madrid-mi, mikhiyotaoyun aktokniginik oyagaktakveom. Avataoyomik aktoknigilaakta Madrid-mi Nalvaakheokveokhaaktomin nunamik, naoteaniklo taemanilo ihoakotinik ihoakhilaaktun atokniginin ihomagiyaoteaktonin monagiyotinilo pitkuheoyonin.

2.3.4 Résumé analytique

TMAC Resources Inc. (TMAC) propose d'entreprendre un programme d'exploration approfondie de la zone Madrid de la ceinture de roches vertes de Hope Bay (la ceinture de Hope Bay ou Hope Bay) dans la région de Kitikmeot au Nunavut. La zone Madrid est située à environ 130 km au sud-ouest de Cambridge Bay.

De nombreuses activités d'exploration et de développement dans la ceinture de Hope Bay ont été entreprises par TMAC et d'anciens operateurs depuis les vingt dernières années. La ceinture de Hope Bay dispose d'une infrastructure existante significative y compris des pistes d'atterrissage, des routes, du stockage de carburant, une installation portuaire, des centrales électriques, des bâtiments abritant l'administration, la géologie et les laboratoires, et des aménagements souterrains dans les zones Doris et Boston.

Le projet Doris North (Doris North), reconnu sous la phase 1 du développement de la ceinture Hope Bay, consistera en une production d'or effectuée à partir d'une mine souterraine située près du lac Doris. Doris North est actuellement complètement autorisé et est partiellement construit. TMAC demande l'autorisation pour le programme d'exploration approfondie de la zone Madrid pour effectuer des travaux supplémentaire afin de mieux définir les ressources minérales de Madrid North et de Madrid South, comprendre la variabilité du dépôt, soutenir la planification minière et valider la faisabilité économique.

Le programme d'exploration approfondie proposé de la zone Madrid comprend l'extraction d'échantillons de minerai en vrac d'environ 50 000 tonnes provenant de chacune des zones Madrid North et Madrid South, employant des méthodes d'extraction souterraines. Le minerai sera ensuite acheminé par camion pour traitement à l'usine de Doris North. Le programme d'exploration approfondie, d'une durée de 10 ans, comprendra également des activités reliées à l'infrastructure et au soutien, comme la production d'électricité à partir de diesel, les zones de stockage de stériles et du minerai, la gestion des eaux souterraines et de surface, le stockage et l'utilisation d'explosifs, les activités de carrière, les routes quatre saisons et d'hiver, et les forages au diamant souterrain et de surface. Les installations de camp de Doris North seront utilisées pour accueillir les quelque 70 personnes requises pour le programme d'exploration approfondie de la zone Madrid. Les déchets solides, dangereux et non dangereux générés dans le cadre de ce programme d'exploration seront acheminés vers les installations de gestion existantes de Doris North.

L'eau douce nécessaire pour le programme proviendra principalement des lacs Patch et Windy et sera utilisée pour des fins industrielles (surtout forages de surface et souterrain) et pour usage domestique à un taux de pointe quotidien de 295 m^3/jour. L'utilisation de l'infrastructure et les voies d'accès existants à Doris North, et les méthodes d'exploitation minière souterraine à Madrid, minimise

l'empreinte concernée. Le potentiel pour des effets environnementaux sur les ressources biologiques, physiques et traditionnelles associées au programme d'exploration approfondie pourra être atténué en intégrant les considérations de conception avec les pratiques de gestion reconnues.

2.4 APPLICATION FEE

The associated $30 application fee is submitted to the NWB with this application.

2.5 WATER USE FEE

The water use fee of $30 for this application is submitted with the application fee and the balance will be submitted with the issuance of the water licence.

2.6 SIG CONCORDANCE

The Madrid Advanced Exploration Program SIG has been used to develop the information provided within this report and is presented in Appendix 2.

2.7 STUDIES

Section 2 of the SIG concordance table includes listing all studies completed for the water licence application. To date, studies have been completed within the Hope Bay Belt to determine environmental baseline conditions, develop project activities and components, identify water use and the predicted environmental effects and proposed mitigation measures. The reference lists within this Supplemental Information Report, within Appendix 4 (Project Description) and within Appendix 5 (Environmental Baseline Report) provide a list of studies completed to date used to develop the Madrid Advanced Exploration Program.

3. GENERAL WATER LICENCE APPLICATION

Section 3 of this Technical Report addresses Section 3.0 – "General Water Licence Application" as presented in: Nunavut Water Board information Requirements for a Type B Water Licence Application.

3.1 APPLICATION FORM

The application form for the Madrid Advanced Exploration Program – Exploration Type B Water Licence is presented in the preamble of this technical report.

3.2 APPLICANT INFORMATION

TMAC Resources Inc. is a privately held, Canadian-based mineral exploration and development company. Led by an experienced management team, the vision and sole focus of the company is the responsible and economically sustainable exploration, development and mining of the Hope Bay Greenstone Belt as Canada's next major gold mining camp.

TMAC considers development of the Hope Bay Belt to be an opportunity to further develop the positive working relationship that has been established with the Inuit, Nunavut, and Canada by managing risk and sharing the economic and social benefits with stakeholders through a responsible approach to exploration, mining, and gold production.

The Project's official mailing address is:

TMAC Resources Inc.
95 Wellington Street West
Suite 1010, P.O. Box 44
Toronto, Ontario, M5J 2N7

3.3 APPLICANT REPRESENTATIVE AND INFORMATION

3.3.1 Representative Authorization Letter

The contact person for the Project is:

M. John Roberts
Vice President, Environmental Affairs
TMAC Resources Inc.
95 Wellington Street West
Suite 1010, P.O. Box 44
Toronto, Ontario, M5J 2N7

Phone: 416-628-0126
Fax: 416-644-9337
e-mail: john.roberts@tmacresources.com

3.3.2 List of Officers of the Company and Evidence of Registration

The list of Officers of the Company is attached in Appendix 3.

3.3.3 Financial Statement

TMAC's most recent financial statement is presented in Appendix 3.

3.4 TERM OF THE MADRID EXPLORATION PROJECT WATER LICENCE

TMAC requests that the term of the licence be 10 years. This includes preparation and construction activities over a period of 2 to 3 years, operation for 2 to 3 years, closure 1 to 2 years, and post closure of 2 years. If additional time is needed to accommodate further post closure monitoring, the water licence will be renewed and amended at that time. The requested issuance would be Q3 2015 so procurement can occur in Q3 2015 and work start Q4 2015-Q1 2016. The bulk sample program at Madrid North and Madrid South is currently planned to be completed sequentially with initial work completed at Madrid North. Surficial exploration diamond drilling will occur throughout the 10 year Project life.

3.5 OVERVIEW

3.5.1 Project Background

TMAC Resources Inc. (TMAC) is proposing to undertake an advanced exploration program, including a bulk sample, at the Madrid area (Madrid North and Madrid South), located within the Hope Bay Greenstone Belt (the Hope Bay Belt), an 80 by 20 kilometre Property located along the south shore of Melville Sound in Nunavut (Figure 3.5-1). The Madrid area of the belt is located approximately 130 km southwest of Cambridge Bay, Nunavut and 720 km northeast of Yellowknife, Northwest Territories. The nearest communities are Umingmaktok (70 km to the southwest of the Property), Cambridge Bay, and Kingaok (Bathurst Inlet; 150 km to the southwest of the Property).

The Hope Bay Belt is a north-south trending greenstone belt, with economically viable zones of gold mineralization that can be divided into three areas: Doris, Madrid, and Boston. Over the past twenty years, the belt has undergone considerable exploration and development activities by TMAC and previous operators. As a result, the Hope Bay Property has significant infrastructure including air strips, roads, fuel storage, a port facility, power plants, administration, geology, and lab buildings, and underground development at the Doris and Boston areas. The main area of infrastructure development is the Doris North Project, partially constructed in 2010 and 2011 (NIRB 2013). The Doris North Project has not processed any ore or created any tailings, as it has yet to enter the production mining stage of operations (NIRB 2013). The existing Doris North Project infrastructure is located approximately 14 and 9 km to the north of the proposed Madrid South and Madrid North bulk sample areas respectively (Figure 3.5-2). The footprints of the proposed Madrid North and Madrid South bulk sample areas are included in Figure 4.2-1, Figure 4.3-1, and Appendix 4.

Figure 3.5-1

Hope Bay Belt
Regional Location



TMAC is currently progressing with phased approvals of the Hope Bay Belt, with the expansion of the Doris North Project Phase 1 and the potential development of the Madrid and/or Boston areas (Phase 2). The approval to proceed with the Madrid Advanced Exploration Program is sought as a related but distinct Project.

Previous underground developments at Doris (2010-2011) and Boston (1996-1997) provided critical access to various parts of the mineralization in order to collect bulk samples used to evaluate the character and metallurgical nature of the ore. Underground development and bulk sampling is a necessary step in the advanced exploration process to determine the economic viability of the mineralization. Madrid area is the only district in the Hope Bay Belt without the benefit of a bulk sample program.

The intent of TMAC's proposed Madrid Advanced Exploration Program is to extract bulk samples from the potentially high-grade underground mineral resources, and test the samples at the Doris North Project Mill (Figure 3.5-2). This will allow adequate resource definition and confirmation of mill processing approaches for the Madrid mineral resources, which are required to validate the economic feasibility of the deposit and determine how to incorporate the Madrid area into the mine plan for the Phase 2 Hope Bay Belt development. Access to the underground is needed to better understand the formation of the deposit itself, to explore from underground, to test mining methods, and assess mineral recovery methods. This information will inform feasibility and engineering decisions and assist with strategic planning for the area. This underground work is supported with continued diamond drilling on surface to improve definition of resources and reserves and support ongoing exploration activities.

3.6 SITE HISTORY

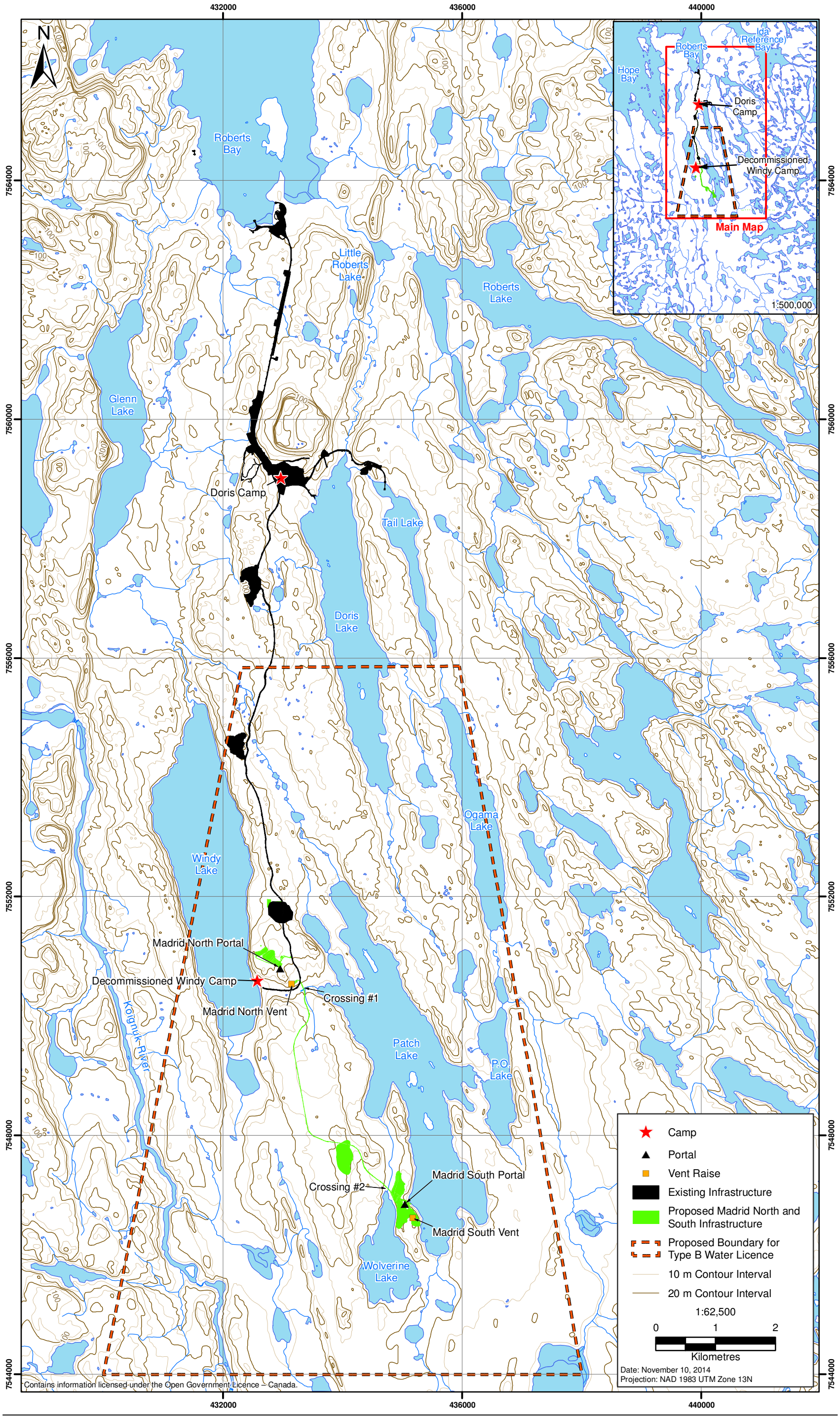
The Hope Bay Belt was first outlined in 1962 by J.A. Fraser of the Geological Survey of Canada during a reconnaissance mapping program. From the mid-1960s to the late 1980s, a variety of small-scale exploration and mining activities were conducted in the belt by Roberts Mining Company, Radiore Uranium Mines, Hope Bay Mines Ltd., Perry Nickel Mines, Noranda Exploration, and Abermin Corporation.

BHP Billiton (BHP) commenced an initial review of the area in 1988, staking claims over the belt in 1991-1992. Between 1991 and 1998, BHP's activities included prospecting, geological reconnaissance and geological mapping, geochemical till sampling, mineralogical studies, and airborne and ground geophysical surveys. BHP also undertook core drilling comprising 1,261 drill holes (approximately 120,000 m), metallurgical testwork, decline construction and an underground bulk sampling program at Boston, and mineral resource estimation and mining studies. Baseline environmental studies were also completed. BHP's work identified the Boston deposit in 1992, the Madrid deposit in 1994, and the Doris deposit in 1995.

In December 1999, the Hope Bay Belt was purchased from BHP by the Hope Bay Joint Venture, which was a 50:50 joint venture between Cambiex Exploration Inc. and Miramar Hope Bay Ltd. (a wholly owned subsidiary of Miramar Mining Corporation). All claims were registered in the name of Cambiex Exploration Inc., which changed its name to Hope Bay Gold Corporation Inc. in 2001. In May 2002, Hope Bay Gold Corporation Inc. merged with Miramar Mining Corporation.

Figure 3.5-2

Madrid Advanced Exploration Program



From 2000-2007, Miramar Hope Bay Ltd. conducted geophysical surveys, till sampling, mapping, and prospecting. Drilling (surface, underground, geotechnical, condemnation) totaled approximately 382,000 m in 2,215 holes. Miramar's work also included metallurgical studies, resource/reserve estimates, and engineering to support the completion of a feasibility study in 2003 for the Doris deposit as well as environmental baseline studies to support the completion of an environmental impact statement for the Doris North Project in 2006.

In late 2007, Newmont Mining B.C. Ltd., an indirect wholly-owned subsidiary of Newmont Mining Corporation, purchased Miramar Hope Bay Ltd. and formed Hope Bay Mining Ltd. (HBML), which became the registered owner of all the Hope Bay Belt tenure. From 2007-2012, HBML conducted core drilling, including exploration, infill, and geotechnical holes, geological mapping, surface sampling, resampling of selected existing drill core, metallurgical test work, mineral resource estimation, collection of whole-rock geochemical data, preliminary metal leaching and waste rock characterization studies, collection of environmental and social base line data, development of a site-wide, probabilistic water balance model, groundwater monitoring programs, and preliminary mining and engineering studies.

In 2010 and 2011, activity at the Doris North Project was focused on completing infrastructure necessary for the development of the mine including the construction of a number of facilities and structures at Roberts Bay area, Doris North Project Camp and some Tail Lake facilities (NIRB 2013). Construction of the North Dam of the Tail Lake Tailings Impoundment Area (TIA) began in January 2011 and was complete in April 2012.

In late 2012, HBML placed the Hope Bay Belt into care and maintenance, and the project was seasonally closed during the winter of 2012/2013. TMAC acquired the Hope Bay Belt from Newmont in March 2013. The acquisition included exploration and mineral rights over the Hope Bay Belt, including the Doris North Project and its permits, licences, and authorizations for development received by previous owners. TMAC re-opened the Doris North Project camp in March 2013. Exploration and environmental monitoring and compliance have been the primary focus of TMAC's efforts in 2013 and 2014.

3.7 RELATIONSHIP OF PHASE 1 AND PHASE 2 HOPE BAY BELT AND MADRID ADVANCED EXPLORATION PROGRAM

The following overview of the phased approach to the potential long-term belt-wide development of the Hope Bay Belt is intended to provide context for the proposed Madrid Advanced Exploration Program.

TMAC views the Doris North Project (Nunavut Impact Review Board (NIRB) Project Certificate No. 003, NWB Type A Licence 2AM-DOH1323) as Phase 1 of a belt-wide development, with limited gold production from one stand-alone underground mine located near Doris Lake (Figure 3.5-2). Originally, Miramar Hope Bay anticipated a 2 year mine life for the Doris North Project; however, ongoing exploration by HBML and more recently TMAC suggests there are sufficient resources and tailings storage capacity to allow 2 to 4 years of additional mine life. TMAC has submitted an amendment request to the NWB to extend the mine life. While envisioned as a key phase in the Belt-wide development, the Doris North Project is designed to operate as a stand-alone operation.

A project proposal for Phase 2 of the Hope Bay Belt, which is intended to cover the reasonable and foreseeable proposed incremental development of the Belt, has been submitted and NIRB EIS Guidelines (NIRB Dec 2012) have been issued. Phase 2 could include the development of the Madrid and/or Boston areas if found to be economically viable. The development would include infrastructure and waste management facilities to support underground mining and processing of ore both districts.

Phase 2 would also include expansion of the existing infrastructure associated with the Doris North Project that would be required to support a Belt-wide production approach. In addition to mining and potential milling facilities for each district, new infrastructure could include tailings and waste rock storage facilities. The Project also anticipates access roads and small support camps off the main north/south transportation corridor to facilitate ongoing exploration activities along the length of the Belt. These alternatives will be investigated in further detail in the upcoming EIS for the Phase 2 Hope Bay Belt Proposal.

TMAC is submitting this licence application to extract bulk samples and to expand exploration drilling of the Madrid deposit. Access to the underground is needed to better understand the formation of the deposit itself, to explore from underground, to test mining methods, and assess mineral recovery methods.

Bulk samples will be extracted from two portals. (Madrid North and Madrid South) which are currently planned to be completed sequentially with initial work completed at Madrid North. This approach means that the same equipment and personnel can be used at both areas and the experience with collecting the bulk sample at Madrid North will help plan and implement the mining to extract the bulk sample at Madrid South. Although the infrastructure and activities presented will be a stand-alone program, Phase 2 development will be planned, as much as possible, to incorporate use of similar footprint and equipment.

4. PROJECT DESCRIPTION

The Madrid Advanced Exploration Program will be staged from two different areas within the Madrid District identified as Madrid South and Madrid North. Madrid South will advance the knowledge base of two sub-deposits (Patch 14 and Wolverine) and Madrid North will advance the knowledge base of two additional sub-deposits (Naartok and Suluk).

The advanced exploration at each site will consist of four components – diamond drilling, underground development within the ore zones, test stoping, and bulk sampling of ore – with the following objectives:

- Diamond drilling – Additional diamond drilling from the surface across the Madrid area will be complemented by closely spaced infill diamond drilling from underground platforms, with the combined objective of increasing deposit knowledge and upgrading resource classification to facilitate detailed Phase 2 mine design, conversion to reserve, and economic assessment.
- Underground development in ore – Underground development conducted along the strike of the ore body, on two or more levels. This will advance the geological understanding of controls on mineralization, provide validation of the current geological models, and establish both geological and grade continuity within the ore zones. The deposits are relatively short strike length, steeply dipping ore zones and are approximately 5 km apart. This spatial distribution does not support accessing both areas with one underground development and is the reason that two bulk sample portal access locations are proposed.
- Test stoping – Test stopes will provide sufficient sample to allow a grade/tonnage reconciliation to be completed against the current resource estimate, assessment of geotechnical parameters, and confirmation of recovery and dilution factors assumed in the reserve conversion. Test stoping will also provide confirmation of the mining methods selected.
- Bulk sampling of ore – Processing of ore sample of sufficient size to assess milling and processing performance. This will be beneficial in providing confirmation of crushing and grinding criteria used to set throughput capabilities and operating criteria such as power usage, reagent usage, and water usage. Bulk sampling will also provide metal recovery estimates that would be more representative of an ore body than core samples or chip samples, thus allowing development of overall economics of the bulk sample based on the recovery of metal. The bulk sample will also allow development of operating techniques to maximize recovery and throughput of the ore body in general.

A portal will be established at each site, along with associated surface infrastructure, underground development in waste, vent raises, and sill development in ore within the ore bodies, and test stoping. At Madrid North, approximately 4,200 m of underground development is expected to occur in waste and 1,000 m in ore. At Madrid South, approximately 3,500 m of underground development is expected to occur in waste and 1,000 m in ore. The proposed underground activities at each site are expected to take approximately 1.5 years to complete once the portal has been established for a total of 3 years of underground mining to extract the bulk sample. Over each 1.5 year period on

average approximately 100 tonnes per day (tpd) of material will be mined. TMAC currently plans to undertake the work at Madrid South and Madrid North sequentially as distinct projects starting with Madrid North and followed by Madrid South.

The existing all-weather road from the Doris North Project to Windy Lake passes in close proximity to the proposed portal site for Madrid North. An approximate 4.7 km extension to this road is proposed for access to the Madrid South portal.

Surface ore and waste storage pads will be required at each site as follows:

- Madrid North – to support approximately 275,000-300,000 tonnes of waste material generated from the underground development, approximately 25,000-30,000 tonnes of ore produced from sill development, and 25,000-30,000 tonnes of ore produced from test stopes.
- Madrid South – to support approximately 225,000-250,000 tonnes of waste material generated from the underground development, approximately 25,000-30,000 tonnes of ore produced from sill development, and 25,000-30,000 tonnes of ore produced from test stopes.

The ore will be processed at the approved Doris North Project processing facility (Figure 3.5-2). Ore grade sample material will be temporarily stored at the bulk sample site and will be trucked approximately 9 km north from Madrid North to the Doris North Project, and approximately 14 km from Madrid South, for processing. Ore from each site may be processed as stand-alone batch material and/or as blended material with ore from the Doris North Project.

TMAC will mine and stockpile the entire bulk sample from Madrid North and Madrid South on their respective designated ore stockpile. When ready, ore will be hauled to Doris North Project using available Haul Trucks with approximately 40 round-trips per day. The time period to complete the transport of material from Madrid to the Doris North Project mill processing facilities will be completed in the shortest possible time period; however, it will be dependent on operational needs, environmental factors, economic and safety considerations.

4.1 EXISTING INFRASTRUCTURE

The proximity of the Madrid area to the Doris North Project provides the opportunity to take advantage of existing infrastructure that will reduce costs, minimize the footprint and minimize the time required to complete the Madrid Advanced Exploration Program. The permitted infrastructure and facilities at Doris North Project have sufficient capacity to support the proposed Project. Infrastructure associated with the Doris North Project includes port facilities, an airstrip, a camp, waste treatment facilities, milling and processing facilities, tailings impoundment facilities, and existing access roads.

4.1.1 Transport

4.1.1.1 Roads

An all-weather access road currently exists from the Doris North Project (camp and mining facilities) approximately 9 km south to the former regional exploration camp at Windy Lake. This camp site is

currently being reclaimed by TMAC as described in the Windy Camp and Patch Lake Facility Updated Closure Plan (SRK 2014e). In addition to this access road, there are approximately 15 km of all-weather roads within the Doris North Project connecting the port, camp and mining facilities.

4.1.1.2 Airstrip

The existing all-weather airstrip located between Roberts Bay and Doris North Project camp will be used to support the advanced exploration program. The airstrip is approximately 900 m long and is capable of landing various aircraft including the DC3 and Dash 7. Approvals are in place to extend this airstrip to 1,400 m; sufficient length to service Bombardier Q400 aircraft. The airstrip is constructed with run-of-quarry rock topped with a crush layer for durability.

A certified and Transport Canada registered ice airstrip is constructed on Doris Lake each year. This ice strip is normally operational from February to mid-April when ice thicknesses and surface conditions permit larger aircraft operations direct to the Hope Bay Belt.

4.1.1.3 Shipping

Roberts Bay is located approximately 5 km from Doris North Project camp and is the main port entry point to the Belt. The port provides a cargo offloading jetty, a diesel fuel offloading facility, and a fuel storage facility. Fuel storage at Roberts Bay includes available storage capacity for 15 M litres of diesel fuel in steel tanks within secondary, lined containment.

In order to provide for the economic supply of material and equipment into the Hope Bay Belt, an annual sealift is required. This sealift generally occurs in the ice-free period of August-September, when ships and barges can access the site.

4.1.2 Processing Plant

Bulk sample ore will be transported from Madrid North and Madrid South to the Doris North Project mill for test processing. The Doris North Project mill is an approved but yet to be constructed facility under the Type "A" Water Licence 2AM-DOH1323. It uses a conventional milling process consisting of crushing, grinding, gravity and flotation concentration, cyanide leach of the concentrate, gold recovery, and on-site refining. Once constructed, the mill will have the permitted capacity to process ore from the bulk samples at an average rate of 800 tonnes per day. Ore from each site may be processed as stand-alone batch material and/or as blended material with ore from the Doris North Project. If processed in bulk, each bulk sample represents the equivalent of 75 days of processing by the mill at 800 tonnes per day.

In 2013, TMAC submitted an application to the Nunavut Water Board (NWB) to amend the current Type "A" Water Licence, 2AM-DOH1323. Amongst other changes, this application contemplates the expansion of the mill from an initial average ore processing rate of 800 tonnes per day to an average of 1,800 tonnes per day over time. The Madrid North Advanced Exploration Program is not reliant on expansion of the mill; however, if approved and constructed, the length of time needed to process the bulk samples may be reduced.

4.1.3 Tailings Containment Areas

The tailings impoundment area (TIA) associated with the Doris North Project has been partially constructed. In 2012, a retention dam (North Dam) was constructed at the north end of the existing approximately 4.5 km long lake. This dam provides for the storage and controlled release of effluent from the impoundment area. There are plans to construct a dam at the south end of Tail Lake (South Dam) to increase the capacity of the impoundment area to meet the needs for the Doris North Project. Once fully constructed, the TIA will have the capacity to process the ore from the currently permitted Doris North Project mine and process the bulk sample ore from the Madrid Advanced Exploration Program. Tail Lake has been added to Schedule 2 of the Metal Mining Effluent Regulations and is fully permitted for use as a tailings impoundment area. Discharge from the TIA must meet the water quality criteria for the Doris North Project Type "A" Water Licence 2AM-DOH1323.

As part of the amendment application submitted in 2013, TMAC is proposing to revise its tailings water management strategy. The revised strategy will have a single discharge from the TIA to the marine environment in Roberts Bay directly instead of being discharged to Doris Creek which discharges to Roberts Bay. The change in the water management strategy will reduce the potential for environmental effects from highly saline groundwater expected when mining in the talik zones of the Doris North Project or in deep areas below the permafrost. The Madrid Advanced Exploration Program is not reliant on changes to the proposed tailings management strategy described above as the proposed tailings volume contribution from Madrid Advanced Exploration activities would be covered by the current Type A water licence. If the amendment to the Type A is approved and implemented, the risks for potential environmental effects may be further mitigated.

4.1.4 Camp Site

The Madrid Advanced Exploration Program will utilize available capacity at the existing permanent camp facilities at the Doris North Project and/or the planned camp at Windy Lake permitted under Type "B" Water Licence 2BE-HOP122. Combined, these camps have the capacity to house 360 workers.

Activities associated with the Madrid Advanced Exploration Program will be scheduled such that additional camp space will not be required during the construction, operations, or closure stages. It is expected that the Madrid Advanced Exploration Program will require a peak work force of up to 70 workers during construction of the roads, portal, and infrastructure, bulk sampling and exploration drilling and as few as 3 to 4 during closure.

4.1.5 Other

Fuel storage is available at Doris North Project at both the camp and mining infrastructure. Approximately 22.5 M litres of storage capacity is available for diesel fuel in variable volumes and storage facilities. Existing infrastructure is also in place to manage sewage, non-hazardous waste, and hazardous waste for the Doris North Project; this infrastructure will be used to support the proposed Madrid Advanced Exploration Program. No changes to existing Doris North Project infrastructure are required as a result of the advanced exploration program; however, some of the existing management plans will need to be updated to encompass the addition of the Madrid area.

4.2 MADRID NORTH ADVANCED EXPLORATION PROGRAM – PROJECT DESCRIPTION

The Madrid North area has been explored since the mid-1990s with activities including prospecting, surficial mapping and sampling, geophysical surveys (downhole, surficial and airborne) and diamond drilling. To support this exploration, various activities and infrastructure have been incorporated into the program including exploration camps (e.g., Windy Camp), quarry activities, drummed fuel storage and caches, helicopter access, ice airstrips, and all-weather and winter roads. Much of this existing infrastructure is part of ongoing remediation and reclamation efforts by TMAC.

The following text outlines the proposed infrastructure to be established at Madrid North as part of the Project. Preliminary engineering drawings are included in Appendix 4 and Figure 4.2-1. Completed investigations show that the location of the proposed infrastructure avoids known archaeological sites. Should sites be encountered during construction, mitigation measures are available that would be implemented for site recovery. All new infrastructure has been sited more than 31 m away from adjacent waterbodies.

4.2.1 Transport

4.2.1.1 Roads

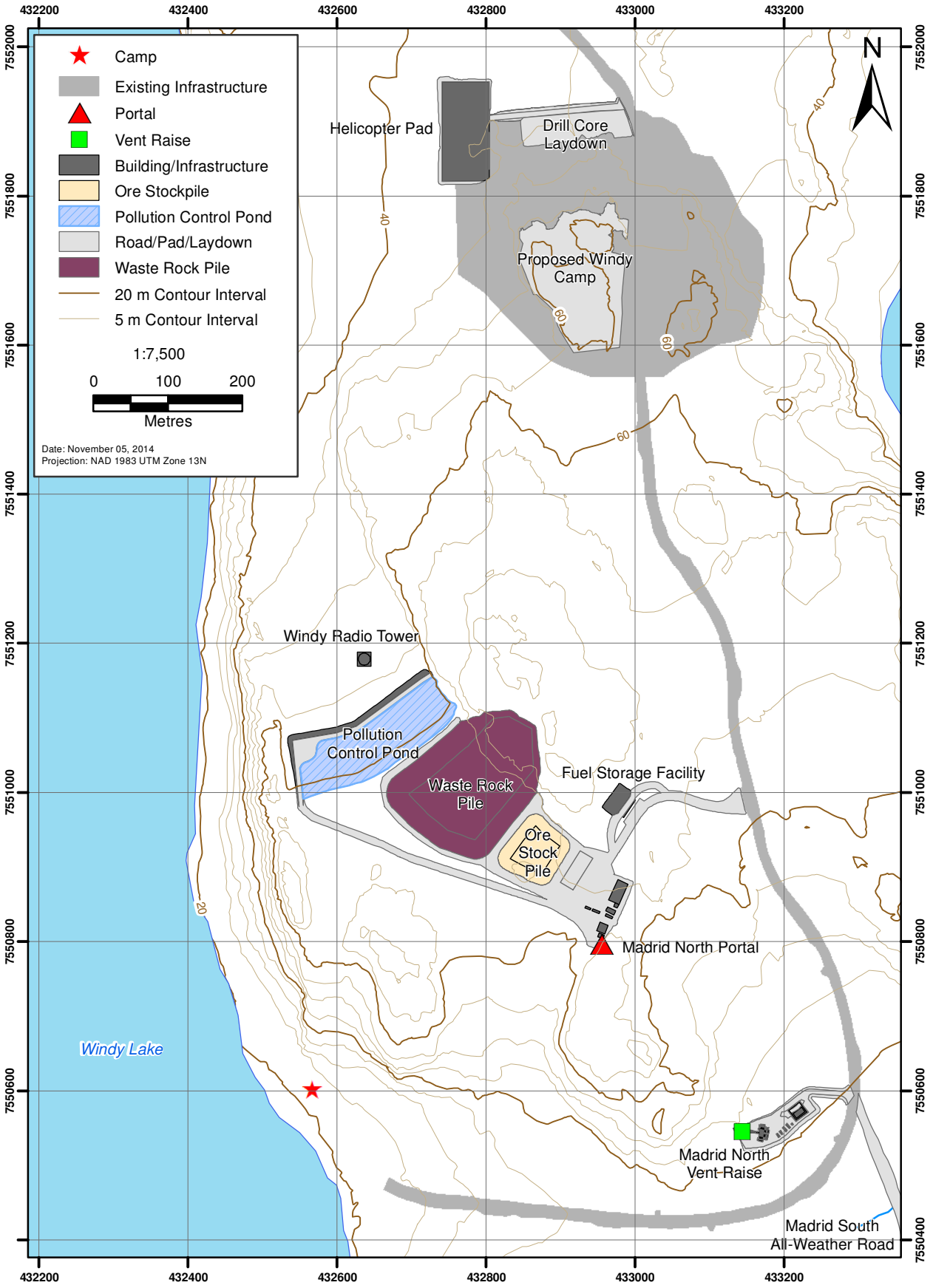
Madrid North is located about 9 km south of the Doris North Project camp, along the Doris North Project-Windy All-weather Road. An all-weather access road will turn off the Doris North Project-Windy Road at kilometre 8+600 and head west up to the Portal and Infrastructure Pad as well as waste rock and ore stockpiles. At kilometre 9+000 a second turn off, on the west side of the Doris North Project-Wind All-weather Road, will lead to the Vent Raise Pad. Prior to its construction TMAC may construct a winter road to access the area.

There are two road alignments at the Madrid North portal. The Portal Access Road alignment is the 225 m long by 9.5 m wide haul road which extends from the Doris North Project-Windy All-weather Road west to the Portal and Infrastructure Pad. The second road alignment is the 460 m long by 6 m wide access road which extends from the Portal and Infrastructure Pad to the Pollution Control Pond berm. It will be used only for light vehicle traffic use. A culvert is to be installed in the Doris North Project-Windy All-weather Road at the Portal Access Road to aid in surface water drainage.

The Vent Raise Access Road alignment is the 130 m long by 9.5 m wide. A culvert is to be installed in the Doris North Project-Windy All-weather Road at the Vent Raise Access Road to aid in surface water drainage.

Preliminary engineering drawings are included as Appendix 4-C. The roads will be constructed in accordance to SRK's Technical Specifications Earthworks and Geotechnical Engineering (SRK 2011c).

Figure 4.2-1
Proposed Site Layout for Madrid North
Advanced Exploration Program



4.2.2 Bulk Sample Stockpile

The Ore Stockpile pad is designed to accommodate approximately 50,000 to 55,000 tonnes of ore within a base area of 5,560 m^2. The ore stockpile will be constructed with an overall slope of 2.5 Horizontal to 1 Vertical (2.5H:1V). The ore stockpile will be placed on a pad consisting of a minimum of 1m thick Run of Quarry (ROQ), and/or mine operations waste rock, material placed over the original ground. This pad will maintain underlying permafrost conditions.

4.2.3 Waste Rock Storage and Disposal

The Waste Rock Stockpile pad is designed to accommodate at approximately 285,000 tonnes of waste rock within a base area of 21,530 m^2. The waste rock stockpile will be constructed with an overall slope of 2.5H:1V. The waste rock stockpile will be placed on a pad constructed of a minimum of 1m thick ROQ material placed over the original ground.

4.2.4 Laydown Areas

The Madrid North laydown area is located on the Portal Upper Pad. The pad (includes those for waste rock and ore storage) will be a minimum of 1 m thick ROQ for permafrost protection and to allow for adequate seepage drainage and will be in accordance to SRK's Technical Specifications (SRK 2011c). No excavation is allowed, except in designated rock quarries. All pads will be graded at 0.5% towards Pollution Control Ponds in order to control runoff and sedimentation.

The Portal Pad provides a base for the Shop, Laydown Area, Office trailers, Brine Mixing Facility, and the storage of calcium chloride. The Vent Raise Pad provides a base for the vent raise, air heating facility and fuel containment. Placement of the facilities is shown in Figure 4.2-1.

4.2.5 Borrow Pits and Rock Quarries

The completion of the Madrid Advanced Exploration Program will require quarry material from five quarries. Three of these quarries (Quarries A, B, and D) are located along the Doris North Project-Windy All-Weather Road and are currently permitted, approved quarries. Two new quarries (Quarries G and H) will also be required. Quarry G is located along the proposed access road to Madrid South and Quarry H is located at the Madrid South bulk sample site.

The existing quarries (A, B, and D) and new quarries (G and H) combined will supply ROQ material needed for the construction of the road network and infrastructure pads needed for the Project. The management and monitoring of these quarries will be done so in accordance with Hope Bay Belt, Quarry Management and Monitoring Plan (Appendix 8-C).

4.2.6 Underground and Aboveground Equipment

Tables 4.2-1 and 4.2-2 summarize the dedicated equipment expected for the Project. This equipment list is preliminary and may be refined as the Project advances. Personnel will be bussed from Doris North Project camp to Madrid North using the existing busses at Doris North Project.

Table 4.2-1. Underground Equipment List for Madrid Advanced Exploration Program

Item	Model	Qty	Description
Jumbo drill	Sandvik DD321	2	2 boom jumbo drills used for development rounds
Roof bolter	McLean MEM928	2	Scissor deck bolter used for installing ground support
LHD scoop	Sandvik LH514	2	6 m^3 capacity bucket underground loader for excavating ore and waste
LHD scoop	Sandvik LH307	1	3 m^3 capacity bucket underground loader for excavating ore and waste in narrow drifts and stopes
Haul truck	Sandvik TH540	2	40 tonne capacity underground haul truck for moving ore and waste to surface
Alimak	ABI-5A Single Drive	1	Rail raise climber for developing vertical ventilation raises
Grader	Miller M86	1	Underground grader for maintaining ramps
Boom truck	McLean BT-3	1	Underground truck for transporting supplies
Shifter truck	Miller Toyota Landcruiser	4	Underground light truck for transporting supervisors and support and technical services personnel
LH drill	Sandvik DL331-5	1	Longhole drill for wide stopes
LH drill	Boart Stopemate	1	Longhold drill for narrow stopes
Loader	Cat 930 Loader	1	Loader for stockpile surface stockpile maintenance and underground services

Table 4.2-2. Surface Equipment List for Madrid Advanced Exploration Program

Item	Model	Qty	Description
Blasting drill	Sandvik Ranger DX800	1	Drill for quarry operations
Haul trucks	Caterpillar 725	1	25 tonne capacity for moving quarry material to construction site and hauling ore to Doris North Project
Haul trucks	Caterpillar 740	2	40 tonne capacity for moving quarry material to construction site and hauling ore to Doris North Project
Loader	Caterpillar 988	1	Loading material onto the haul trucks and crusher
Excavator	Caterpillar 325	1	For construction and maintenance of infrastructure at the pad, portal, and road
Bulldozer	Caterpillar D6		For construction and maintenance of infrastructure at the pad, portal, and road
Explosives truck	To be specified	1	To transport explosive from the Doris North Project facility for delivery to the quarry
Crusher	Clemro	1	To size quarry material to appropriate size for use in construction and maintenance of infrastructure
Pickup trucks	Ford F350	2	Personnel transportation
Diamond drills	To be specified	6	To extract core samples on underlying geologic material for logging and sampling

4.2.7 Water Management

Windy Lake is in the Madrid North area and has been used as water supply for surficial exploration diamond drilling in the area and for an exploration camp (currently being decommissioned). Windy Lake currently provides domestic water for the Doris North Project.

There will be no camp facilities at Madrid North; however, potable water will be needed for domestic use in the office and emergency/medical facilities. Water use is principally industrial use to support mining the bulk sample. Water is needed to prepare brine for drilling in the underground workings. Surficial diamond drilling will also require water to prepare drilling mud. Water will also be required for the construction of seasonal winter roads and dust management

The goal of the water management system for Madrid North will be to use intercepted contact water in preference to lake water for make-up water and to maximize the mine water reuse within the underground workings. Runoff from the Waste Rock/Ore Pad and the Portal and Infrastructure Pad will be collected in the Pollution Control Pond and transferred by truck or pumped to the 50,000 L tank. Make-up water for the BMF will be drawn from this tank. Make-up water should only be needed when water already used from drilling can no longer be recycled. Make-up water will only be drawn from Windy Lake when it cannot be drawn from the Pollution Control Pond. Engineering drawings for Madrid North pads and access are provided in Appendix 4-A and include plans and details regarding the water access point and water storage tank, Pollution Control Pond location, and berm specifications. Excess water collected in the Pollution Control Pond will be discharged to the tundra (if compliant with established discharge criteria) or transported to TIA for disposal.

There will be a single Pollution Control Pond at Madrid North located down gradient of the portal, ore and waste stockpile pads. The Pond will act as a sedimentation basin and will be lined with a geomembrane. The Pond will be contained by a 6-m wide berm designed to allow for light vehicle access around the Pond for regular inspection; to assist in accommodating any required maintenance; and to allow for a vacuum truck to remove any retained water. Conceptual level engineering drawings are included in Appendix 4-A. The surface area of the Pollution Control Pond is up to 13,900 m^2 with a maximum depth of 2.8 m.

The Pollution Control Pond will have the capacity to contain flow from the overall drainage area plus 25% of the annual snow coverage combined with a 100-year, 24-hour storm event or an approximate 15,100 m^3 in total.

The run-off water captured by this Pond will be used within the Brine Mixing Facility or discharged at an approved location.

Further details are included in Appendix 4-A, including the conceptual level engineering drawings of the Pollution Control Ponds, and the sizes and quantities of rip rap.

Water management plans for operations and closure or temporary closure, are presented separately below and in Appendix 8.

4.2.8 Water Management during Operations

The sources of water during operations are runoff from the Portal Pad, waste rock and ore stockpiles and water drawn from Windy Lake. During operations, the underground bulk sampling water demand will be supplied from three sources listed in priority as follows:

1. Reused contact water collected in underground settling sumps;
2. Contact water from waste rock and ore stockpiles, collected and stored in the Pollution Control Ponds; and
3. Freshwater from Windy Lake.

Water will initially be drawn from Windy Lake to make brine for drilling. Brine used underground will be reused to maximum extent possible by settling solids in sumps underground. Some of the drilling brine will be lost in waste rock and ore, and make-up water will be required.

Contact water runoff from the portal pad, and waste rock and ore stockpiles will be collected in the Pollution Control Pond.

Water will be trucked or pumped from the Pollution Control Ponds and stored in a 50,000 L tank, as needed. Water will be pumped from this tank through the BMF. This additional brine will be used for underground drilling as needed.

The total brine/water usage per day for development will be approximately 23 m^3. If the Pollution Control Ponds and underground settling sumps cannot meet the demand for brine, make-up water will be obtained from Windy Lake. Freshwater will be extracted from Windy Lake at a location along the eastern shoreline using a water truck with a mounted mechanical pump and hose. The intake end of the hose will be screened in accordance with guidelines for pump intakes published by DFO (1995).

4.2.8.1 Excess Water Management

Any excess water from the underground workings will be pumped to the surface to the Pollution Control Pond. Water from the Pollution Control Pond that meets criteria (Section 7) will be discharged to the tundra. If these criteria cannot be met, water in the Pollution Control Pond will be trucked to the Doris North Project and discharged to the existing Doris North Tailings Impoundment Area (TIA).

4.2.9 Closure and Temporary Closure

In the case of temporary mine shut down, or permanent closure, water management will be adjusted such that:

- Runoff from the portal pad, waste rock dumps and ore stockpiles will be collected in the Pollution Control Ponds for settling, and if meets discharge criteria will be discharged to the environment, or if noncompliant, excess contact water will be transported to the TIA for disposal.

- Any remaining waste rock or ore remaining on the stockpiles will either be transported to Doris North Project or covered in place with a HDPE liner to eliminate contact, or some combination of both management approaches.

4.2.10 Chemicals and Hazardous Materials

4.2.10.1 Explosives Use and Storage

Regulations governing the storage and mixing of explosives require that powder and detonators are stored in independent magazines and that all storage magazines, bulk ammonium nitrate and the mixing plant be separated by minimum distances based on the amounts being stored (NRCan 1995).

Explosives used in the Madrid Advanced Exploration Program will be sourced from the Doris North Project Explosives Mixing and Storage Facility, as approved under water licence 2AM-DOH1323. This facility has not yet been constructed. Until this facility is available, pre-packaged explosives will be used and transported, handled and stored in temporary storage facilities located at Madrid North that meet NRCan regulations and related territorial regulations.

Explosives required for the bulk sample and for quarry operations will be transported to the site daily. Once the underground project has advanced to the appropriate depth an underground Type 4 magazine will be constructed and used to store explosives transported from the Doris North Project Explosives Facility necessary for the completion of the underground development and production. Estimates of explosive use are 1.40 kg ANFO per BCM (banked cubic metre) for quarry rock and 75 kg per metre of underground drilling or 3 kg per BCM.

4.2.10.2 Chemical Transport, Handling, and Storage

The bulk sample will require the use of two chemicals: a flocculent for the suppression of sediment in the Pollution Control Pond and salt (calcium chloride ($CaCl_2$) or sodium chloride ($NaCl_2$)) to be used in the diamond drilling necessary for blasting. These chemicals will be transported to Madrid North via trucks in bulk for temporary storage in their designated areas. The flocculent will be stored in the Madrid North Laydown Area as shown in Figure 4.2-1. A salt storage area for calcium chloride or sodium chloride will be located adjacent to the BMF.

4.2.10.3 Fuel Handling and Storage

Fuel will be delivered to the Doris North Project fuel storage facilities as part of the annual sealift resupply and will include fuel for the Madrid Advanced Exploration Project. There will be two locations where fuel will be stored at Madrid North. A 75,000 L double-walled tank will be located at the Fuel Transfer Station on the Infrastructure Pad and a 60,000 L double-walled fuel storage tank will be located at the Fuel Storage Facility on the Vent Raise Pad. The Fuel Transfer Station is 40 m from Windy Lake and the fuel storage tank facility at the vent raise is 150 m from Patch Lake. These are the nearest waterbodies to the fuel facilities.

The double-walled fuel storage tank at each location will be placed into a lined containment facility (This HDPE lined containment will be designed to accommodate 110% of the tank volumes plus 10%

of the fuel transport truck as well as 25% of annual snow cover combined with a 1-in-100 year 24-h storm event). In the case of the Fuel Transfer Station (75,000 L) and the Vent Raise Fuel Storage tank (60,000 L) the bermed containments will hold up to 135,000 L and 110,000 L respectively. In addition, each of these containment areas will be equipped with a fuel transfer apron. A sump will be installed in one corner of the containment to allow for collection and removal of runoff and snow melt that accumulates inside the containment. This discharge will be collected and if below effluent criteria proposed in Table 7.6-1 it will be discharged to the tundra; if above these limits, the contact water will be transported and disposed in the Pollution Control Pond.

The fuel transfer stations will be designed to the following codes and guidelines:

- NFPA 30 – Flammable and Combustible Liquids Code 2008 Edition;
- Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products - Canadian Council of Ministers of the Environment; and
- Canada Gazette Part 1, Vol 141, No. 14 April 7, 2007.

The facilities will be staffed and monitored continuously during fuel transfer events and inspected at least once daily at other times to ensure that any potential releases to the containment are identified and mitigated prior to any adverse impact to the environment.

Any uncontrolled discharge or spill of regulated materials will be managed according to the Spill Contingency Plan (TMAC 2014) and according to all applicable regulatory requirements in order to mitigate possible impacts.

4.2.11 Waste Management

4.2.11.1 Waste Water (Grey Water, Sewage, and Other)

To optimize site footprint, no standalone waste water treatment facilities will be established at Madrid North. All grey water and sewage will be transported to Doris North Project to be processed within licensed facilities operating according to the approved Wastewater Treatment Management Plan (SRK 2014c). In general, the wastes will be collected by a sewage effluent vacuum truck and dispensed to a lift station in the Doris North Project Camp wastewater treatment system for processing through the bio-membrane plant. Treated effluent is monitored for quality and volume and discharged in accordance with the requirements of Doris North Project Water Licence 2AM-DOH1323. If "Pacto"- type portable toilet facilities are used, these wastes will be returned to Doris North Project for incineration. The management of contact water from the waste rock dump, ore stockpile and portal pad and underground workings is described in Sections 4.2.7, 4.2.8, and 4.2.9.

4.2.11.2 Solid Waste

To optimize site footprint, no standalone solid waste management facilities will be established at Madrid North. All combustible, non-hazardous waste will be transported to the Doris North Project facilities to be incinerated according to the approved Incinerator Management Plan (HBML 2012c). Only food waste and domestic waste approved for inclusion in the incinerator waste stream is

burned. Recycling and established waste sorting within work areas will divert non-burnable solid waste from the incinerator. All non-combustible, non-hazardous waste and recyclables will be stored in suitable containers and disposed in or transferred to approved on-site or offsite facilities.

4.2.11.3 Hazardous Waste

All hazardous waste will be transported to Doris North Project to be managed according to the approved Hazardous Waste Management Plan (HBML 2012).

Any soil, overburden, and/or snow contaminated with light hydrocarbons (diesel or gas) at the Madrid Advanced Exploration Program will be transferred to the Doris North Project Landfarm Facility for treatment. This multi-cell, multi-treatment stage approved facility is operated in accordance with the Doris North Project Landfarm Management Plan (SRK 2014a). Heavy petroleum (motor oil and grease) contaminated soil, overburden and snow will be excavated and placed in suitable containers to be shipped to the Doris North Project waste management facility staging area at Roberts Bay and shipped off-site for final disposal.

4.3 MADRID SOUTH ADVANCED EXPLORATION PROGRAM – PROJECT DESCRIPTION

The Madrid South area has been explored since the early 1990s with activities including prospecting, surficial mapping and sampling, geophysical surveys (downhole, surficial and airborne) and diamond drilling. To support this historic exploration, various activities and infrastructure have been incorporated into the program including exploration camps (e.g., historic Wolverine Camp), drummed fuel storage and caches, helicopter access, ice airstrips and winter roads.

The following text outlines the proposed infrastructure to be established at Madrid South as part of the Project. Preliminary engineering drawings are included in Appendix 4-B and Figure 4.3-1. Completed investigations show that the location of the proposed infrastructure avoids known archaeological sites. Should sites be encountered during construction, mitigation measures are available that would be implemented for site recovery. All new infrastructure has been sited more than 31 m away from adjacent waterbodies.

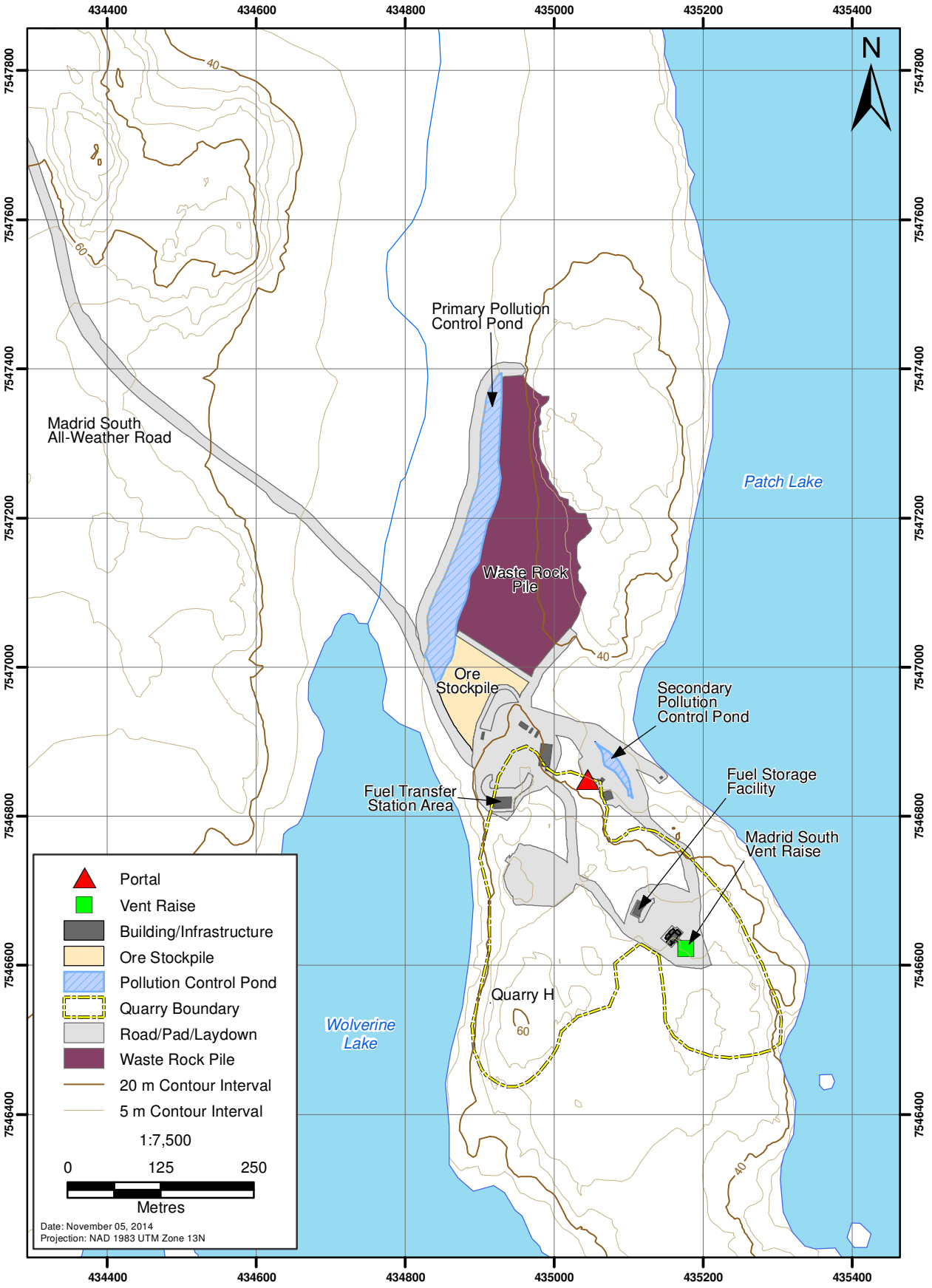
4.3.1 Transport

4.3.1.1 Access Road

Currently there is no permanent access to Madrid South and therefore TMAC proposes to construct a 4.7 km long all-weather road which will branch off from the southernmost end of the existing Doris North Project-Windy All-weather Road (Appendix 4-C). Prior to its construction TMAC may construct a winter road to access the area.

The all-weather road will allow dual lane traffic for vehicles travelling more frequently, such as trucks and crew busses, while allowing single lane traffic for occasional oversize vehicles. Strategically placed road turnouts provide safe use by oversized vehicles (single lane use). To allow water flow, water crossings will be via installation of closed culverts.

Figure 4.3-1
Proposed Site Layout for Madrid South
Advanced Exploration Program



The route extends south from the existing Doris North Project-Windy All-weather road crossing the topographic low (requiring a culvert stream crossing) between Patch and Windy Lakes. After about 0.6 km, the route turns southwest and runs uphill for about 0.6 km onto high well-drained ground. The route continues due south for about 1.5 km before turning south-east heading downhill for about 1.7 km towards the second topographic low (requiring a second culvert stream crossing) between Patch Lake and Wolverine Lakes. Madrid South is reached 0.3 km further.

Animal crossings will be constructed along the all-weather road alignment if required. It is proposed that the actual location of these crossings be determined by Elders after construction of the road has been completed.

4.3.1.2 Madrid South Roads

There are two road alignments to be constructed within the Madrid South footprint. The first road alignment is approximately 500 m long and is a combined haul road and vent raise access road on the east side of the site. The second road alignment is approximately 250 m long and is an infrastructure access road which extends from the Infrastructure Pad past the Laydown Pad to the Vent Raise Pad along the southwest side of the site.

The haul road connecting the Infrastructure Pad to the Madrid South portal is 16 m wide to allow for two-way traffic, of larger vehicles, to and from the waste rock and ore stockpiles. The Vent Raise Access Road section and the Infrastructure Access Road will only carry light vehicle traffic and have therefore been designed with a final road crest width of 8 m.

4.3.2 Bulk Sample (Ore) Stockpile

The Ore Stockpile pad is designed to accommodate approximately 50,000 to 55,000 tonnes of ore within a base area of 12,200 m^2. The ore stockpile will be constructed with an overall slope of 2.5H:1V. The ore stockpile will be placed on an underlying pad consisting of a minimum of 1m thick Run of Quarry (ROQ) material and/or mine waste material placed over the original ground. This pad maintains the underlying permafrost conditions and is graded toward the Primary Pollution Control Pond to control runoff

4.3.3 Waste Rock Management

The Waste Rock Pile pad is designed to accommodate approximately 225,000 tonnes of waste rock. The waste rock pile pad has a base area of 31,230 $m^2$and will be constructed of a minimum of 1 m thick ROQ placed over the original ground to maintain the underlying permafrost conditions. This pad is graded toward the Primary Pollution Control Pond to control runoff. The waste rock pile will be constructed on the pad with an overall slope of 2.5H:1V.

All waste rock placed on the pad will be managed in accordance with the Madrid South Waste Rock Management Plan (Appendix 8-B).

4.3.4 Laydown Area and Infrastructure Pads

The Madrid South laydown area and infrastructure pads include: the Infrastructure Pad; the Portal Pad; Upper Portal Pad, and the Vent Raise Pad. All pads will be a minimum of 1 m thick ROQ for permafrost protection and to allow for adequate seepage drainage and will be constructed in accordance with SRK's Technical Specifications, Earthworks and Geotechnical Engineering (SRK 2011c). No cut is allowed, except in designated rock quarries. All pads will be graded at 0.5% towards the Pollution Control Ponds in order to control runoff and sedimentation.

The Infrastructure Pad provides a base for the Shop, Fuel Transfer Station, Laydown Area, and Office trailers. The Vent Raise Pad provides a base for the vent raise, air heating facility and fuel storage. The Upper Portal Pad provides a base for the water storage tank. The Madrid South Portal Pad provides a base for the brine mixing facility and the storage of calcium chloride ($CaCl_2$). The Brine Mixing Facility will be moved underground once the main ramp is sufficiently sized to allow safe underground mining operations and mixing facility operations. Placement of the facilities, when on surface, is shown in Figure 4.3-1.

4.3.5 Borrow Pits and Rock Quarries

The completion of the Madrid Advanced Exploration Program will require quarry material from five quarries. Three of these quarries (Quarries A, B, and D) are located along the Doris North Project-Windy All-weather Road and are currently permitted, approved quarries. Two new quarries (Quarries G and H) will also be required. Quarry G is located along the proposed access road to Madrid South and Quarry H, is located at the Madrid South bulk sample site.

The existing quarries (A, B, and D) and new quarries (G and H) combined will supply the Run of Quarry (ROQ) material needed for the construction of the road network and infrastructure pads needed for the Project. The management and monitoring of these quarries will be done in accordance with Hope Bay Belt, Quarry Management and Monitoring Plan – Revision 02 (Appendix 8-C).

4.3.6 Underground and Aboveground Equipment

The same equipment that will be used at Madrid North will be used at Madrid South (see Table 4.2-1 and Table 4.2-2).

4.3.7 Water Management

Madrid South is an undeveloped site with no current water use. No changes to the waterbodies or water courses are required for the project. Historically, the waterbodies in Madrid South area have been used to supply water for diamond drills.

There are no camp facilities at Madrid South; however, water will be needed for domestic use in the office and emergency/medical facilities. Industrial water use will be required for mining the bulk sample and for construction and maintenance of winter roads as needed. Specifically, water is needed to prepare brine for drilling in the underground workings, for surficial diamond drilling, in the preparation of drilling mud and for access road dust suppression.

The goal of the water management system for the Madrid Advanced Exploration Program will be to collect and reuse as much contact water as possible in preference to using lake water. Some freshwater will be required initially and for make-up water during the mining of the bulk sample, and freshwater is used seasonally for ice road construction and dust suppression. Water management plans also maximize the mine water reuse within the underground workings. Runoff from the waste rock and ore stockpiles and the Portal Pad will be collected in Pollution Control Ponds and transferred by truck or pumped to the 50,000 L water storage tank. Water for the Brine Mixing Facility (BMF) will be drawn from this tank. Make-up water for underground drilling should only be needed when water already used for drilling can no longer be recycled. Make-up water will only be drawn from Patch Lake when it cannot be drawn from the Pollution Control Ponds. Engineering drawings for the Madrid South pads and access in Appendix 4-B include details regarding intake location and water storage tank, Pollution Control Pond locations, and berm specifications. Excess water collected in the Pollution Control Ponds will be discharged to the tundra (if compliant with established discharge criteria), or if non-compliant will be transported to the TIA for disposal.

There are two Pollution Control Ponds at Madrid South. The Ponds will be lined with a geomembrane and will act as sedimentation basins, facilitating the settling of suspended solids. The run-off water captured by these Ponds will be used within the BMF or removed for disposal to the TIA.

The primary Pollution Control Pond will be constructed downstream of the waste rock and ore stockpiles and will be contained by an 8-m wide berm which will double as a roadway and allow for access around the Pond and to the waste rock storage location. The surface area of the primary Pollution Control Pond is 12,300 m^2 and has the capacity to contain flow from the overall drainage area plus 25% of annual snow coverage combined with a 100-year, 24-hour storm event or approximately 15,000 m^3 in total.

The secondary Pollution Control Pond is located next to Madrid South portal and the BMF. This Pond will be contained by a 6-m wide berm. This berm has been designed to allow for light vehicle access around the Pond for regular inspection and to assist in accommodating any required maintenance. The secondary Pollution Control Pond has the capacity to contain flow from the overall drainage area plus 25% of the annual snow coverage or an approximate total of 900 m^3. However, it is expected that this Pond will always be operated in a manner as to allow for pumping to commence as soon as the containment volume is large enough for one continuous hour of pumping.

Water management plans for operations and closure or temporary closure, are presented separately below and in Appendix 8.

4.3.8 Water Management during Operations

Water management during operations at Madrid South will be similar to water management at Madrid North with freshwater supply provided by Patch Lake. See Section 4.2.8 for details.

4.3.9 Closure and Temporary Closure

Closure at Madrid South will be similar to closure at Madrid North. See Section 4.2.9 for details.

4.3.10 Chemicals and Hazardous Materials

Management of chemicals and hazardous materials at Madrid South will be similar to management at Madrid North. See Section 4.2.10 for details.

4.3.11 Waste Management

Waste management at Madrid South will be similar to management at Madrid North. See Section 4.2.11 for details.

4.4 EXPLORATION ACTIVITIES

Although the Madrid Area is moving into more advanced exploration activities, surficial exploration will continue as well. Geologic and geophysical mapping, diamond drilling, and sampling provide statistically robust estimates of the extent and quality of the deposit and the improved geologic knowledge of the area. The surface drilling at Madrid North and South, in combination with underground drilling and the bulk sample program, will collectively provide information that will support an upgrade to the mineral resource estimated to a higher classification. Surface exploration will continue in the Madrid area over the next several years.

All surface exploration activities will occur in consultation with the project archaeologist, and exploration personnel will be trained in archaeological site recognition and reporting. Locations of drill infrastructure or other activities will be > 31 m from waterbodies and be visually pre-surveyed for the presence of nests and dens. The drill inspection and monitoring program will be implemented to ensure impacts from exploration are minimized. A program of progressive reclamation will be undertaken for all surface drilling. Immediately upon completion of drilling, all casings and other materials will be removed, and disturbed areas will be returned to natural land conditions to the extent practicable.

4.4.1 Diamond Drilling

The diamond core drilling uses a core barrel and bit with a hollow diamond drill bit to collect a continuous sample of rock. These samples will be transported to Doris North Project camp for processing in the core logging and sampling facilities. The associated water use and waste management with core logging and sampling completed as part of the Project will be conducted in the same manner as currently permitted under 2BE-HOP1222 and 2AM-DOH1323. Management of exploration diamond drilling will be incorporated into the current exploration management plans.

Diesel fuel will be stored in small double-walled fuel tanks at each drill site. Quantities will vary, but should not exceed ~1,500 L at a time, and will have spill containment protection.

Chemicals used during drilling activities include calcium chloride (salt) used to prevent freezing of the water in the hole, Visco which is used as a lubricant in the hole, linseed soap for cleaning of drill string components, and heavy grease to prevent seizure of drill rods to each other. Salt will be stored in appropriate containment, while the other materials are stored within the drillers' sea-cans located on site. Small quantities of each material are also located with each drill.

4.4.2 Water Use

In Arctic permafrost drilling conditions, diamond drilling requires a drilling fluid that uses water that is either heated and/or saline to maintain the sample and drill efficiency. To maintain a properly conditioned drill hole, drilling fluids are added to drill water and injected down the hole. Additives, such as polymers, assist in lubrication, wall cake suspension, and other functions needed for different drilling conditions. Flocculent agents are used to assist in removing drill cuttings from the drill water supply in the event that recirculation and containment of fluids/spoils are required. Calcium chloride ($CaCl_2$) is used to lower the freezing point of drill fluids to allow them to remain in liquid form while drilling in freezing subsurface conditions.

Water supply for the individual drill sites will be provided by any nearby lake that has a surface area of at least 15,000 m^2 in surface areas and, if drawing water from under ice, complies with DFO "Water Withdrawal Under Ice" guidelines. Intake screens will also incorporate DFO best management practices for the protection of fish. For many drill locations, Patch and Windy Lakes will serve as the source of water. Water is metered and recorded daily as consumed by each drill, or tracked by delivered truckload to temporary water supply tanks when drills are located adjacent to the road system.

4.4.3 Waste Management

Water from the drill will be recycled to minimize the quantity of freshwater used, and allowed to freeze in the hole upon completion of the drilling. Experience in this region indicates that freezing of the hole takes place in a timeframe ranging from hours to days. Excess brine generated during the drilling process will be removed from the drill site and deposited onto waste rock piles, into Pollution Control Ponds, or discharged to the TIA.

Drill cuttings are pumped to a cuttings management containment system that allows the cuttings to settle and separate from the drill water. The clarified water is re-circulated through the system. If "brine free", cuttings sludge may be deposited in a natural depression in the vicinity of the drillhole, or transported by helicopter to a central cuttings management area where direct flow into a waterbody is not possible and no additional impacts are created. If the cuttings are contaminated with brine, they are transported to a separate contaminated cuttings management facility where runoff is captured for treatment or transfer to an appropriate wastewater disposal facility (e.g., Doris North Project TIA).

4.4.4 Airborne, Surficial, and Downhole Geophysics

Geophysical methods are used to describe the magnetic and gravity properties of the geologic material. No water is used and no wastewater is produced and this activity is included to provide a comprehensive list of activities that may occur as part of exploration activities.

4.4.5 Prospecting, Trenching, Mapping, and Sampling

Prospecting and mapping typically involve surficial investigations to systematically identify the underlying geologic material and mineralization. This program also involves the collection of

samples collected by hammer from outcrops or from shallow depths using mechanical methods such as channel saws and portable/back-pack diamond drills. Water needed for the mechanical methods would be provided by local nearby lakes.

Trenching involves the use of heavier equipment to excavate the underlying material to access areas to sample. No trenching is planned at this time in the Madrid Area; however, if needed to improve geologic understanding or inform ongoing feasibility studies, an amendment will be requested.

5. ENVIRONMENTAL AND SOCIAL SETTING

5.1 BASELINE STUDIES

Baseline environmental studies covering multiple years of data collection have been conducted in the Hope Bay Belt (comprising the Madrid Advanced Exploration Program, "the Project" region) since 1993, and are still ongoing today (Figure 3.5-1). Various components describing both the physical and biological environment have been studied in and around the Project area, in addition to various socioeconomic-related studies. A comprehensive list of all baseline data relevant to the Madrid Advanced Exploration Program Type B Water Licence Application is provided in Appendix 5. A summary of this available information is described in the sections below.

5.2 PHYSICAL ENVIRONMENT

The Hope Bay Belt property (Figure 3.5-1) is located within the Queen Maud Gulf Lowlands, in the east-central portion of the West Kitikmeot region of Nunavut, approximately 685 km northeast of Yellowknife. A number of protected areas exist within the West Kitikmeot Region; however, no sites overlap with the Project area.

The area lies within the Slave Geological Province, which is underlain by granite and related gneisses, as well as by sedimentary and volcanic rocks (more than 2.5 billion years old (WKRLUP 2005). The area is seismically stable, lying in Canada's lowest category for seismic hazard (NBC 2011). The topography of the area is typical of coastal lowlands in the Arctic, characterized by low and moderate relief with some high relief features. Watersheds are generally long and narrow, predominantly orientated along the north-south axis. The Belt area became ice-free from the most recent glaciation about 8,800 years ago as the Laurentide Ice Sheet melted back towards the southeast, leaving a blanket of basal till (morainal deposits). During this glacial recession, sea level was higher and marine sediments were deposited over most of the landscape. Isostatic rebound after de-glaciation resulted in emergent landforms, and during this process ocean waves and currents washed the landscape, resulting in areas with exposed moraine and/or bedrock.

Permafrost is continuous and deep (up to 500 m) with low ice content across the entire Project area (WKRLUP 2005). The active layer is generally less than 1 m thick in morainal sediments, but is expected to vary considerably with surficial geology and may be as much as 5 m deep in coarse sediments such as glaciofluvials. Taliks (unfrozen ground in otherwise continuous permafrost) are expected to be present beneath current and pre-existing surface water features.

The Madrid area within the Hope Bay Volcanic Belt comprises a north-south striking package of mafic volcanic rocks, with gold mineralization in the corridor being most commonly associated with the Fe-Ti tholeiites, and is structurally controlled by a large-scale zone of deformation (Madrid Deformation Zone) trending north-south along Patch Lake and at its northern end sharply changes orientation to an east-west trend across Windy Lake (TMAC 2013). Four zones comprise the gold mineralization with the Madrid trend.

Geochemical variability according to lithology and/or sample location was assessed in 2010 for additional quarry locations proposed in this application (Quarries G and H) by sampling numerous drillholes at selected locations (SRK 2014d). Results obtained through this characterization program revealed that material from both quarries have a low potential for ARD generation and low sulphur content. Materials are thus considered suitable for construction-related purposes (i.e., road and other infrastructure associated with the Project).

Climate in the region can be described as a subarctic desert with limited rainfall. The region is characterized by long dark winters and short bright summers. Meteorological baseline studies, involving a variety of automated and manual methods, have been conducted in the Madrid area since 1993 through the use of the Doris North Project meteorological station. Most precipitation falls as rain during the summer, and a mean of 10 cm of snow per month falls during the winter (WKRLUP 2005). The ground is covered in snow from October to June most years. Lakes are ice-covered from approximately October to June most years, with ice thickness reaching depths of 2.0 m.

Groundwater is generally controlled by topography, the distribution of hydraulic conductivity, and permafrost extents in the Project area. Flowing groundwater only exists within the permafrost where salinity depresses its freezing temperature, and is present in pore spaces in the active layer (during summer only), in taliks, beneath the permafrost, and in cryopegs. It is anticipated that the Madrid South underground activities will intercept groundwater when operating in areas of taliks. Groundwater in the Project area has been identified as saline, with a salinity (total dissolved solids) content similar to seawater (Roscoe Postle Associates Inc. 2013).

Rivers in the Project area have stream flow typical of the Arctic nival regime (Church 1974). The long and severe Arctic winter, and brief time when air temperatures are above freezing, limit surface water activity to a short period. Surface water flow typically begins in late May or early June, and rapidly rises to peak annual flow by early to mid-June. Snow that accumulated over the long winter is usually the dominant contributor of water to stream flow on an annual basis. Shortly after air temperature rises above freezing, the snow melts rapidly.

After the snowmelt-fed freshet, stream flow steadily decreases to a summertime minimum, which typically occurs in August. Due to the presence of permafrost, there is limited groundwater supply to smaller streams; however, there may be interaction between groundwater systems and larger rivers and/or lakes through taliks. Although snowmelt is typically responsible for the majority of runoff in most years, this may not be the case in exceptionally rainy seasons. In October, air temperature normally dips below freezing, precipitation begins to fall as snow, and stream flow ceases for the winter except in rivers with very large watersheds. Based on the results of hydrometric monitoring in the Project area, all monitored streams freeze solid in the winter with the exception of the Koignuk River, which retains under-ice liquid water in isolated pools separated by frozen sections of the river (Rescan 2009b, 2011d). However, no under-ice flow has been measured in the Koignuk River.

The northern portion of the Hope Bay Belt (Doris and Madrid areas) consists of two main watersheds: Windy-Glenn (48 km^2) and Doris-Roberts (194 km^2). The Project area extends into two watersheds: Windy Glenn (48 km^2) in Madrid North and Doris-Roberts (194 km^2) in Madrid South. Numerous hydrometric stations have been installed and operated throughout the Hope Bay Belt since the mid-1990s, allowing for multiple data years for many of the major lake drainage outlets

within Madrid areas. Automated monitoring began in 1996 and continues, to various levels, to the present. Streams in the Madrid area generally have low gradients and low bank slopes. Lakes may drain through channelized, permanent outlet streams or undefined, dispersed, and ephemeral drainages. In defined channels, substrate is generally composed of sand, gravel, and cobbles.

Bathymetric information, collected between 1993 and 2007, is available for numerous waterbodies located in the Project area, as are physical limnology characteristics, collected during the ice-covered and or the open-water season, from 1995 to 1998, 2007, 2009, and 2010. Profiles of dissolved oxygen concentrations and temperatures are typical of ice-covered Arctic lakes over both winter and open-water seasons. Ice cover is approximately 2 m thick and water temperatures are coldest just below the ice. Dissolved oxygen concentrations were highest near the water-ice interface, averaging 13.0 mg/L, and gradually decline with depth. Bottom waters in some lakes (e.g., Ogama and Wolverine lakes) were nearly anoxic (≤ 1 mg/L dissolved oxygen). In open-water season the lakes in the area mix fully at least two times per year resulting in well mixed or weakly stratified lakes. Dissolved oxygen concentrations are generally saturated to super-saturated, and remained relatively constant throughout the water column (Rescab 2010a, 2011d). Water clarity is variable amongst lakes, and can likely be attributed to relatively high phytoplankton biomass or the re-suspension of fine sediments along the shoreline resulting from wave action and strong winds common to the area.

Based on available baseline data the Madrid area freshwater is neutral to slightly alkaline, and contain variable concentrations of nutrients and metals; some seasonal water trends are apparent. Madrid area lakes have typically low nutrient concentrations, particularly during summer months, and are characterized as being ultra-oligotrophic to mesotrophic. Mean metal concentrations in Madrid area lakes are generally below CCME (Canadian Council of Ministers of the Environment) guidelines, except for a few lakes that are naturally elevated in aluminum, chromium, copper, and iron (Rescan 2010a). Lake sediments also exhibit some naturally elevated metal concentrations that exceed CCME Interim Sediment Quality Guidelines (ISQG), including arsenic, chromium, and copper; these metals concentrations were often higher than CCME ISQGs.

Multiple stream water quality baseline studies were conducted in the Madrid in 1996, 1997, and 2006 to 2009. Streams tend to be neutral to slightly basic, and have variable turbidity levels. Maximum concentrations of some nutrients (total phosphorus and ammonia) and metals (chromium and nickel) tend to occur during freshet. Stream sediments, containing lower metal concentrations than lake sediments, were also naturally high in chromium.

5.3 BIOLOGICAL ENVIRONMENT

5.3.1 Terrestrial Ecosystems

Over the years, various data describing existing biological environmental conditions have been collected within the Madrid area.

A number of baseline vegetation studies have been conducted in the Hope Bay Belt area from 1996 to 2011 (Rescan 1997a, 1997b, 2010c; Golder 2009). A preliminary regional Ecosystem Land Classification (ELC) system developed by Golder (2009) was used to classify vegetation in the Madrid area in 2010 (Rescan 2010c). The Project area, located north of the tree line, falls in the Queen Maud Gulf Lowland Ecoregion, a tundra, high shrub zone. Identified wetlands surveyed in the Hope Bay belt are

generally either fens or bogs, with lowland polygon fends being the most common. Vegetation tends to be part of either warm (e.g., tall dwarf birch, willow and alder) or wet community sites (sphagnum moss and sedge tussocks). Eleven dominant vegetation communities have been identified through the use of the ELC system in the Madrid area, with *Eriophorum* Tussock meadow being the most common (Rescan 2010c). Through various field studies conducted, no species of conservation concern were identified during the baseline field surveys for the Madrid area. On a regional basis, however, three species (all bryophytes) considered vulnerable or at risk and an "introduced" species, the common dandelion, have been identified within the Hope Bay Belt.

Large terrestrial vertebrate studies involving caribou, muskoxen, grizzly bears in the Madrid area have been conducted at a regional scale since 1996. Various other wildlife surveys have been conducted in the region since the 1970s including bird terrestrial breeding surveys, aerial surveys (e.g., raptors, waterbirds), as well as ground nesting surveys for seabirds. Various data is also available through Inuit Traditional Knowledge (ITK) from a variety of sources including Thorpe et al. (2002) and Keith et al. (2005).

Two ungulate species have been identified including the Barren Ground Caribou (a species of Special Concern) from two distinct herds and Muskoxen. Caribou are a keystone species in the Arctic, both biological and culturally (COSEWIC 2007, 2014). Ahiak caribou historically utilized some portions of the regional area for calving and post-calving during the late 1990s; however, recent collar data suggests that the calving range has moved east and out of the area. Surveys were sporadically conducted over the years; however, 2011 was the last year of aerial surveys due to the inability of detecting a zone of influence from low observed counts or presence-absence data. Muskoxen have also been observed throughout the region through targeted or incidental observations; however, numbers between years and seasons are highly variable, with the last of aerial observations being completed in 2011.

Five carnivore species exist within the Madrid region including Grizzly Bear (*Ursus arctos horribilis*), Wolverine (*Gulo gulo*), Wolf (*Canis lupus*), Arctic Fox (*Vulpes lagopus*), and Red Fox (*Vulpes vulpes*). Grizzly bears are a species of Special Concern (COSEWIC 2002) and are classified as Sensitive in Nunavut (COSEWIC 2005). Approximately 800 grizzly bears are found in the West Kitikmeot region at low densities (COSEWIC 2002). The coastal region comprising the Madrid area is highly productive for grizzly bears, with DNA hair capture studies identifying densities of approximately 8 to 11 individual grizzly bears for every 1,000 km^2. Wolverine populations in the central Arctic tend to be stable, and their conservation status is dependent on where they are found. Wolverines, classified as Secure in Nunavut but as a species of Special Concern in the western Canadian population, have been observed in the Madrid region during aerial surveys and incidental observations. Low sample sizes and recapture rates have prevented population level analyses from being undertaken. Wolves and foxes, also considered Secure, are found throughout the area. Carnivore den surveys identified one active den out of three wolf dens in 2009.

A number of bird species, including upland breeding birds, waterbirds, and raptors, have been identified in the Hope Bay Belt area through baseline and Wildlife Mitigation and Monitoring Program WMMP studies, as well as incidental sightings. Results from previous baseline and monitoring studies have identified 25 species of upland breeding bird, 28 species of waterbirds, and 9 species of raptors to be present in the RSA (Table 5.3-1).

Table 5.3-1. Incidental Observations of Birds in the Hope Bay Belt Area, 1996 to 2013

Species	Type	Total	Species	Type	Total	Species	Type	Total
Canada Goose	V	>1,522	Long-tailed Duck	V	>100	Savannah Sparrow	V	>75
	N	9		N	>2		N	1
Snow Goose	V	>787	Gadwall	V	10	American Tree Sparrow	V	>32
Greater White-fronted Goose	V	>705	Glaucous Gull	V	>55		N	2
Brant Goose	V	1	Herring Gull	V	>17	White-crowned Sparrow	V	>30
Tundra Swan	V	>200	Common Raven	V	>99	Horned Lark	N	2
	N	1		N	2	Snow Bunting	V	>9
Sandhill Crane	V	>151	Rough-legged Hawk	V	>69	Horned Lark	V	>15
	N	>1		N	1	American Pipit	N	2
Pacific Loon	V	>253	Northern Harrier	V	2	Common Redpoll	V	>15
Common Loon	V	6	Golden Eagle	V	>65	American Pipit	V	>5
	N	1	Bald Eagle	V	3	Hoary Redpoll	V	58
Red-throated Loon	V	>29	Peregrine Falcon	V	>29	Lapland Longspur	V	>42
	N	3	Gyrfalcon	V	7		N	2
Yellow-billed Loon	V	4	Short-eared Owl	V	44	Gray-cheeked Thrush	V	Yes*
King Eider	V	>8	Snowy Owl	V	7	Semipalmated Sandpiper	V	>6
Common Eider	V	5		N	1	American Golden Plover	V	5
Red-breasted Merganser	V	>65	Arctic Tern	V	>9	Least Sandpiper	V	>11
Common Merganser	V	1	Parasitic Jaeger	V	>4	Baird's Sandpiper	V	2
Greater Scaup	V	98	Long-tailed Jaeger	V	>1	Pectoral Sandpiper	V	2
Lesser Scaup	V	9	Willow Ptarmigan	V	>98	Wilson's Snipe	V	12
American Green-winged Teal	V	16	Rock Ptarmigan	V	13	Red-necked Phalarope	V	>9
Northern Pintail	V	>210	Harris' Sparrow	V	1	Semipalmated Plover	V	2

Notes:
V = Visual observation; N = Nest observation
** All sightings noted as "yes" were recorded as being "several."*

Birds in Nunavut are protected under various forms of federal and territorial legislation. All upland breeding birds and waterbirds identified at Hope Bay through baseline and monitoring studies, with the exception of ptarmigan species, are considered "migratory birds" and are protected under the *Migratory Bird Convention Act* (1994). Raptors and Common Raven are not considered migratory birds under the *Migratory Bird Convention Act*. However, all bird species, including raptors, are protected under the Nunavut *Wildlife Act* (2003).

Several species encountered during baseline and monitoring studies in the Hope Bay Belt are of conservation concern at the federal and territorial level. Of the 62 species identified, two are listed under the federal *Species at Risk Act* (SARA; 2002). Peregrine Falcon and Short-eared Owl are listed as species of Special Concern under Schedule 1 of SARA. Several others are listed as Sensitive in Nunavut by the Canadian Endangered Species Conservation Council (CESCC 2010), including American Golden-plover, American Pipit, American Tree Sparrow, Arctic Tern, Common Eider, Glaucous Gull, Golden Eagle, Gyrfalcon, Harris' Sparrow, Hoary Redpoll, King Eider, Least Sandpiper, Long-tailed Duck, Red-necked Phalarope, and Rough-legged Hawk, Semipalmated Sandpiper, Snow Bunting, and White-crowned Sparrow.

5.3.2 Aquatic Ecosystems

Aquatic systems comprise organisms from multiple trophic levels, and include periphyton (algae that grows on the surface of rocks or larger plants), phytoplankton (free-floating autotrophic algae), zooplankton (heterotrophic component of aquatic plankton), benthic macroinvertebrates (greater than 0.5 mm in size, also known as benthos) and fish (highest trophic level). Primary producers (e.g., phytoplankton/periphyton) are useful for examining the "early warning" effects of nutrient and metal pollution; they are sensitive to changes in water quality, have short life-cycles, and serve as the basis to higher trophic levels.

Comprehensive phytoplankton, zooplankton, periphyton, and benthos baseline sampling programs were conducted in the Madrid area in various streams and lakes in 2009; additional baseline data are available for some lakes and streams in 2010, and prior to 2009 (Rescan 2010b, 2011b).

Baseline fish studies were also conducted in the Madrid area in 2009 and 2010 (Rescan 2010b, 2011a). Fish habitat was defined as those environmental components that are required either directly or indirectly by fish to carry out their life processes, including spawning and rearing areas, food production areas, migration routes, and over-wintering areas. Channel and instream habitat characteristics were similar among streams and typical of slow-moving streams flowing through tundra wetlands. Streams in the area were generally ephemeral and offered temporary habitat for fish during the spring and early summer months. Outflow streams from lake sources were relatively larger and permanent (e.g., Patch Outflow). These streams supplied relatively high quality habitat, especially for small-bodied fish species such as Ninespine Stickleback (*Pungitius pungitius*). Juvenile Lake Trout (*Salvelinus namaycush*) and Arctic Char (*Salvelinus alpinus alpinus*) were also observed utilizing these large streams for rearing habitat. Lakes, ranging in surface area from 83.1 ha to 1,062.8 ha (e.g., Windy Lake, Wolverine Lake and Patch Lake), were the predominant form of fish habitat in the Madrid Area and supplied the greatest amount of perennial fish habitat. Ponds (maximum depth is < 3 m) assessed in the Madrid Area were rated as having limited habitat.

5.4 FISHERIES

Lake Trout are important to local Inuit for food and fishing is central to culture, identity and recreation. Arctic Char are considered most valuable for subsistence living by local communities, followed by lake Trout and Lake Whitefish. As supported by information gathered through focus groups, the region around the Hope Bay Belt (including the Madrid Area) is known for fishing; there is still evidence of fishing camps the region (Golder 2003; Miramar 2005).

Extensive fish community and fish habitat studies have been completed in waterbodies around the Madrid Area between 1995 and 2014. Sampled waterbodies in the Doris Watershed include Wolverine, Patch, Imniagut, P.O., Ogama and Doris lakes, whereas Windy Watershed sampled waterbodies include Windy, Nakhoktok, and Glenn lakes; outflows of all aforementioned lakes were also assessed. Seven freshwater fish species have been identified within the Project Area (Table 5.4-1). Tissue metals analyses have been conducted for Lake Trout and Lake Whitefish sampled in Patch, P.O., Doris, and Windy lakes.

Table 5.4-1. Species of Fish Captured in the Madrid Advanced Exploration Program Area

Common Name	Scientific Name	Watershed	Habitat (Lake or Stream)
Lake Trout	*Salvelinus namaycush*	Doris, Windy	Lake^{DW}, Stream^{DW}
Arctic Char	*Salvelinus alpinus*	Windy	Lake, Stream
Lake Whitefish	*Coregonus clupeaformis*	Doris, Windy	Lake^{DW}, Stream^{D}
Lake Cisco	*Coregonus artedi*	Doris, Windy	Lake^{DW}, Stream^{D}
Least Cisco	*Coregonus sardinella*	Doris	Lake
Slimy Sculpin	*Cottus cognatus*	Windy	Lake, Stream
Ninespine Stickleback	*Pungitius pungitius*	Doris, Windy	Lake^{DW}, Stream^{DW}

Note: D = Doris; W = Windy

A road will be constructed between Madrid North and Madrid South. This is an extension of the existing Doris North Project all-weather road and requires two crossings. The most northern crossing (Crossing #1) is located slightly upstream of an inflow to Patch Lake, whereas the more southern crossing (Crossing #2) is situated at the most southerly end of Wolverine Lake and is an inflow to Patch Lake. Only Crossing #2 is fish-bearing (with confirmed ninespine stickleback) and with limited value as fish habitat.

5.5 TRADITIONAL WATER AND LAND USE AREAS

The closest settlements to the Project area are Umingmaktok (~70 km) and Kingaok (~150 km). The communities of Iqaluktuuttiaq (Cambridge Bay; ~130 km) and Kugluktuk (~350 km) are the closest major regional centres. Other communities within the region that are further from the Project, include Gjoa Haven (~445 km), Taloyoak (~550 km) and Kugaaruk (~690 km). The Madrid Area falls within the traditional "Areas of Influence" (as defined by the West Kitikmeot Regional Land Use Plan, WKRLUP) of the communities of Bathurst Inlet, Umingmaktok, and Cambridge Bay. Areas of

Influence encompass broad areas of land and sea that are included in traditional land use patterns by community members (HBML 2011; Rescan 2012c).

The Nunavut Planning Commission (NPC), as established under the Nunavut Land Claim Agreement, is currently developing a Nunavut Land Use Plan (NLUP) for all Nunavut regions that are outside of municipal boundaries. While the plan has not yet been approved and remains in draft form, TMAC has reviewed the Draft Nunavut Land Use Plan in relation to the planned Project and is of the view that it is in conformity with the current draft.

The Inuit of the Kitikmeot have a longstanding relationship of reciprocity and respect with their region's wildlife and environment as a whole, as is manifested within *Inuit Qaujimajatuqangit* (IQ) (Golder 2003). As part of the Environmental Impact Statement (EIS) of the Doris North Project, IQ provided assistance in obtaining baseline data for the Hope Bay Belt, which includes Madrid Area sites (Miramar 2005).

IQ for the Hope Bay Belt area was augmented with results from an IQ Workshop in 2003 that was held in Iqaluktuuttiaq (Golder 2003). Definitions for IQ and an understanding of climate change, air quality, noise, landscape and terrain, hydrology and water quality, aquatic organisms and habitat, vegetation, terrestrial wildlife and habitats, archaeology, cumulative environmental effects and valued ecosystem components were documented (Golder 2003). Through the literature review, gap analysis, interviews, and workshop, a variety of IQ was collected that is pertinent to the Hope Bay Belt and Doris North Project. Information collected during historical data collection activities was supplemented by more recent community-based research detailed in the Socio-economic and Land Use Baseline Report completed by Rescan (2012). This consisted of site visits and the completion of interviews with key informants from each study community, a focus group session held with land users from Umingmaktok, and visits to other communities during 2011.

Particular importance has been placed on monitoring water quality to protect fisheries. Lake Trout are important to local Inuit for food, while fishing is central to culture, identity and recreation. Arctic Char are considered most valuable for subsistence living by local communities, followed by lake Trout and Lake Whitefish. As supported by information gathered through focus groups, the region around the Hope Bay Belt (including the Madrid Area) is known for fishing; there is still evidence of fishing camps the region (Golder 2003; Miramar 2005). The region is also known for its important caribou habitat, particularly for calving (i.e., historical grounds for the Bathurst herd**).** Caribou are culturally important and are regarded as indicators of environmental change (Golder 2003). They are hunted for food, clothing, tools and other material, and the act of caribou hunting is central to Inuit identity, culture and subsistence. Inuit have always held respect for wolverines for their tenacious and often unpredictable behaviour. Wolverines have always been hunted, particularly for their fur. IQ indicates that the Wolverine and Grizzly Bear are common in the Hope Bay Belt, due to the abundance of prey animals for scavenging (i.e., caribou, seals) and prey animals, respectively, and the presence of suitable habitat, such as eskers (Golder 2003). Many nesting bird species such as Eagles and Gyrfalcons are found throughout the Hope Bay Belt and Project areas. Important landscape features such as highlands, cliffs and mesas common to the region provide key nesting habitat (Golder 2003). These bird species feed on a variety of prey including Ground Squirrels, Arctic Hare and Canada Geese, and their fluctuations in population size can likely be attributed to changes in prey abundance (Golder 2003).

Very little was known about the history and people of the central Arctic mainland until several scientific expeditions visited the region in the early 1900s. The local residents of this central Arctic coastline at the time of the early studies were identified as Copper Eskimo (or Inuit) due to their use of copper. According to historic sources, from December to May, Copper Inuit people congregated at the coastline to conduct breathing-hole sealing. Local residents reported numerous archaeological and traditional sites in the general region to the Nunavut Planning Commission Transition Team (NPCTT), stating that the Aimaokatalok Lake area was extensively used for caribou hunting in the early 1900s or earlier (NPCTT 1996 as cited in HBML 2011). During the 2003 workshop, an informant indicated that archaeological sites (e.g., sealing, hunting and fishing camps, food caches burial sites and hunting blinds) could likely be found along any good-sized river system, main caribou migration routes and on islands (Golder 2003).

6. WATER USE

Licensing criteria for the use of waters in Nunavut are set out in the Nunavut Waters Regulations (Waters Regulations) and specifically set out in Schedule 2 of the Waters Regulations. TMAC has reviewed these criteria and identified the following water uses required in order to construct and operate the Project.

6.1 WATER USE

Every effort is made to maximize reuse of water including water once it has come in contact with Project Components and/or Activities. Contact water from surface and underground operations will be collected and used/recycled as much as possible. Initiation and make up water is needed from freshwater sources for industrial uses. Freshwater sources are also needed for domestic supply. A combination of sources is proposed to meet operational needs and minimize environmental footprint. Sources are primarily Patch Lake, Windy Lake, and other area lakes with surface area > 15,000 m^2 (as required) for freshwater. A summary of fresh water uses and volumes is presented in Table 6.1-1.

Table 6.1-1. Summary of Freshwater Use Volumes

Freshwater Use		Daily Rate	Annual Rate
Domestic	Office, medical facilities	Up to 5 m^3/day	
Industrial	Drilling (surface, underground, quarry) Dust Suppression (seasonal) Ice Roads (seasonal) - including berms, ramps, temporary water crossings, and portages	Up to 290 m^3/day	
Total		**Up to 295 m^3/day**	**295 × 365 = 108,000 m^3/year**

Note that water usage will be managed in such a way that cumulative peak daily usage for this Project will not exceed 295 m^3/day from freshwater sources. Therefore TMAC requests a total annual volume approval of 108,000 m^3/year.

Water crossings and surface water diversions will also be required in order to proceed with the planned Project activities; however such water uses are required to be licensed but not restricted by volume pursuant to Schedule 2 of the Waters Regulation. TMAC confirms that Project-related alterations of flow or diversions will be limited to surface runoff management and these activities will not come within the Type A licensing threshold set out in Column 5 of Schedule 2.

6.1.1 Madrid North

The bulk sample program at Madrid North and Madrid South is currently planned to be completed sequentially with initial work completed at Madrid North. During construction of Madrid North, freshwater will be sourced from Windy Lake and managed in such a way that cumulative peak daily usage for this Project will not exceed 295 m^3/day.

Industrial use will have a daily peak rate of 290 m^3/day with uses such as drilling, seasonal dust management, and seasonal construction and maintenance of ice roads. This industrial use during construction will also include quarry operations and ongoing exploration drilling activities with water sourced from lakes near these activities.

Freshwater supply at Madrid North will be pumped using similar facilities as Madrid South. The water will be pumped from the lake into a water truck for transportation to the storage tank.

During operations, the underground water demand will be supplied from three sources listed in priority as follows:

1. Reuse mine water collected in underground settling sumps (this includes drilling wastewater).
2. Contact water from waste rock dumps and ore stockpiles, collected and stored in one of two Pollution Control Ponds.
3. Freshwater from Windy Lake.

Groundwater is not expected to contribute to the underground seepage as the workings are within the continuous permafrost. Water will initially be drawn from Windy Lake to make brine for drilling; however, as operations progress drilling waste water will accumulate in the underground settling sumps and be available for reuse. For this reason, a combination of sources is proposed to meet operational needs and minimize environmental footprint. The industrial use will have a daily peak rate of 290 m^3/day over the operational period and includes ongoing exploration drilling activities sourced from lakes near surficial drilling activities. Water supply installed for the construction phase will be maintained for the operational period of the underground activities. Quarry activities and surficial activities will also maintain the same water supply from local sources.

During closure activities, water use will be limited to industrial uses such as surficial exploration drilling, dust management, and ice road construction and maintenance.

6.1.2 Madrid South

The bulk sample program at Madrid North and Madrid South is currently planned to be completed sequentially with initial work completed at Madrid North followed by Madrid South. Water use will be staged accordingly between Madrid North and Madrid South.

During construction the freshwater source will be Patch Lake and use will be managed in such a way that cumulative peak daily usage for this Project will not exceed 295 m^3/day. Domestic use will have a peak rate of 5 m^3/day for use in the office/first aid facilities. Industrial use will have a daily peak rate of 290 m^3/day with uses including dust management, and ice road construction and maintenance. This industrial use during construction will also include quarry operations and ongoing exploration drilling activities with water sourced from lakes near these activities.

Industrial fresh water supply will not be treated; water will be pumped to a water truck for transportation to a holding tank for use. To the extent possible (contact water) will be collected, treated for suspended solids removal and recycled. Fresh water used for surficial drilling, quarrying activities and winter road construction is not treated prior to use.

During operations, the underground water demand will be supplied from three sources listed in priority similar to the priority noted for Madrid North (Section 6.1.1) with freshwater supply from Patch Lake.

Fresh water will initially be drawn from Patch Lake to make brine for drilling; however, as operations progress drilling waste water will accumulate in the underground settling sumps and be available for reuse. For this reason, a combination of sources is proposed to meet operational needs and minimize environmental footprint. The industrial uses will have a daily peak rate of 290 m^3/day over the operational period.

Domestic water supply system and tanks installed for the construction phase will be maintained for the operational period of the water licence. Quarry activities and surficial activities will also maintain the same water supply from local sources.

During closure activities, water use will be limited to industrial uses such as surficial exploration drilling, dust management, and ice road construction and maintenance (if needed).

6.2 QUARRY AND ROAD OPERATIONS

The quarrying for infrastructure and road (4.7 km) construction activities consist of drilling, blasting, mucking, crushing, haulage to usage locations (e.g., the advancing road limit), end dump and levelling; all activities with the potential for generating dust. The major source of dust generation during the operations of the quarries will be in the vicinity of the crusher while it is operating. Dust will also be generated during use of the road corridor. Dust suppression, where required in the quarry or road, will use water and a record of the volume used for this purpose will be maintained. Water use along the road also includes the water crossings; however, this volume is indeterminate and not included in the anticipated water use allocation request.

Road access into the project sites may be required before the all-weather access roads are constructed, therefore water may be used during winter months for ice road construction. Preparation for winter road/ice road construction involves establishing snow fencing along potential routes to collect snow to form the base of the road. Once snow is accumulated along the route, this snow is then packed down and covered with successive layers of water and/or additional snow and allowed to freeze between applications. Water for this purpose will be obtained from nearby waterbodies authorized for use and extracted in accordance with the DFO protocol for winter water withdrawals. All water volumes used for winter road construction will be tracked and recorded. Additional clean snow may be obtained if needed from the surface of nearby frozen lakes. Once completed, this frozen road surface then protects the underlying ground from vehicle traffic. Routine maintenance is conducted throughout the winter road use season by grading and with further snow/water applications. The ice roads degrade naturally and disappear with warming temperatures in spring.

6.3 WATER QUALITY AND QUANTITY

6.3.1 Surface Water

Based on available baseline data the Madrid area freshwater is neutral to slightly alkaline, and contains variable concentrations of nutrients and metals; some seasonal water trends are apparent.

Madrid area lakes have typically low nutrient concentrations, particularly during summer months, and are characterized as being ultra-oligotrophic to mesotrophic. Mean metal concentrations in Madrid area lakes are generally below CCME (Canadian Council of Ministers of the Environment) guidelines, except for a few lakes that are naturally elevated in aluminum, chromium, copper, and iron (Rescan 2010a). Lake sediments also exhibit some naturally elevated metal concentrations that exceed CCME ISQGs, including arsenic, chromium, and copper (Rescan 2010a).

Multiple stream water quality baseline studies were conducted in the Madrid in 1996, 1997, and 2006 to 2009. Streams tend to be neutral to slightly basic, and have variable turbidity levels. Maximum concentrations of some nutrients (total phosphorus and ammonia) and metals (chromium and nickel) tend to occur during freshet. Stream sediments, containing lower metal concentrations than lake sediments, were also naturally high in chromium.

6.3.2 Groundwater

It is anticipated that the Madrid North underground activities will not intercept groundwater; however, Madrid South underground activities may intercept groundwater. Groundwater quality information is not available for the Madrid Area; however, data within the Hope Bay Belt Project area has indicated groundwater as being saline, with a salinity (total dissolved solids) content of approximately 41,000 mg/L similar to seawater (Roscoe Postle Associates Inc. 2013; see Table 7.3-1).

Estimates of the groundwater inflow when operating in these areas ranges from 16 to 1,073 m^3/day with varying permeability. For the purposes of water management design, variable hydraulic properties of key formations (deep volcanic rock and altered rock) were considered resulting in an estimate of total flow of 500 m^3/day. This estimate of flow is used for water balance calculations.

6.4 SITE WATER MANAGEMENT

Site water management during operations and closure is presented in Figures 6.4-1, 6.4-2, and 6.4-3, and described in Section 8. Similar water management approaches are proposed at both Madrid North and Madrid South and the conceptual water management plans (Section 8) are applicable to both.

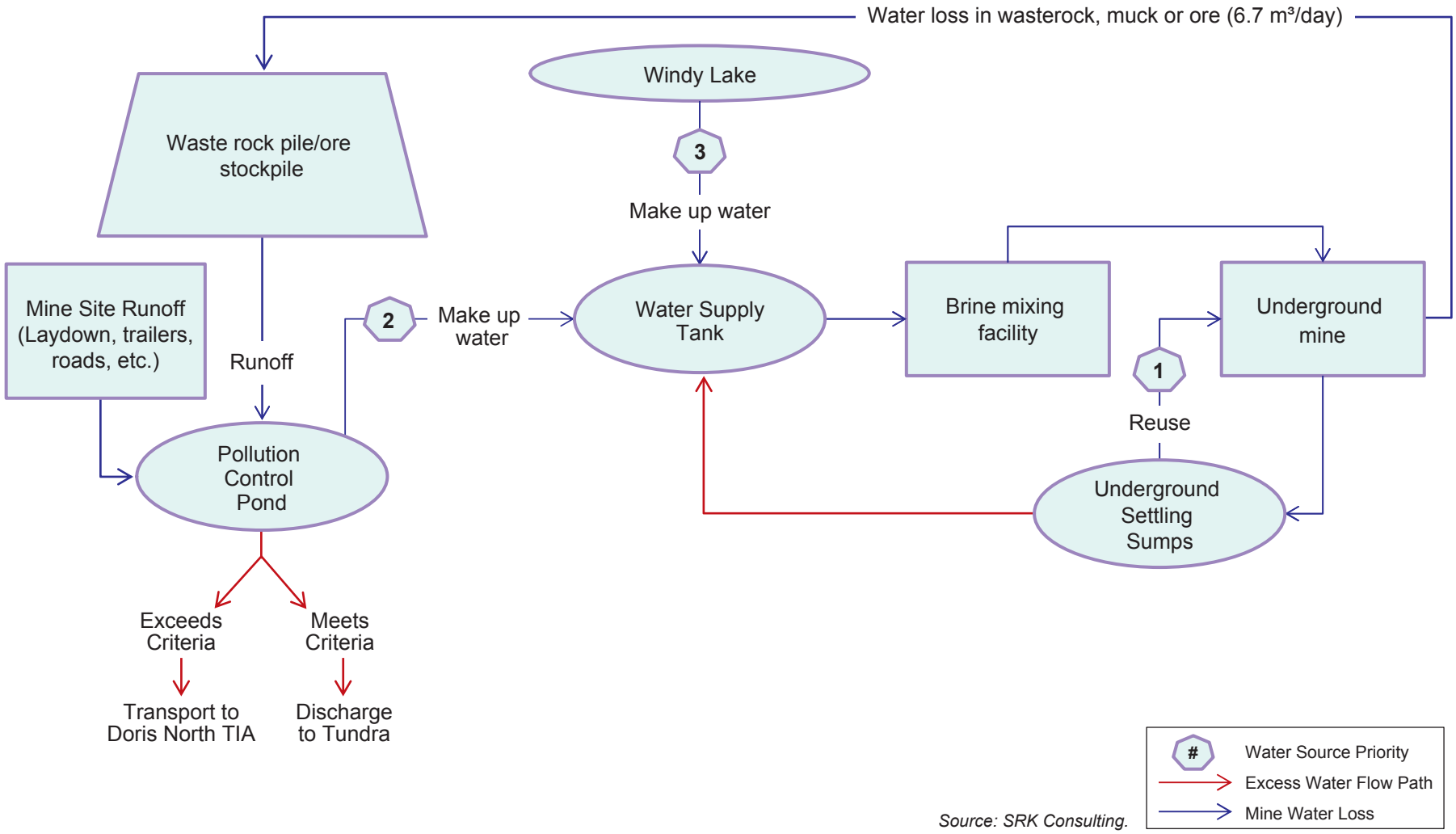
In general, water supply during operations is from surface runoff that has come in contact with Project infrastructure, stockpiles, and underground mine workings, with freshwater make-up drawn from Windy Lake or Patch Lake. The underground mine water demand will be supplied from three sources in the following priority:

1. Reuse mine water collected in underground settling sumps.
2. Contact water from waste rock and ore stockpiles, collected in the Pollution Control Ponds.
3. Freshwater make-up.

Excess water from the underground workings or the Pollution Control Ponds will be managed depending on the water quality. If the excess water meets proposed discharge criteria in Section 7, it will be discharged directly to the tundra to a designated location 31 m away from local waterways and armoured such that erosion and ponding is minimized. If water quality exceeds threshold criteria, water will be trucked to the Doris North Project for disposal in the TIA.

Figure 6.4-1

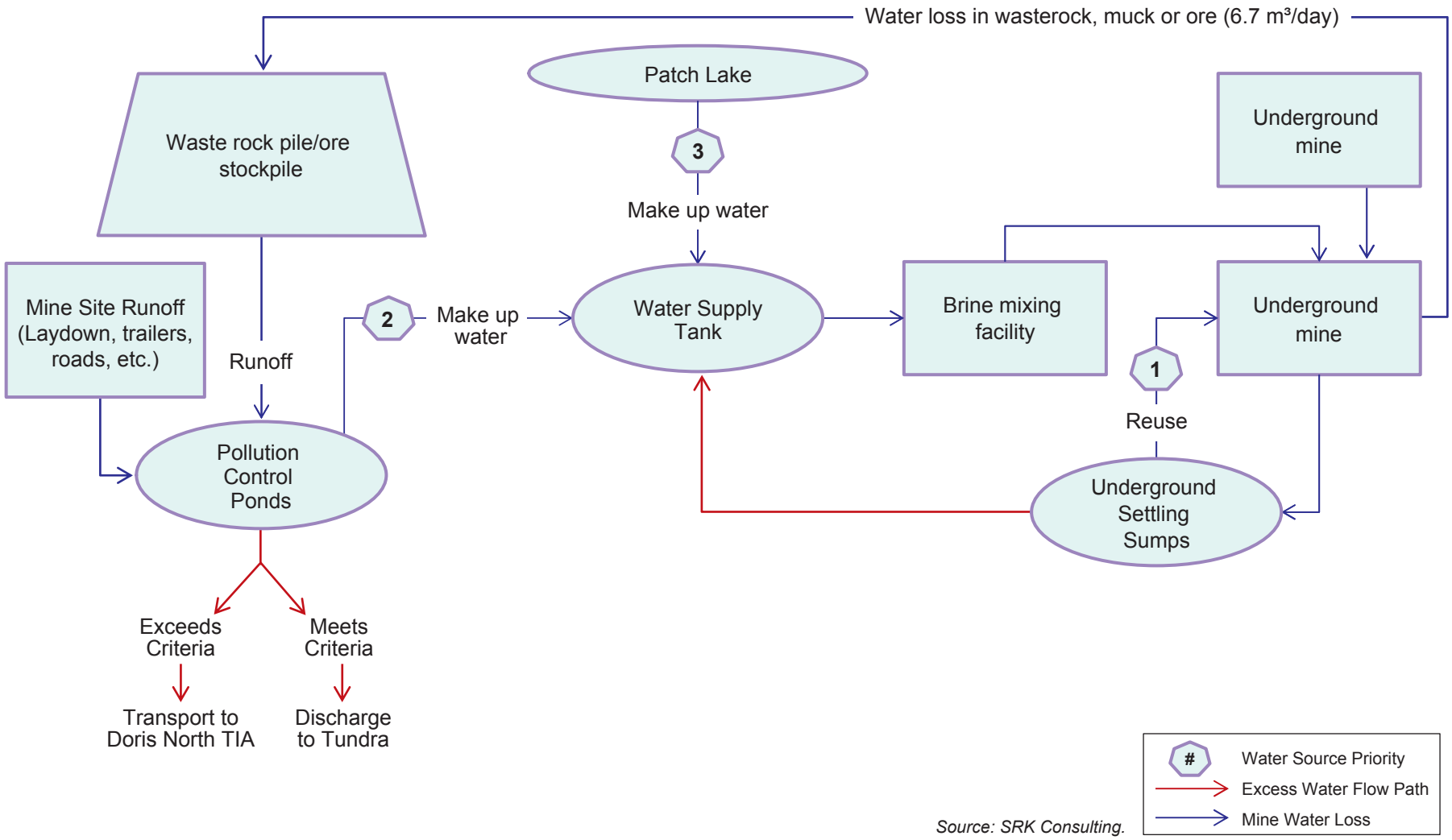
Water Management Schematic for Madrid North - Operations



Source: SRK Consulting.

Figure 6.4-2

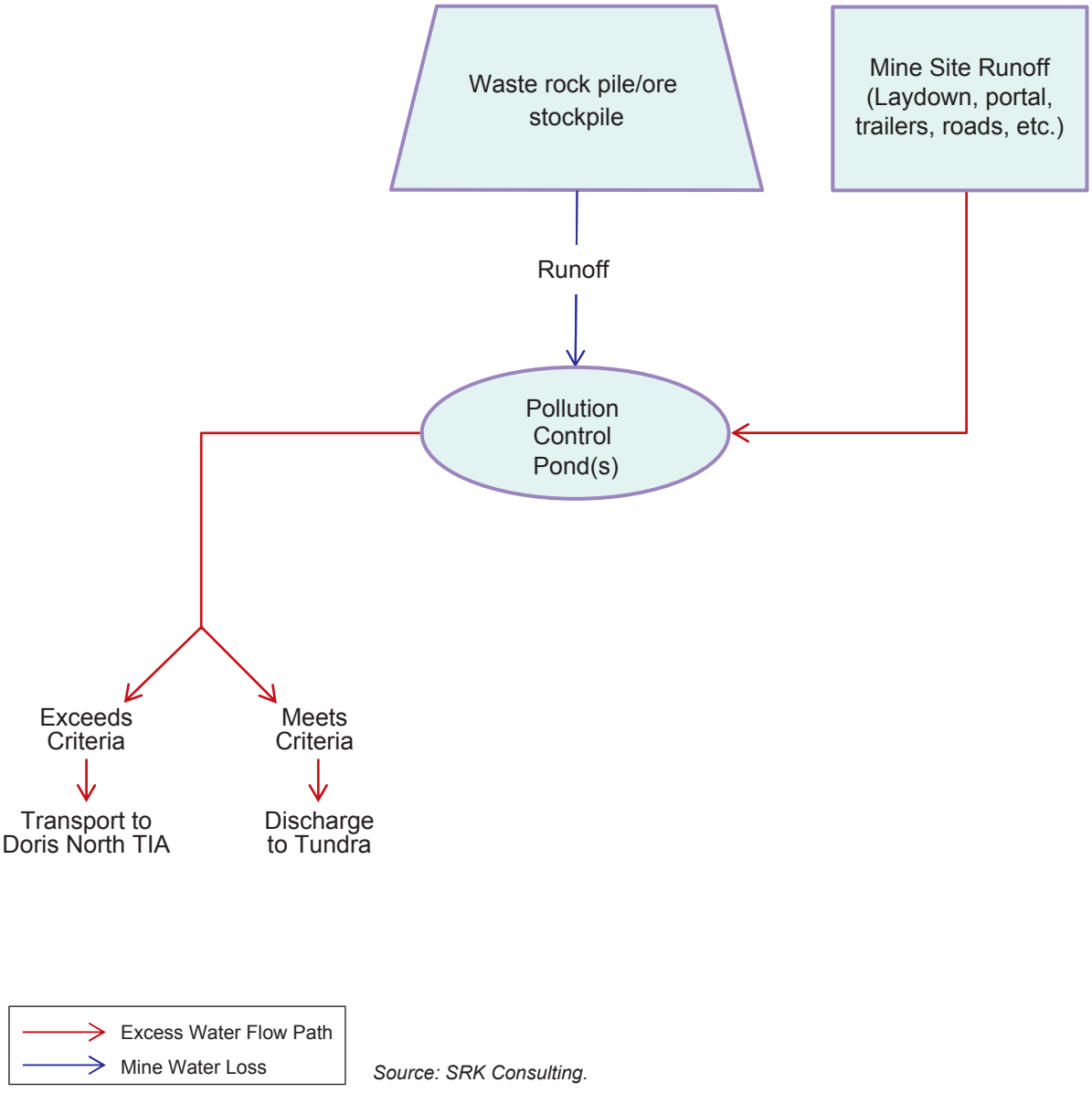
Water Management Schematic for Madrid South - Operations



Source: SRK Consulting.

Figure 6.4-3

Water Management Schematic for Madrid North and Madrid South - Closure and Temporary Closure



Source: SRK Consulting.

6.5 WATER CROSSINGS

The proposed road extension includes two water crossings. The most northern crossing (Crossing #1) is located slightly upstream of an eastward-moving inflow to Patch Lake. The crossing is to occur along the drier and mostly underground portion of the inflow; however, to the west and slightly upstream, the inflow consists of ephemerally-connected ponds. The most downstream (and most eastward) reach situated just upstream of the lake is relatively steep (measured 8% near the mouth). The inflow is considered non-fish bearing; no fish were captured during fishing surveys conducted in 2010 (either through electrofishing along the inflow or minnow traps set in the ponds situated upstream).

The more southern crossing (Crossing #2) is situated at one of the outflows (most southern end) of Wolverine Lake which flows to Patch Lake. The outflow does not have a clearly defined channel, as water seeps through vegetation over a broad area. The site of Crossing #2 thereby consists of a flooded wetland area, reflecting the ephemeral nature of the outflow. Although habitat is generally of poor quality, it is fish-bearing (confirmed Ninespine Stickleback presence); the lake located upstream (Wolverine Lake) contains Least Cisco and Ninespine Stickleback, whereas the downstream lake (Patch) contains multiple fish species. Migration between these two lakes is considered limited and closed culvert installation is proposed.

Closed-bottom culverts will be installed at these two locations since neither crossing location contains fish that are part of a recreational, commercial or Aboriginal fisheries, or that support such a fishery (DFO 1985). Engineering drawings for Madrid North, Madrid South, and all-weather road are provided in Appendices 4-A, 4-B, and 4-C, and include detailed cross-sections and specifications for the water crossings.

6.6 WATER INTAKES

If the Pollution Control Ponds and underground settling sumps cannot meet the demand for brine, make-up water will be pumped from Patch Lake or Windy Lake. Freshwater will be pumped from either Patch Lake or Windy Lake from a location along the shoreline. The intake hose and mechanical pump will be mounted to the water truck used to transport to the storage tank that supplies the BMF. The intake end of the hose will be screened in accordance with guidelines for pump intakes published by DFO (1995).

7. WASTE DISPOSAL

Waste generated at Madrid North and Madrid South will include sewage, greywater, solid waste, waste oil, hazardous waste, scrap metal, contaminated soil and/or water, contact water, fuel storage contact water and diamond drill cuttings.

7.1 WASTE DISPOSAL

Waste generated at Madrid North and Madrid South will be securely stored temporarily on site, and transported to Doris North Project camp for inclusion in its waste management. Exceptions to this are the contact water, drill cuttings and discharge from containment which will be managed and disposed of as described below.

Table 7.1-1 summarizes the type of waste expected, quantity and proposed disposal method to be used to manage waste generated in the Madrid area.

7.2 QUARRY CONTACT WATER MANAGEMENT

The development of each quarry will proceed in a manner that, to the extent possible, all water generated as a result of precipitation or snow melt is retained within the quarry boundaries. Generally this will be accomplished by ensuring that the quarry floors are sloped toward the natural low area of the quarry floor and, if required the creation of a quarry sump to collect the waters and settle out suspended solids.

After significant precipitation events, the quarry area will be inspected and the water level in the quarry sump assessed.

In the event that the quarry sump requires pumping, a sample of the ponded water will be collected, preserved in the appropriate manner, and submitted to an accredited laboratory for the analysis of the parameters listed in Table 7.2-1. These parameters are outlined in Part D Item 18 and Part J Item 6 of Water Licence 2BE-HOP1222 and the quarry effluent quality limits for these aforementioned parameters are listed at Part D Item 18 (Table 7.2-1). Monitoring results will be reported as part of the monthly monitoring reporting.

Additionally, notification will be provided to the Inspector, at least fifteen (15) days prior to the planned pumping. The notification will include the volume proposed for discharge and the discharge location. Following receipt of the laboratory results, water meeting the discharge requirements will be discharged. As the governing permits for Quarry G and H are not presently defined, the discharge requirements are assumed to be the same as those outlined in Table 7.2-1.

Table 7.1-1. Summary of Waste Quantity and Disposal

Type of Waste	Composition	Quantity Generated	Treatment Method	Disposal Method
Sewage	Portable toilet wastes installed as part of a wash truck will be combined with greywater waste	< 10 m^3/d (sewage and grey water)	Collected for transport to the Doris North Project Camp	Disposal as per approved 2AM-DOH1323 wastewater treatment management plan.
Greywater	Grey water from wash trucks will be combined with sewage waste	< 10 m^3/d (sewage and grey water)	Collected for transport to the Doris North Project Camp	Disposal as per approved 2AM-DOH1323 wastewater treatment management plan.
Solid Waste	Mixed non-hazardous waste typically generated at a work site	< 5 m^3/d	Collected for transport to the Doris North Project Camp	Disposal as per approved 2AM-DOH1323 waste management plan.
Waste Oil	Waste oil generated from mining equipment (electrical generators, trucks, drills)	< 1 m^3/d	Collected for transport to the Doris North Project Camp	Disposal as per approved 2AM-DOH1323 waste management plan.
Hazardous Waste, Scrap metal, and Contaminated soil and/or water	Waste generated from drilling activities and accidents	Unknown	Collected for transport to the Doris North Project Camp	Disposal as per approved 2AM-DOH1323 waste management plan and Spill Contingency Plan.
Contact Water	Water that has come in contact with surface infrastructure and underground workings and collected in Pollution Control Pond(s)	Up to 40k m^3/year on average (from Madrid South with groundwater) and up to 6.5k m^3/year (from Madrid North) transported to TIA or reused. Up to 94k m^3/year maximum (Madrid South) and 15k m^3/year (Madrid North) to be reused or transported to TIA.	Discharged to the tundra in area of Pollution Control Pond; any contact water that does not meet discharge criteria, trucked to Doris North Project North for disposal in TIA.	Discharge to designated location at a distance of at least 31 m from the ordinary high water mark of any adjacent waterbody, where direct flow into a waterbody is not possible and no additional impacts are created. At TIA, disposal as per approved 2AM-DOH1323 water management plan.

(continued)

Table 7.1-1. Summary of Waste Quantity and Disposal (completed)

Type of Waste	Composition	Quantity Generated	Treatment Method	Disposal Method
Fuel Storage Contact Water	Water that accumulates in the containment area of the fuel storage areas.	Unknown	Water that does not meet discharge criteria, will either be treated using oil/water separator until criteria met, or trucked to Pollution Collection Pond or to the TIA.	Discharge to designated location at a distance of at least 31 m from the ordinary high water mark of any adjacent waterbody, where direct flow into a waterbody is not possible and no additional impacts are created.
Drill Cuttings	Drill waste, including water, chips, muds and salts ($CaCl_2$) from land-based and on-ice diamond drilling.	Unknown	Cuttings are dewatered, and the separated water or brine is recycled back into the drilling process.	Saline cuttings: removed from the drill site and deposited in a contained location (i.e., designated sump or waste rock pile) where runoff is captured for treatment or disposal to an appropriate facility (i.e., TIA). Non-saline cuttings: disposed in a sump or natural depression proximal to the drill where direct flow into a waterbody is not possible and no additional impacts are created. May be used for reclamation purposes. Excess Brine: removed from the drill site and deposited onto waste rock piles, into Pollution Control Ponds, or discharged to the TIA.

Table 7.2-1. Quarry Effluent Discharge Quality Limits[a]

Parameter	Maximum Average Concentration	Maximum Concentration in Any Grab Sample
pH	6.0 to 9.0	9.0
Electrical Conductivity	500 µS/cm	500 µS/cm
Total Ammonia	2 mg/L	4 mg/L
Total Suspended Solids	15 mg/L	30 mg/L
Oil and Grease	5 mg/L and no visible sheen	10 mg/L and no visible sheen
Total Aluminum	1.0 mg/L	2.0 mg/L
Total Arsenic	0.05 mg/L	0.10 mg/L
Total Copper	0.02 mg/L	0.04 mg/L
Total Iron	0.30 mg/L	0.60 mg/L
Total Lead	0.01 mg/L	0.02 mg/L
Total Nickel	0.05 mg/L	0.10 mg/L
Total Zinc	0.01 mg/L	0.02 mg/L

[a] *From Hope Bay Regional Exploration Program 2BE-HOP1222, Part D for discharges to tundra from the quarries.*

Care will be taken not to disturb settled solids in the bottom of the sump and pumping of the sump will only take place when conditions are suitable. Care will also be taken to discharge water such that it does not enter fish bearing waters and that the pump discharge is positioned in a manner that minimizes erosion and siltation of the area downstream of the discharge.

In the event that the quarry contact water does not meet the discharge criteria, an inquiry of the cause of the noted exceedances will be conducted, appropriate mitigation developed, implemented and a summary report include in the annual report to the NWB. Any non-compliant water that needs to be discharged would be transported to Doris North Project TIA for disposal, or recycled through the Pollution Control Pond water management for use underground.

7.3 UNDERGROUND CONTACT WATER MANAGEMENT

To assist with water management planning, inflow of water into the underground workings was estimated (Appendix 7-A).

The Madrid North underground bulk sample area is within the Naartok deposit and will be within permafrost. As such, groundwater inflows are not expected to occur. The Madrid South underground bulk sample is within the Patch 14 and Wolverine deposits and is expected to intercept the talik zones. There is no specific thermal data available for either the Patch 14 or Wolverine deposits; however, permafrost conditions can be estimated based on thermal data from the Doris and Boston areas of the Hope Bay Belt.

At Madrid South, groundwater is expected to be intercepted when operating in areas of talik. Estimates of the groundwater inflow when operating in these areas ranges from 16 to 1,073 m^3/day with varying permeability. For the purposes of water management design, the hydraulic properties

of key geologic formations vary independently to provide an estimate of total groundwater flow of 500 m^3/day.

There is no groundwater quality data available for Madrid South area, however, groundwater quality for this area can be estimated based on data from Doris and Boston areas. Both areas have saline groundwater at relatively shallow depths in the respective taliks and it is assumed that the water quality would be similar in the Madrid Area. The groundwater collected from the deepest zone at the Doris Central Westbay (Table 7.3-1) can be characterized as follows:

- calcium, sodium, and chloride were the dominant ions;
- the groundwater may be regarded as saline, with a TDS of 41,000 mg/L;
- the majority of total metals had concentrations below detection limits; and
- detected trace metals included cobalt, copper, iron, manganese, molybdenum, nickel, and zinc.

Table 7.3-1. Summary of Groundwater Quality Data for Doris Central Westbay Zone 1

Parameter	Unit	10WBW001-Zone1 (548 m) 6-Apr-2011
pH	pH	7.1
Total Dissolved Solids	mg/L	41,000
Alkalinity (as $CaCO_3$)	mg/L	2.7
Chloride (Cl)	mg/L	19,000
Sulfate (SO_4)	mg/L	940
Bicarbonate (HCO_3)	mg/L	-
Dissolved Metals		
Aluminum (Al)	mg/L	< 0.005
Arsenic (As)	mg/L	< 0.002
Cadmium (Cd)	mg/L	< 0.00005
Calcium (Ca)	mg/L	4,800
Chromium (Cr)	mg/L	< 0.0005
Cobalt (Co)	mg/L	0.000059
Copper (Cu)	mg/L	0.00083
Iron (Fe)	mg/L	0.034
Lead (Pb)	mg/L	< 0.0003
Magnesium (Mg)	mg/L	71
Manganese (Mn)	mg/L	0.73
Mercury (Hg)	mg/L	< 0.00001
Molybdenum (Mo)	mg/L	0.011
Nickel (Ni)	mg/L	0.0016
Potassium (K)	mg/L	39
Selenium (Se)	mg/L	< 0.002
Sodium (Na)	mg/L	7,000
Zinc (Zn)	mg/L	0.16

Based on these conclusions, water management includes the potential interception of underground mine water that is assumed to be saline. During operations, the priority is to reuse mine water collected in underground settling sumps to supply the underground drilling activities. When present, excess water from the underground sumps will be directed to the surface Pollution Control Pond for reuse in the Brine Mixing Facility; release to environment if compliant with discharge criteria; or if noncompliant, transported to Doris North Project TIA for disposal.

7.4 CONTACT WATER MANAGEMENT

The goal of the water management system for the Madrid Advanced Exploration Program will be to recycle intercepted contact water in preference to using lake freshwater for make-up water and to maximize the mine water reuse within the underground workings.

Annual volumes of contact water reporting to the Pollution Control Ponds can be estimated by calculating the contribution from surface runoff and contribution from groundwater inflow to the underground workings (Appendix 7-A). These values for an average year are:

- Madrid North – 21,384 m^3 per year;
- Madrid South – 16,430 m^3 per year (4,655 m^3/y (PCP 1) + 11,775 m^3/y (PCP 2));
- Madrid South (with groundwater) – 134,804 m^3 per year.

In order to maximize mine water reuse, runoff collected in Pollution Control Ponds will be transferred by truck or pumped to the 50,000 L tank to be used as water supply for the Brine Mixing Facility (BMF). Make-up water will only be drawn from the freshwater sources when it cannot be drawn from the Pollution Control Ponds.

Excess contact water in the Pollution Control Ponds that meets discharge criteria (Table 7.4-1) will be discharged to the tundra. Water that does not meet discharge criteria will be trucked to Doris North Project TIA for disposal. Discharge from the TIA must meet the water quality criteria for the Doris North Project Type "A" Water Licence 2AM-DOH1323.

Table 7.4-1. Pollution Control Pond Effluent Discharge Quality Limits

Parameter	Maximum Average Concentration	Maximum Concentration in Any Grab Sample
pH[a]	6.0 to 9.0	9.0
Total Suspended Solids[a]	15 mg/L	30 mg/L
Total Ammonia[a]	2 mg/L	4 mg/L
Oil and Grease[a]	5 mg/L and no visible sheen	10 mg/L and no visible sheen
Chloride[c]	150 mg/L	600 mg/L
Total Aluminum[a]	1.0 mg/L	2.0 mg/L
Total Arsenic[b]	0.5 mg/L	1.00 mg/L
Total Copper[b]	0.30 mg/L	0.60 mg/L

(continued)

Table 7.4-1. Pollution Control Pond Effluent Discharge Quality Limits (completed)

Parameter	Maximum Average Concentration	Maximum Concentration in Any Grab Sample
Total Iron[a]	0.30 mg/L	0.60 mg/L
Total Lead[b]	0.20 mg/L	0.40 mg/L
Total Nickel[b]	0.50 mg/L	1.00 mg/L
Total Zinc[b]	0.50 mg/L	1.00 mg/L

[a] From Doris Mining and Milling Licence 2AM-DOH1323 for discharges to tundra from the Sediment Control Pond (ST-1), Cyanide and Reagent Storage Facility (ST-11), and Landfill (ST-3). Doris PCP (ST-2) does not have tundra discharge criteria – it is discharged into the TIA.
[b] MMER criteria and Boston Advanced Exploration Project Licence 2BB-BOS1217 for discharge of mine water and drainage from decline, waste rock and ore stockpiles to tundra via Containment Pond monitoring station BOS-2.
[c] From Doris Mining and Milling Licence 2AM-DOH1323 for discharges at Doris Outflow Creek (TL-3) and BC Ambient Water Quality Guidelines (http://www.env.gov.bc.ca/wat/wq/BCguidelines/chloride/chloride.html).

7.5 BULK FUEL STORAGE FACILITIES CONTACT WATER MANAGEMENT

Water accumulated in the containment berms for the Fuel Transfer Stations or Fuel Storage Facilities will be sampled for the analysis of oil and grease, benzene, toluene, ethylbenzene and lead. Contact water that meets discharge criteria (Table 7.5-1) will be discharged to the tundra. Water that does not meet discharge criteria will be trucked to either the Madrid Pollution Control Ponds or Doris North Project TIA for disposal. Discharge from the TIA must meet the water quality criteria for the Doris North Project Type "A" Water Licence 2AM-DOH1323.

Table 7.5-1. Madrid Fuel Storage Facility Effluent Discharge Quality Limits[a]

Parameter	Maximum Average Concentration	Maximum Concentration in Any Grab Sample
pH	6.0 to 9.0	9.0
Total Suspended Solids	15 mg/L	30 mg/L
Oil and Grease	5 mg/L and no visible sheen	10 mg/L and no visible sheen
Total Lead	0.01 mg/L	0.02 mg/L
Benzene	0.37 mg/L	-
Toluene	0.002 mg/L	-
Ethylbenzene	0.090 mg/L	-

[a] From Doris Mining and Milling Licence 2AM-DOH1323 for discharges to tundra from Bulk Fuel Storage Facilities ST-5, ST-6A, and ST-6B.

8. MONITORING AND MANAGEMENT PLANS

8.1 MANAGEMENT PLANS

The Madrid Advanced Exploration Program will be conducted in close proximity to existing infrastructure and activities associated with the Doris North Project and the regional exploration program completed across the Hope Bay Belt. The materials and equipment needed to construct and operate the advanced exploration program will use existing transportation infrastructure including the port site at Roberts Bay, the all-weather and ice air strips, and the existing road network. The workforce will stay at the existing camp facilities and solid wastes generated at the Madrid area will be managed at the Doris North Project. The bulk samples extracted from underground development at Madrid North and Madrid South will be processed at the Doris North Project mill and tailings will be managed at the approved tailings impoundment area (TIA). Surface and underground water generated at the two bulk sample sites may also be transported to the TIA for management.

By virtue of utilizing this existing infrastructure, many activities associated with the Madrid Advanced Exploration Program have existing monitoring and management plans in place. These plans have been implemented in accordance with the requirements of the Doris North Project NIRB Project Certificate and the Type "A" Water Licence.

Table 8.1-1 summarizes the plans currently in place for Doris North Project that will be updated in consideration of the Madrid Advanced Exploration Program. The Hope Bay Belt Quarry Management Plan has already been updated and included in this application (Appendix 8-C). The other existing plans require revision in order to capture the scope and/or location of the proposed activities. TMAC proposes to update this plans at least 60 days prior to the execution of any proposed activities associated with the Madrid Advanced Exploration.

In addition to the existing plans that will be updated to incorporate the Madrid area, TMAC has identified stand-alone plans to support this application that are also summarized in Table 8.1-1:

- Madrid North and South Water Management Plan (Appendix 8-A);
- Madrid North and South Waste Rock Management Plans (Appendix 8-B); and
- Closure and Reclamation Plan (Section 9).

Discrete monitoring stations, parameters and frequency of sampling proposed as appropriate by TMAC for monitoring water use and waste disposal under the requested Type "B" water licence are presented in Table 8.1-2. All sampling, sample preservation and analyses shall be conducted in accordance with methods prescribed in the current edition of *Standard Methods for the Examination of Water and Wastewater* and submitted to an accredited laboratory for analysis.

Table 8.1-1. TMAC Management Plans Applicable to Madrid Advanced Exploration Program

Name	Purpose of the Plan and/or Nature of Change	Submission Date
Existing Management and Monitoring Plans applicable to Madrid Advanced Exploration Program		
Noise Abatement Plan	Describes the mitigation measures to reduce or eliminate the potential effects of noise on wildlife. The existing mitigation measures will apply to the Madrid Advanced Exploration Program and the plan will be updated to include this geographic areas.	60 days prior to the commencement of construction
Air Quality Management Plan	Describes the mitigation measures to reduce or eliminate the potential effects of dust, particulate matter, and emissions. It also includes monitoring of weather data. The existing mitigation measures will apply to the Madrid Advanced Exploration Program and the plan will be updated to include this geographic area.	60 days prior to the commencement of construction
Non-Hazardous Waste Management Plan	Describes the measures taken to dispose of non-hazardous waste including open-burning and transport off-site for disposal to approved landfill facilities. All non-hazardous waste from the Madrid Advanced Exploration Program will be transported to Doris North Project for management in accordance with this plan. This plan will be updated to include the Madrid as a source of wastes to be managed under the plan.	60 days prior to the commencement of construction
Hazardous Waste Management Plan	Describes the measures taken to dispose of hazardous waste; transport off-site for disposal and/or recycling at approved facilities. All hazardous waste from the Madrid Advanced Exploration Program will be transported to Doris North Project for management in accordance with this plan. This plan will be updated to include the Madrid Advanced Exploration Program as a source of wastes to be managed under the plan.	60 days prior to the commencement of construction
Landfarm Management Plan	Describes the management of hydrocarbon contaminated soil and snow at a facility constructed at the Doris North Project. Any contaminated snow and soil generated from the Madrid Advanced Exploration Program will be transported to Doris North Project for management in accordance with this plan. This plan will be updated to include the Madrid Project as a source of wastes to be managed under the plan.	60 days prior to the commencement of construction
Incinerator Management Plan	Describes the measures taken to dispose of food wastes, pressed sewage waste, and paper in an on-site incinerator at Doris North Project. These wastes will be transported from the areas of Madrid Advanced Exploration Program activity to Doris North Project for management in accordance with this plan. This plan will be updated to include the Madrid Project as a source of wastes to be managed under the plan.	60 days prior to the commencement of construction

(continued)

Table 8.1-1. TMAC Management Plans Applicable to Madrid Advanced Exploration Program (continued)

Name	Purpose of the Plan and/or Nature of Change	Submission Date
Existing Management and Monitoring Plans applicable to Madrid Advanced Exploration Program *(cont'd)*		
Wastewater Treatment Management Plan	Describes the management of grey water and sewage generated from camp operations. No changes to this plan are required as a result of personnel residing at either the Doris North Project. Sewage and grey water generated at wash trailers and portable toilets at Madrid North and Madrid South sites will be transported to Doris North Project for management in accordance with this plan. This plan will be updated to include the Madrid Advanced Exploration Program as a source of wastes to be managed under the plan.	60 days prior to the commencement of construction
Interim Water Management Plan for Doris North Project	Describes the management of water generated at Doris North Project including the mine site, diversion berm, Pollution Control Pond and sumps, as well as the Tailings Impoundment Area (TIA). The TIA may receive excess water from Pollution Collection Ponds as part of the management plan for the Madrid Advanced Exploration Program and may receive excess surface and/or groundwater generated at Madrid North or Madrid South that is not otherwise discharged to the local receiving environment. This plan will be updated to include the Madrid Advanced Exploration Program as a source of wastes to be managed under the plan.	60 days prior to the commencement of construction
Aquatic Effects Monitoring Program	Describes the monitoring program designed to determine the short and long-term effects in the aquatic environment resulting from the Doris North Project, to evaluate the accuracy of impact predictions, and to assess the effectiveness of planned impact mitigation measures and to identify additional impact mitigation measures to avert or reduce environmental effects. This plan will be expanded in geographic scope to include the Madrid Area; for example proposed locations Table 8.1-2 may also be used to monitor effects within Patch Lake.	60 days prior to the commencement of construction
Hydrology Monitoring Program	The Hydrology Monitoring Program in the area includes locations within the Doris Watershed, Windy Watershed, Roberts Watershed, and reference watersheds. Hydrometric monitoring has included two locations along Doris Creek, Roberts Lake Outflow Windy Lake and Windy Lake Outflow. The continued monitoring of Windy Outflow and Roberts Outflow can be used to identify any significant water level decreases that could affect fish habitat in Windy Outflow during dry years. A tidal gauge installed in Roberts Bay will also allow continuous monitoring of water levels during bathymetric surveys. This plan will be expanded to include the Madrid Project area.	60 days prior to the commencement of construction
Wildlife Monitoring and Management Program	The spatial extent of the Wildlife Monitoring and Management Program (WMMP) currently in place for the Doris North Project includes the Madrid Area. The existing plan will be updated in consideration of the changes in activity level proposed in this area, including the addition of targeted monitoring of areas of infrastructure for interactions with wildlife.	60 days prior to the commencement of construction

(continued)

Table 8.1-1. TMAC Management Plans Applicable to Madrid Advanced Exploration Program (continued)

Name	Purpose of the Plan and/or Nature of Change	Submission Date
Existing Management and Monitoring Plans applicable to Madrid Advanced Exploration Program *(cont'd)*		
Community Relations Management Plan	The Community Relations Management Plan applies to all area of activity within the Hope Bay Belt and will reviewed on its regular schedule and updated as necessary in consideration of the changes in activity level proposed in the Madrid Area.	Annually
Spill Contingency Plan	Identifies a set of procedures to follow during unanticipated spills. The plan also outlines reporting and record keeping requirements for spills, a list of responsibilities to be followed in conducting spill response activities, information on available resources and potential operational hazards encountered when responding to spills, defined methods to review spill events and initiatives to reduce repeat occurrences, and to complete inspections and inventory of spill kits and on-site hazardous materials. The Plan applies to all area of activity within the Hope Bay Belt and will be reviewed regularly and updated as necessary for the Madrid Advanced Exploration Program.	Annually
Emergency Response Plan	The Emergency Response Plan accompanies the Spill Contingency Plan, and covers other non-spill related emergencies. The Emergency Response Plan outlines the roles and responsibilities of different employees in emergency situations. All relevant external emergency numbers and internal telephone numbers and radio channels are listed. This plan will be reviewed at least once annually and revised as required for the Madrid Project.	Annually
Monitoring and Follow-up Plan (MFP)	The MFP summarizes all of the monitoring undertaken in support of the various management plans and site activities. The MFP is accompanied by a Quality Assurance and Quality Control (QA/QC) Plan that details the procedures that are needed so that the quality of the data collected is appropriate for its purpose. This plan will be updated to include all of the monitoring associated with Madrid Advanced Exploration Program, including the requirements identified in the project proposal and the requirements stipulated in the water licence issued by the NWB.	60 days prior to the commencement of construction
Explosives Management Plan	The Explosives Management Plan provides information on how explosives will be transported, stored and used at the Doris North Project focusing on two goals: safety and environmental stewardship. The Plan applies to all activity within the Hope Bay Belt and will be reviewed and updated as necessary to include the Madrid Advanced Exploration Program.	60 days prior to the commencement of construction
Quarry Management Plan	Describes the objectives and measures to maintain and enhance environmental performance of the quarries while avoiding to the extent practical, remedying, and mitigating any potential adverse environmental effects associated with rock quarrying.	Included with Application (Appendix 8-C)

(continued)

Table 8.1-1. TMAC Management Plans Applicable to Madrid Advanced Exploration Program (completed)

Name	Purpose of the Plan and/or Nature of Change	Submission Date
Project Specific Management and Monitoring Plans – Madrid Advanced Exploration Program		
Surveillance Network Program (SNP)	Identifies the locations where discrete samples will be collected for monitoring and analysis to confirm that the use of water and discharges to the environment meet the requirements of water licence.	The proposed locations for SNP stations are provided in Table 8.1-2
Waste Rock Management Plans	Describes the management practices that will be implemented to mitigate potential environmental effects when managing the waste rock and ore generated at Madrid North and Madrid South during construction, operations, and closure.	Included with Application (Appendix 8-B)
Interim Water Management Plan for Madrid North and Madrid South	Describes the management practices that will be implemented to mitigate potential environmental effects associated with the withdrawal of freshwater from Patch and Windy Lakes and collection and disposal of contact water at Madrid North and Madrid South including groundwater that may accumulate in underground workings.	Included with Application (Appendix 8-A)
Preliminary Closure and Reclamation Plan	Describes the activities undertaken at completion of the Madrid Advanced Exploration Program in order to establish stable chemical and physical conditions, enable the future use the sites following reclamation, and to meet the requirements of Aboriginal, Federal and Territorial governments, landowners, local communities and regulatory authorities. The plan includes an estimate of costs for closure and post-closure monitoring for purposes of planning and the provision of financial security.	Included with Application (Appendix 9)

Table 8.1-2. Proposed SNP Compliance Stations, Parameters, and Frequency of Sampling for Madrid Advanced Exploration Program

Project Component	Proposed Monitoring Station	Parameters	Frequency
Madrid North	Water Storage tank (Windy Lake freshwater via water truck)	Volume (m^3/d)	Daily during use.
	Pollution Control Pond	Volume (m^3/d) and percentage full (m^3)	Volume and percent full: once prior to discharge.
		Proposed discharge criteria (Table 7.4-1) based on 2AMDOH1323 and MMER	Discharge: daily during pumping.
		Erosion at discharge point	Water Quality: once prior to discharge and monthly while discharging.
	Fuel Storage Area – Vent Raise	Proposed discharge criteria (Table 7.5-1) including Benzene, Toluene, Ethylbenzene, Oil and Grease, and pH	Any ponded water prior to discharge. Water not meeting established discharge criteria will be transported to the TIA or Pollution Control Pond.
	Fuel Transfer Station	Proposed discharge criteria (Table 7.5-1) including Benzene, Toluene, Ethylbenzene, Oil and Grease, and pH	Any ponded water prior to discharge. Water not meeting established discharge criteria will be transported to the TIA or Pollution Control Pond.
Madrid South	Water Storage tank (Patch Lake freshwater via water truck)	Volume (m^3/d)	Daily during use.
	Pollution Control Pond – Primary	Volume (m^3/d) and percentage full (m^3)	Volume and percent full: once prior to discharge.
		Proposed discharge criteria (Table 7.4-1) based on 2AMDOH1323 and MMER	Discharge: daily during pumping.
		Erosion at discharge point	Water Quality: once prior to discharge and monthly while discharging.
	Pollution Control Pond – Secondary	Volume (m^3/d) and percentage full (m^3)	Volume and percent full: once prior to discharge.
		Proposed discharge criteria (Table 7.4-1) based on 2AMDOH1323 and MMER	Discharge: daily during pumping.
		Erosion at discharge point	Water Quality: once prior to discharge and monthly while discharging.
	Fuel Storage Area – Vent Raise	Proposed discharge criteria (Table 7.5-1) including Benzene, Toluene, Ethylbenzene, Oil and Grease, and pH	Any ponded water prior to discharge. Water not meeting established discharge criteria will be transported to the TIA or Pollution Control Pond.
	Fuel Transfer Station	Proposed discharge criteria (Table 7.5-1) including Benzene, Toluene, Ethylbenzene, Oil and Grease, and pH	Any ponded water prior to discharge. Water not meeting established discharge criteria will be transported to the TIA or Pollution Control Pond

(continued)

Table 8.1-2. Proposed Monitoring Stations, Parameters, and Frequency of Sampling for Madrid Advanced Exploration Program (completed)

Project Component	Proposed Monitoring Station	Parameters	Frequency
Quarry Areas	Contact Water Sump	Proposed discharge criteria (Table 7.2-1) including TSS, pH, Alkalinity, Conductivity, Reduction Potential (Eh), Total Sulphate, Total Ammonia, Nitrate, Oil and Grease. Total Metals (including Al, As, Cu, Fe, Pb, Ni, and Zn).	Any ponded water prior to discharge. Water not meeting established discharge criteria will be transported to the TIA.
Exploration Drill Locations	Water Use Source	Location Volume (m^3/d)	Recorded at setup. Daily.
	Drill Cutting Sump	Location	Recorded at setup.

8.2 WATER MANAGEMENT PLAN FOR BULK SAMPLING PROGRAM

The Water Management Plans for Madrid North and Madrid South (Appendix 8-A) is intended primarily for TMAC Resources Inc. staff and their contractors to employ best practices throughout all water management activities associated with the operation and closure of the Madrid Advanced Exploration Program, thus ensuring minimal potential environmental impacts.

There are no camp facilities at Madrid Area and therefore potable water is limited to daily usage by the work force in the office and emergency/first aid facilities. All remaining water use will be limited to that needed to support mining the bulk sample. Water is needed to prepare brine for drilling in the underground workings. The goal of the water management system is to use intercepted contact water in preference to lake water for make-up water and to maximize the mine water reuse within the underground workings.

This plan has been written in a manner allowing it to be appended to the Hope Bay Water Management Plan, following regulatory approval to proceed with the Madrid Advanced Exploration Program.

8.3 WASTE ROCK AND ORE MANAGEMENT PLAN

The conceptual Waste Rock Management Plan for Madrid North and South is presented in Appendix 8-B. A comprehensive waste rock management plan will be developed and submitted sixty (60) days prior to the start of bulk sample operations. The framework of the waste rock management will address details such as waste rock and seepage monitoring; water management; management of explosives residue; spill prevention and dust management.

The dominant rock types for Madrid South include mafic metavolcanics and porphyry granitoids, with lesser amounts of intermediate volcanics. This waste material is characterized by low sulphur content with 95% of the samples collected to date containing less than 0.50% total sulphur. Higher levels of Neutralization Potential and Total Inorganic Carbon with median values for all rock types greater than 75 kg $CaCO_3$ eq/t with ferroan dolomite as the most abundant carbonate mineral. All samples from Madrid South were classified as non-potentially acid generating (non-PAG) and the potential for acid rock drainage from Madrid South waste rock is low. Metal leaching under neutral pH conditions, notably arsenic, and to a lesser extent nickel, may be an issue for the relatively small proportion of material that contains somewhat higher amounts of sulphide. However, segregating according to sulphide content is considered impractical due to the relatively low amounts of sulphide present in this material. Therefore, all Madrid South waste rock will be placed in one waste rock stockpile.

The potential for acid rock drainage is also considered low for the waste rock from Madrid North area. The ABA data indicate that the waste rock is primarily classified as non-PAG due to nearly ubiquitously high carbonate content. Sedimentary units with high sulphur content and early gabbro have the potential to be Potentially Acid Generating (PAG); however, volumetrically, both rock types are projected to be relatively minor. In terms of metal leaching, arsenic and nickel leaching from waste rock are potential issues. The data show that occurrence of arsenic and nickel leaching is

not related to a specific rock type, sulphur content or metal assays, but possibly to the occurrence of the trace occurrence of the sulphide mineral gersdorffite ((Fe,Co,Ni)AsS), which requires specialized mineralogical instrumentation to identify. As a result, there is no practical field technique for segregation of waste rock that contains gersdorffite, therefore, all Madrid North waste rock will be placed in one waste rock stockpile.

Madrid North and Madrid South each have a designated Ore Stockpile adjacent to the portal. During operations, ore will be brought from the underground workings to the surface using mobile equipment and stockpiled in the designated Ore Stockpile area. Approximately 50,000 to 55,000 tonnes of ore will be stockpiled at Madrid South and Madrid North with transportation to Doris North Project by one haul campaign near the end of the underground operations. The haul campaign will be scheduled when mobile equipment is available to minimize the time needed to complete the transport.

8.4 QUARRY MANAGEMENT PLAN

The proposed construction and development at Madrid South and Madrid North, including the all-weather road that connects to the existing Doris-Windy Road, would make use of rock from Quarry G and H. The Hope Bay Belt Quarry Management and Monitoring Plan (Appendix 8-C) has been prepared by TMAC to address the management requirements for all current and proposed quarries in the Hope Bay Belt.

9. RECLAMATION AND CLOSURE

9.1 EXPLORATION DRILLING

A program of progressive reclamation will be undertaken for all surface drilling. Immediately upon completion of drilling, all casings and other materials will be removed, and disturbed areas will be returned to conditions to blend with local surroundings.

9.2 MADRID BULK SAMPLE AREAS

A conceptual level plan and associated cost estimate for the reclamation and closure for all facilities associated with the Madrid Advanced Exploration Program is presented in Appendix 9. The basis of the plan and its cost estimate is the existing plan and cost estimate approved by the NWB for the Doris North Project and is in accordance with the Mine Site Reclamation Policy for Nunavut (DIAND 2002) and the Northwest Territories Mine Site Reclamation Guidelines (INAC 2007).

The infrastructure associated with the Madrid Advanced Exploration Program has been designed to facilitate effective closure and reclamation. The overall objectives for each of the areas of infrastructure is to establish stable chemical and physical conditions, enable the future use the sites following reclamation, and to meet the requirements of Aboriginal, Federal and Territorial governments, landowners, local communities and regulatory authorities.

There are four distinct areas of infrastructure associated with the Madrid Advanced Exploration Program. These areas are:

1. Madrid North Portal;
2. Madrid North Vent Raise;
3. Madrid South All-weather Road; and
4. Madrid South Portal and Vent Raise.

Materials from existing and approved rock quarries, Quarries A, B and D as well as two new quarries, Quarries G and H to be developed in association with the Madrid Advanced Exploration Program will be used as the source of the needed cover materials for the closure of these sites. The closure and reclamation Quarries G and H is considered as part of the planning for the Madrid Advanced Exploration Program.

Table 9.2-1 provides a summary of the estimated cost for closure and reclamation of the facilities associated with the Madrid Advanced Exploration Program. The cost estimate has been developed using an NWB approved Microsoft Excel spreadsheet that is consistent with the principles of the RECLAIM 6.1 model. The cost estimate does not account for savings in closure costs that may result from conducting the work at Madrid North and Madrid South sequentially as opposed to at the same time. Savings in cost can be reasonably expected by moving infrastructure from one site to the other and progressively reclaiming the sites.

Table 9.2-1. Estimated Closure Costs for TMAC Madrid Advanced Exploration Program

Area	Estimated Cost (2014 CDN $)
Direct Costs	
Madrid North Bulk Sample Infrastructure	$1,834,000
Madrid All-weather Road	$17,000
Madrid South Bulk Sample Infrastructure	$1,757,000
Additional Direct and Supporting Costs (Off-Site Shipping, Disposal Fees, Water Management)	$817,000
Indirect Costs	*$2,706,000*
Total Closure and Reclamation Cost	**$7,131,000**

TMAC currently has posted reclamation security with Aboriginal Affairs and Northern Development Canada (AANDC), the KIA, and DFO covering existing and approved activities at Hope Bay including the Doris North Project, the Boston Advanced Exploration Project, and the Regional Exploration Program. TMAC proposes to post additional financial security in association with the Madrid Advanced Exploration Program in accordance with the estimate provided in Table 9.2-1.

10. IDENTIFICATION OF POTENTIAL ENVIRONMENTAL EFFECTS AND PROPOSED MITIGATION

10.1 INTRODUCTION

Over the past twenty years, the Hope Bay Belt has undergone considerable exploration and development activities by TMAC and previous operators. As a result, the Hope Bay Property has significant infrastructure including airstrips, roads, fuel storage, a port facility, power plants, administration, geology, and lab buildings, and underground development at the Doris and Boston areas. The main area of infrastructure development is the Doris North Project, which was constructed between 2010 and 2011, though the Doris North Project has not yet processed any ore or created any tailings, as it has never entered the production mining stage of operations (NIRB 2013).

The proximity of the Madrid area to the Doris North Project provides the opportunity to take advantage of existing infrastructure that will reduce costs, minimize the footprint and minimize the time required to complete the Madrid Advanced Exploration Program. The permitted infrastructure and facilities at Doris North Project have sufficient capacity to support the proposed program and have been previously screened and assessed by the Nunavut Impact Review Board (NIRB).

Previous underground developments at Doris (2010-2011) and Boston (1996-1997) provided critical access to various parts of the mineralization in order to collect bulk samples used to evaluate the character and metallurgical nature of the ore. Underground development and bulk sampling is a necessary step in the advanced exploration process to determine the economic viability of the mineralization. Madrid area is the only district in the Hope Bay Belt without the benefit of a bulk sample program.

The Madrid Area has been explored since the early 1990s with activities including prospecting, surficial mapping and sampling, geophysical surveys (downhole, surficial and airborne) and diamond drilling. To support this exploration, various activities and infrastructure were authorized including exploration camps (e.g., Wolverine and Windy Camps), quarry activities, drummed fuel storage and caches, helicopter access, ice airstrips, and all-weather and winter roads.

10.2 PREVIOUS AND CURRENT NIRB SCREENING AND REVIEW

Given the level of exploration and development in the Hope Bay Belt, many of the proposed activities and infrastructure supporting the Madrid Advanced Exploration Program have been previously authorized and screened by NIRB (Table 10.2-1). Exploration and bulk sampling activities at Boston have been screened and determined to be exempt (EX148) from environmental assessment and regional exploration activities across the Hope Bay Belt have also been screened and determined to be exempt from environmental assessment. Advanced exploration and mine development at Doris North Project has been screened and undergone environmental assessment (screening 05MN047 and Project Certificate 003).

Table 10.2-1. Hope Bay Belt Authorizations

Quarry Permits	Commercial Lease
• KTP308Q010 - Quarries A, B, D (exp. Jan 20, 2015) • KTP307Q010 - Quarries 2, 3, 4 (exp. Jan 20, 2015) • IOL Surface tenure – Quarries G, H (application pending)	• KTCL313D001 - Commercial Lease (exp. Sept 13, 2018)
Land Use Licences	**Water Licences**
• KTL303C056 - Hope Bay Land Use (exp. Jan 20, 2015) • KTL306C003 - Boston Land Use Licence (exp. Jan 20, 2015) • KTL306F007 - Winter Road Land Use(exp. Jan 20, 2015) • IOL Surface Tenure for Advanced Exploration – Madrid (application pending)	• 2BB-BOS1217 Boston Advanced Exploration Project (exp. Jul 31, 2017) • 2AM-DOH1323 Doris North Mining and Milling Undertaking (exp. Aug 15, 2023) • 2BE-HOP1222 Hope Bay Regional Exploration Program (exp. Jun 30, 2022)

A project proposal for Phase 2 of the Hope Bay Belt, which is intended to cover the reasonable and foreseeable proposed incremental development of the Belt over the next approximately 10 years, has been submitted and NIRB EIS Guidelines (NIRB Dec 2012) have been issued. Phase 2 may include the development of the Madrid and/or Boston areas, including infrastructure and waste management facilities to support underground and open pit mining and processing in both districts.

TMAC is submitting this application in advance of the upcoming Phase 2 Hope Bay Belt EIS. The Project will provide further definition of Madrid South and North mineral resources, support mine planning, and validate the economic feasibility of the deposit. For this reason, TMAC is seeking approval for the Madrid Advanced Exploration Program Type B water licence prior to completion of the NIRB review of Phase 2. TMAC considers these proposed activities exempt from NIRB screening and treated as an exception to the Phase 2 environmental assessment to allow the issuance of the Type B water licence to support continued exploration and/or bulk sampling program.

As such, TMAC has considered the following sections of Article 12 of the NLCA in relation to this application:

> **12.10.1 - Projects Not to Proceed** No licence or approval that would be required in order to allow a proposed project to proceed shall be issued in respect of a project that is to be screened by NIRB until the screening has been completed and, if a review pursuant to Part 5 or 6 is to be conducted, until after that review has been completed and a NIRB project certificate has been issued by NIRB pursuant to these provisions.
>
> **12.10.2 – Exceptions** Notwithstanding Section 12.10.1, where a project proposal has been referred for review pursuant to Part 5 or 6, approvals or licences for exploration or development activities related to that project may be issued if: **(a)** the activity falls within Schedule 12-1; or **(b)** the activity can, in the judgement of NIRB, proceed without such a review.

TMAC has reviewed Schedule 12-1 of the NLCA and in its view, the Project activity falls wholly within Schedule 12-1 (Types of Project Proposals Exempt from Screening):

1. Land use activities not requiring a permit or authorization from the Government of Canada or Territorial Government.
2. Land use activities requiring only a Class B permit under the Territorial Land Use Regulations (SOR/77-210 4 March 1977).
3. All construction, operation and maintenance of all buildings and services within an established municipality, except for bulk storage of fuel, power generation with nuclear fuels, or hydro power and any industrial activity.
4. All hotels, motels or tourist facilities of 20 beds or less outside the boundaries of a municipality.
5. Water uses that do not require a public hearing under Section 13.7.3.
6. Prospecting, staking or locating a mineral claim unless it requires more than a Class B permit mentioned in item 2.
7. Such other categories of activities and projects as may be agreed upon by NIRB and the appropriate Minister.

TMAC is of the view the Project should be exempt from NIRB screening and proceed directly to the NWB licensing as it falls under Schedule 12-1 item 5 and is exempt from screening. Despite this view, TMAC has included NIRB's Part 1 and Part 2 Forms in Appendix 10 for the purposes of completeness.

10.3 IDENTIFICATION AND ASSESSMENT OF ENVIRONMENTAL IMPACTS

Table 10.3-1 identifies the environmental effects associated with the advanced exploration program, quarry activities and associated support throughout the project phases. Identification of the effects is presented as:

- positive (P); or
- negative and mitigable (M); or
- negative and non-mitigable (N); or
- unknown (U).

The methods used to predict effects associated with the Madrid Advanced Exploration Program was guided by the approach used for the Doris North Project Final EIS (Miramar 2005). Valued Ecosystem Components (VECs) for the Doris North Project were selected based on both western scientific data and Inuit *Qaujimajatuqangit*. For screening purposes of the proposed Madrid Advanced Exploration Program, the identification of environmental impacts considered the identified VECs for the Doris North Project and the potential affects due to the quarry and bulk sampling program.

Table 10.3-1. Summary of Potential Effects of the Madrid Advanced Exploration Program

Potential Effect	Project Phase				Summary of Mitigation Measures
	Construction	Operations	Temporary Closure / Closure	Post-Closure	
Air Quality					
Degradation of air quality due to exhaust emissions from vehicles, aircraft and other combustion equipment	M	M	M		Use of well-maintained, fuel efficient equipment and promotion of fuel conservation measures.
Degradation of air quality due to fugitive dust emissions from blasting, quarrying, crushing and screening	M	M			Dust generated will be short term and localized in nature and may settle on nearby overburden/soils, vegetation and surface water. As needed, water will be applied during periods of dry weather.
Degradation of air quality due to fugitive dust emissions from increased use of the existing airstrip and road traffic	M	M	M		Dust generated will be localized in nature and may settle on nearby overburden/soils, vegetation and surface water. As needed, water will be applied during the summer periods of dry.
Greenhouse gas emissions contributing to climate change	M	M	M		Use of well-maintained, fuel efficient equipment and promotion of fuel conservation measures. The equivalent emissions of GHG from the Madrid Advanced Exploration Program during the peak year is approximately 0.002% of Canada's annual emissions. The Hope Bay Project also has a "No-idling" Policy.
Noise					
Changes to background noise conditions due to movement of vehicles, aircraft and other equipment	M	M	M		Equipment fitted with appropriate mufflers and silencers. Use enclosures, berms, acoustic screening and shrouding where stationary sources requiring control are identified. Keeping equipment in a well maintained condition.
Increased noise and vibration due to blasting and exploration drilling	M	M			Use enclosures, berms, acoustic screening and shrouding where stationary sources requiring control are identified. Keeping equipment in a well maintained condition.

(continued)

Table 10.3-1. Summary of Potential Effects of the Madrid Advanced Exploration Program (continued)

Potential Effect	Project Phase				Summary of Mitigation Measures
	Construction	Operations	Temporary Closure / Closure	Post-Closure	
Ground Stability and Permafrost					
Alteration of the active layer	M/N	M/N	M/N	M/N	Effects to permafrost will be mitigated as far as practical by reducing the extent of cut and fill areas; cut and fill will be allowed in designated rock quarries Appropriate thermal insulation will be placed to prevent onset of thermal erosion. Where fill is required, it will be of sufficient thickness and quality such that the active layer is not reduced.
Acceleration of permafrost-related processes such as mass wasting and erosion	M	M	M	M	Minimizing areas of disturbance. Where disturbance occurs, erosion and sediment control measures including compaction, sediment fences, and erosion control blankets will be implemented.
Groundwater					
Changes in groundwater quality due to the interaction between talik groundwater and underground mine water	M	M			Minimize operations within talik zone. Underground water will be collected into sumps and re-used for underground drilling. If excess water accumulates, the collected water will be transported to the Pollution Control Pond on surface.
Changes in groundwater quality due to the interaction between deep groundwater and underground mine water					Mine operations do not extend below the base of the permanently frozen zone.
Degradation of active layer water due to contact with poor quality (contact) water	M	M			Surface water management strategies including diversion/collection systems have been incorporated to reduce the risk of degradation of very shallow groundwater in the active-layer.
Surface Water Quantity					
Surface water drawdown of area lakes as a result of use	M	M			Recycling of intercepted contact water for drilling purposes will reduce the demand for fresh water and lake drawdown. Compliance with DFO Guidelines for under ice water taking.

(continued)

Table 10.3-1. Summary of Potential Effects of the Madrid Advanced Exploration Program (continued)

Potential Effect	Project Phase				Summary of Mitigation Measures
	Construction	Operations	Temporary Closure / Closure	Post-Closure	
Surface Water Quantity *(cont'd)*					
Alteration in surface runoff patterns due to diversions	M	M	M		Minimizing footprint and diversion of surface runoff, minimizes the alteration to runoff patterns. Diverted surface runoff is kept within the existing watershed.
Surface Water Quantity and Sediment Quality					
Changes in surface water quality from disposal of contact water at bulk sample sites		M	M	M	Contact water meeting discharge criteria will be released from the bulk sample pad to the tundra at least 31 m away from the local waterways. If the discharge water does not meet the water quality criteria, it will be transported to the Doris North Project for disposal in TIA.
Changes in water quality from fugitive dust emissions	M	M	M		Appropriate drainage and sediment control structures will be used to prevent sediment laden water from entering surrounding waters. Dust generation will be minimized by road watering or by using other non-toxic, non-wildlife attractant substances to suppress dust.
Changes in surface water quality from runoff from quarry sites	M	M	M	M	Contact water within the quarry boundaries will be collected in a sump. If this contact water meets discharge criteria it will be discharged to the environment. If it does not meet discharge criteria it will be trucked to the Pollution Control Pond for reuse, or trucked to Doris North Project for disposal in TIA. Management plans will outline the storage, handling and use of explosives to minimize excessive residue and nitrogen loading.
Changes in surface water quality from runoff water from roads, pads, and other infrastructure	M	M	M	M	Runoff from the pads will be directed to the Pollution Control Pond and runoff from the roads may be monitored for two years to confirm geochemical stability of the material. Roads and infrastructure pads have been sited to avoid waterbodies and are designed to minimize the risk for erosion and use of silt fencing if and where necessary.
Presence of hydrocarbons owing to fuel spills	M	M	M		The possibility of accidental spills or releases will be eliminated or reduced by implementation of management plans and standard operating procedures. Available spill and emergency response equipment.

(continued)

Table 10.3-1. Summary of Potential Effects of the Madrid Advanced Exploration Program (continued)

Potential Effect	Project Phase				Summary of Mitigation Measures
	Construction	Operations	Temporary Closure / Closure	Post-Closure	
Surface Water Quantity and Sediment Quality *(cont'd)*					
Changes in surface water quality from disposal of treated sewage effluent and/or sludge					The existing camp facilities at Doris North Project will be used and portable, latrine style toilet facilities at Madrid South and Madrid North. Toilet wastes will be returned to the Doris North Project for disposal at existing sewage treatment facilities.
Changes in surface water quality from disposal of underground mine water	M	M	M		Underground contact water will be collected in underground sumps and reused for drilling. Excess water will be pumped to the surface and discharged to the Pollution Control Ponds.
Mobilization of particulate material dust-generating activities	M	M			Dust generation will be minimized by road watering or by using other non-toxic, non-wildlife attractant substances to suppress dust.
Disturbance and suspension of sediments from in-water construction activities	M				Appropriate drainage and sediment control structures will be used to prevent sediment laden water from entering surrounding waters.
Changes in sediment quality from disposal of treated contact water at bulk sample sites	M	M	M	M	Contact water meeting discharge criteria will be released from the bulk sample pad to the tundra at least 31 m away from the local waterways. If it does not meet discharge criteria it will be trucked to the Doris North Project for disposal in TIA.
Presence of hydrocarbons in sediment owing to fuel spills	M	M			The possibility of accidental spills or releases will be eliminated or reduced by implementation of management plans and standard operating procedures.
Changes in sediment quality from disposal of treated sewage effluent and/or sludge					The existing camp facilities at Doris North Project will be used and portable, latrine style toilet facilities at Madrid South and Madrid North. Toilet wastes will be returned to the Doris North Project for disposal at existing sewage treatment facilities.

(continued)

Table 10.3-1. Summary of Potential Effects of the Madrid Advanced Exploration Program (continued)

Potential Effect	Project Phase				Summary of Mitigation Measures
	Construction	Operations	Temporary Closure / Closure	Post-Closure	
Vegetation					
Loss of ecosystems and vegetation to infrastructure development	N	N			Loss of ecosystems and vegetation will be minimized by minimizing Project footprint and utilization of existing infrastructure and access corridors associated with the Doris North Project. The total area that will be converted to roads, pads, and laydown areas amounts to approximately 25 ha across the Madrid area. Current Doris North Project footprint is approximately 70 ha.
Degradation of eco-systems and vegetation through increased dust deposition, chemical spills, alteration of local hydrology, or the introduction of invasive species	M	M	M	M	Implementation of dust mitigation measures and available spill and emergency response measures. Where practical, road construction and maintenance will prevent the ponding of water to maintain local hydrological patterns. The introduction of invasive plant species to newly disturbed areas will be minimized by washing machinery and vehicles thoroughly prior to their use on site.
Degradation of ecosystems and vegetation through discharge to the tundra		M			Erosion will be mitigated through the use of silt curtains and Pollution Control Ponds, as required.
Terrestrial Fauna					
Habitat loss due to infrastructure development	M	M	M	M	Minimizing overall Project footprint and avoiding significant habitat. Avoiding clearing during wildlife sensitive periods or using qualified personnel to conduct pre-clearing surveys if clearing occurs within sensitive wildlife periods.
Changes in movement and behaviour due to sensory disturbance from blasting, human presence, vehicle and aircraft traffic	M	M	M		Equipment fitted with appropriate mufflers and silencers. Use enclosures, berms, acoustic screening and shrouding where stationary sources requiring control are identified. Keeping equipment in a well maintained condition. Blasting restrictions for proximity of sensitive wildlife.

(continued)

Table 10.3-1. Summary of Potential Effects of the Madrid Advanced Exploration Program (continued)

Potential Effect	Project Phase				Summary of Mitigation Measures
	Construction	Operations	Temporary Closure / Closure	Post-Closure	
Terrestrial Fauna *(cont'd)*					
Mortality due to vehicle and aircraft traffic	M	M	M		Vehicle speed limits will be implemented and enforced and vehicles restricted to site roads and quarry footprints. Wildlife has the right of way on the road system, supported by a notification system. Established management procedures for deterring wildlife from active areas.
Mortality or reduced vigor from ingestion of contaminants deposited in food and water sources due to construction activities, vehicle traffic, and drilling activities	M	M	M	M	A waste and wildlife attractant management protocol implemented such that wildlife do not have access to camp wastes, contaminated areas, and attractants.
Aquatic Fauna					
Reduction in habitat or de-oxygenation of water through water withdrawals for operations and dust suppression activities	M	M			Recycling of intercepted contact water for drilling purposes will reduce the demand for fresh water and lake drawdown. Compliance with DFO Guidelines for under ice water taking. Minimizing footprint and diversion of noncontact surface runoff, minimizes the alteration to runoff patterns. Diverted surface runoff is kept within the existing watershed.
Reduction in habitat quality through reduced water or sediment quality associated with the introduction of nutrients or contaminants, including elevated TSS levels through dust-generating and in-water construction activities	M	M			The mitigation measures already described for water and sediment quality will help minimize the potential effects to aquatic organisms, fish, and fish habitat by minimizing changes to water and sediment. Elevated levels of TSS will be mitigated through the use of erosion control, silt curtains and Pollution Control Ponds, as required.

(continued)

Table 10.3-1. Summary of Potential Effects of the Madrid Advanced Exploration Program (completed)

Potential Effect	Project Phase				Summary of Mitigation Measures
	Construction	Operations	Temporary Closure / Closure	Post-Closure	
Aquatic Fauna *(cont'd)*					
Removal or alteration of aquatic habitat for infrastructure, including the construction of culverts	M	M			Minimized accepted techniques for sediment control, riparian care, site isolation, and timing windows. Location of infrastructure to minimize the loss of aquatic systems, with a particular focus on avoiding important fish habitat. Infrastructure is designed with a minimum 31 m setback distance from adjacent waterbodies and the water that comes into contact with these facilities will be intercepted for management prior to release to the environment.
Historical and Traditional Uses					
Disturbance or loss of recorded and unrecorded archaeological sites or significant heritage resources	M	M			The footprint has been surveyed and the recorded archaeological sites are mitigable with recovery in accordance with Territorial legislation and implementation of a "chance find" procedure.
Damage or removal of archaeological material	M	M			The footprint has been surveyed and the recorded archaeological sites are mitigable with recovery in accordance with Territorial legislation and implementation of a "chance find" procedure.
Decrease in access to land for land users	N	N	M	M	Communication will be a major component of mitigation to changes to access to the area. This would inform other land users of activities associated with Project construction and operations, including restricted areas, blasting activities, and wildlife management. Communication will enable land users to adjust their activities accordingly, and stay informed regarding Project development. (TMAC is discussing with KIA measures that generally address any impacts of the project on Inuit.)
Changes to the aesthetic quality of the area	M	M	M	M	TMAC will also consider suggestions made by land users and residents of local communities in the development of mitigation and enhancements, in the interest of ensuring that these measures are meaningful and effective in the local context.

The following discussion focuses on the environmental impacts that are identified as either: negative and mitigable (M) or negative and non-mitigable (N). The potential direct, indirect, and cumulative effects that the proposed Madrid Advanced Exploration Program may have on the biophysical and socio-economic environments during the construction, operations, closure/temporary closure, and post-closure phases are covered. Where potential effects have been identified, mitigation measures are proposed to minimize or eliminate the potential environmental and/or social effects.

10.4 POTENTIAL EFFECTS AND PROPOSED MITIGATION FOR THE PHYSICAL ENVIRONMENT

10.4.1 Air Quality and Noise

Potential Project-related effects on air quality and noise during the construction, operations, closure/temporary closure, and post-closure phases include degradation of air quality, increased Greenhouse Gas emissions, and increased noise and vibration. These impacts are identified as negative and mitigable. Proposed mitigation measures are described in the following.

Air emissions, primarily airborne particulates and oxides of sulphur and nitrogen will be generated as a result of the use of combustion engines including the generation of electricity at each of the bulk sample sites. Mitigation measures will include the use of well-maintained equipment, a "No-idling" policy, and conservation of fuel through the efficient use of vehicles and equipment. Conservation is motivated in part due to the high cost of fuel in the arctic. Through the course of the advanced exploration project, it is estimated that at peak activity levels, up to 5.5 million L per year of diesel fuel may be consumed by on-site equipment. For reference, Doris North Project has a current capacity of 22.5 million L and is licenced for up to 29 million litres of fuel. The equivalent emissions of greenhouse gases from the Madrid Advanced Exploration Program during the first year of construction (peak year) may be in the order of 16,000 tonnes CO_2e which is approximately 0.002% of Canada's annual emissions.

Fugitive dust emissions will be generated through the movement of road vehicles and aircraft. Fugitive emissions are also expected to be generated as a result of quarry development and operations (blasting, loading and unloading of equipment). Dust generated from these activities will be localized in nature and may settle on nearby overburden/soils, vegetation and surface water. Dust emissions will be mitigated in the same manner as currently undertaken with the Doris North Project, where roads are watered during summer periods of dry weather. Whereas the quarries will be a source of fugitive emissions for only a short period of time during project development, the road will be a source of fugitive emissions during construction, operations, and periods of use during closure.

Noise emissions will be concentrated at the two bulk sample sites, the associated vent raises and along the access roads from Doris North Project. Noise and vibration generated underground is not expected to propagate to the surface. Fixed wing aircraft moving personnel and goods to the project will result in noise as will the use of rotary aircraft to support surface drilling activities. However, these activities are short term and temporary. Noise and vibration during construction will be more intense than during operations as quarry rock is produced, roads and site pads are constructed, and

the portals and ramps to access the underground are established. Mitigation measures for noise controls are being considered and include:

- using equipment that is fitted with appropriate mufflers and silencers;
- using enclosures, berms, acoustic screening and shrouding where stationary sources requiring control are identified; and
- keeping equipment in a well maintained condition.

10.4.2 Ground Stability and Permafrost

Potential Project-related effects on ground stability and permafrost during the construction, operations, closure/temporary closure, and post-closure phases include alternation of the active layer and acceleration of permafrost related processes such as mass wasting and erosion. These effects have been identified as negative and mitigable, with the exception of the change to the active layer that is negative and non-mitigable. Proposed mitigation measures are described in the following.

The project will require the establishment of two quarry sites, the construction of an approximately 5 km long access road, and the construction of pad areas to house the equipment and materials to support the advanced exploration program. In total, the project will have an associated physical footprint of approximately 25 ha. For comparison, the Doris North Project has approximately 15 km of all-weather road and a footprint of approximately 209 ha. The total amount of excavated rock and overburden will be limited by optimization of the bulk sample development plan including the utilisation of existing infrastructure and access corridors associated with the Doris North Project.

Disturbances of overburden and overlying tundra vegetation as a result of constructing this footprint may alter the thermal regime, which could induce a shift in the active layer and melting of ground ice, resulting in thaw settlement. Depressions caused by these settlements could form, leading to erosion and ponding of water.

The potential for increased surface erosion during the construction phase will be proactively addressed by minimizing areas of disturbance. In areas where disturbance is unavoidable, mitigation will focus on stabilizing cut and fill areas and implementing erosion and sediment control measures including compaction, sediment fences, and erosion control blankets. All pads will be graded at 0.5% towards the Pollution Control Ponds in order to control runoff and sedimentation.

Effects to permafrost will be mitigated as far as practical by reducing the extent of cut and fill areas. Where cutting occurs, appropriate thermal insulation will be placed to prevent onset of thermal erosion. Where fill is required, it will be of sufficient thickness and quality such that the active layer is not reduced. Specifically, all pads will be a minimum of 1 m thick for permafrost protection and to allow for adequate seepage drainage and will be constructed in accordance with SRK's Technical Specifications, Earthworks and Geotechnical Engineering (SRK 2011c).

10.4.3 Groundwater

Potential Project-related effects on groundwater during the construction, operations, closure/ temporary closure, and post-closure phases includes changes in groundwater quality due to the

interaction between talik groundwater and underground mine water; changes in groundwater quality due to the interaction between deep groundwater and underground mine water; and degradation of active layer water due to contact with poor quality (contact) water. These effects are identified as negative and mitigable. Proposed mitigation measures are described in the following.

In developing its plans for advanced exploration at Madrid South and Madrid North, TMAC has determined that program objectives can be met without working below the basal depth of permafrost (approximately 450 m). This will limit the potential of interaction of the workings and the deep groundwater system. Mining the bulk sample within talik zones beneath Patch Lake at Madrid South may result in groundwater seeping into underground workings. The rate of inflow into mine workings is dependent on the location and extent to which bulk sample mining within these zones occurs. Potential effects to the quality of groundwater are introduced by mining within these unfrozen zones.

Sustained collection of groundwater seeping into the mine will induce a groundwater sink, thereby preventing seepage of contact water into the natural groundwater regime from the underground mine. Water will be collected in sumps and re-used for underground drilling, with excess transported to the Pollution Control Pond on surface.

The underground operations do not pose a risk to the groundwater regime in terms of change to water quantity or quality.

Groundwater in the active-layer could be affected by activities that influence surface water. Active-layer water refers to the water that exists in the thin layer of soil/overburden above the continuous permafrost that thaws during the summer months. Active-layer water interacts with surface water for a short period of time in the summer and is thus susceptible to degradation due to contact with poor quality surface water.

Surface water management strategies including noncontact surface water diversion and contact water collection systems have been incorporated to reduce the risk of degradation of very shallow groundwater in the active-layer.

10.4.4 Hydrology

Potential Project-related effects on hydrology during the construction, operations, closure/temporary closure, and post-closure phases are surface water drawdown of area lakes and streams as a result of use and alteration in surface runoff patterns. These effects are identified as being negative and mitigable with proposed mitigation measures described in the following.

For the purposes of predicting the potential of effects due to the withdrawal of freshwater, the change in water level using a conservative set of assumptions was calculated. The initial assumption is to assume a sustained withdrawal from both Patch and Windy lakes is each 299 m^3/day (Table 10.4-1) each year. This is slightly more than the requested volume of 295 m^3/day. Based on these assumptions:

- Open water season is assumed to be July to October 15 and ice-cover season from October 16 to June 30.

- During ice-covered season it is conservatively estimated that the ice thickness is 2 m throughout the season.

Table 10.4-1. Projected Water Drawdown from Patch Lake and Windy Lake at 299 m³/day

Lake	Days	Total Volume in Lake (000 m³)	10% of Total Lake Volume (000 m³)	Withdrawal of Total Lake Volume at 299 m³/d (%)	Withdrawal of Total Lake Volume at 642 m³/d (%)
Windy Lake					
Open Water	106	59,190	5,919	0.05	0.12
Ice Covered	259	48,741	4,874	0.16	0.35
Patch Lake					
Open Water	106	23,544	2,354	0.13	-
Ice Covered	259	12,722	1,272	0.61	-

At the maximum withdrawal rate of 299 m³/day sustained for a year, there would be less than 1% drawdown of the total lake volume during any season. The greatest % removal would be in Patch Lake during the ice-covered season (0.61% of total lake volume) due to its much lower average depth.

Windy Lake is authorized to be a water source for other water licences in the area; with a peak withdrawal of 299 m³/day at Madrid North the cumulative withdrawal rate including permitted volumes under other licences may peak at 642 m³/day. At this cumulative withdrawal rate sustained for a year, there would be less than 1% drawdown of Windy Lake total lake volume well below the 10% limits outlined by DFO Guidelines.

Drawdown effects on the lake and its respective watershed are further influenced by the loss of surface runoff. Engineered pads at Madrid North and Madrid South are designed to intercept and capture surface water that contacts the area during the period of operations, including the waste rock and ore stockpiles. This water will be used for drilling purposes and will reduce the demand for fresh water from Patch and Windy Lakes. However, this captured water is removed from its watershed (at least temporarily) and as such its loss may lead to potential hydrological impacts.

Based on a preliminary water balance conducted for Madrid South and Madrid North bulk sample sites, the total average annual runoff contributions to Patch Lake and Windy Lake that may be lost from each lake as a result of contacting the project are summarized in Table 10.4-2. These calculations conservatively assume that none of the collected contact water will be returned to the lake as treated effluent. Change to the lake volumes with the loss of the surface runoff due to contact with infrastructure is less than 1% for both Patch and Windy Lakes. Of note, is that a portion of this surface water may return to the watershed as treated discharge depending on the needs of water for drilling and the balance of water on-site at that time reducing the equivalent volume removed.

Lake volumes may be affected by the concurrent withdrawal for water supply plus loss of surface runoff due to contact with project infrastructure. The effect of these cumulative water withdrawals (Table 10.4-2) is negligible and below the 10% criteria identified by DFO.

Table 10.4-2. Anticipated Changes to Patch and Windy Lake Volumes due to Water Withdrawals and Surface Runoff Removal

	Patch Lake (Madrid South)	Windy Lake (Madrid North)
Average annual discharge	0.25 m^3/s (~7.9 Mm^3/year)	0.11 m^3/s (~3.5 Mm^3/year)
Equivalent volume surface runoff removed	9,200 m^3/year	20,049 m^3/year
Change in lake volume (%)	0.1%	0.6%
Equivalent volume removed with water withdrawal (at 299 m^3/day) and surface runoff loss	118, 335 m^3/year (109,135 m^3/y + 9,200 m^3/y)	129,184 m^3/year (234,330 m^3/y + 20,049 m^3/y)
Change in lake volume	1.5%	7.3%

10.4.5 Surface Water Quality and Sediment Quality

Potential Project-related effects on water and sediment quality during the construction, operations, closure/temporary closure, and post-closure phases include the following.

For surface water quality:

- changes in surface water quality from disposal of contact water at bulk sample sites;
- changes in water quality from fugitive dust emissions;
- changes in surface water quality from runoff from quarry sites;
- changes in surface water quality from runoff water from roads, pads, and other infrastructure;
- presence of hydrocarbons from fuel spills;
- changes in surface water quality from disposal of treated sewage effluent and/or sludge;
- changes in surface water quality from disposal of underground mine water.

For sediment quality:

- mobilization of particulate material from dust-generating activities;
- disturbance and suspension of sediments from in-water construction activities;
- changes in sediment quality from disposal of contact water at bulk sample sites;
- presence of hydrocarbons in sediment as a result of fuel spills;
- changes in sediment quality from disposal of treated sewage effluent and/or sludge.

These effects have been identified as being negative and mitigable with proposed mitigation measures are described in the following sections.

10.4.5.1 Surface Water Quality

Contact Water from Bulk Sample Sites

All water that comes into contact with the pad and its infrastructure, including the waste rock and ore stockpiles will be directed to the Pollution Control Ponds to be used as a water supply for

underground drilling. There will be seasonal excesses of contact water over the Project life and this contact water could contain elevated metals (due to possible metal leaching) and/or nitrogen compounds (from explosives residue).

Contact water meeting discharge criteria will be released from the bulk sample site at Madrid North and Madrid South to the tundra. Meeting these criteria in the discharge water will mitigate the effects to the water quality. If the discharge water does not meet the water quality criteria, it will be transported to the Doris North Project for disposal in the TIA. During normal operations, discharges will be to the tundra away from local waterways (including Windy and Patch Lakes for Madrid North and Madrid South respectively) such that the discharge will be > 31 m away from the normal high water mark.

Fugitive Dust Emissions

Dust-generating activities include the quarry operations and associated crushing and screening activities, construction of roads and buildings and the ongoing use of roads and the airstrip. These activities could introduce particulate matter, such as TSS and metals associated with rock, into surrounding surface waters. Appropriate drainage and sediment control structures will be used according to current industry practice during construction to prevent sediment laden water from entering surrounding waters.

During operations, dust generation will be minimized by implementation of a road speed limit, road maintenance (grading), and suppression of dust in the quarry/road with application of water or other approved products.

Run-off from Quarry Sites

The use of ANFO as an explosive can leave nitrogen residues on rock surfaces, which can then run off into surface waters. Improper storage and handling of ANFO can also introduce nitrogen compounds to surface waters. Quarry design and operations will incorporate measures to collect any contact water within the quarry boundaries to facilitate monitoring. If this contact water meets discharge criteria it will be discharged to the environment. If it does not meet discharge criteria it will be trucked to the Pollution Control Pond for reuse or treatment, or trucked to Doris North Project camp for disposal in TIA.

ANFO will be delivered on a daily basis from the Doris North Project facility and delivered directly to the blast hole as needed. No storage is intended at the quarry locations. Runoff water will be diverted around the loading area to prevent contact with potential contaminants. Nitrogenous residues in quarry sump water will be minimized to the extent possible. Current industry management practices will be used for the handling and use of explosives to minimize excessive residue and nitrogen loading. These practices are already in place for the Doris North Project and will be used for the bulk sample project.

Run-Off from Roads and Pads

Run-off water from roads and infrastructure pads has the potential to release poor quality water to down gradient lakes and streams. As a primary means of mitigation, roads and infrastructure pads

will be constructed of quarry materials that have been confirmed to pose low risk for metal leaching and/or potential acid generation and constructed to minimize potential for erosion.

Runoff from the pads will be directed to the Pollution Control Pond (Table 8.1-2). Roads and infrastructure pads have been sited to avoid waterbodies and are designed to minimize the risk for erosion and currently accepted industry construction practices will be employed during construction and operations.

There are two crossings along the road between Madrid North and Madrid South bulk sample sites. Potential for effects at these crossings, including the release of poor quality water and/or sediment during construction and operations will be avoided through the use of erosion control measures and available spill and emergency response equipment.

Fuel Spills

The transportation and handling of hydrocarbons on site during construction and operations could potentially cause the introduction of hydrocarbons to surface waters if there was a spill or if not handled properly.

The possibility of accidental spills or releases will be eliminated or reduced by implementation of current industry management practices, including facilities that incorporate containment, and standard operating procedures.

Treated Sewage and/or Sludge

Workers will utilize the existing camp facilities at Doris North Project or the new permitted camp at Windy Lake. There will be portable, latrine style toilet facilities established at Madrid South and Madrid North. Toilet wastes will be returned to the Doris North Project for disposal at existing sewage treatment facilities. As the existing camp space and associated infrastructure has the capacity for the workers associated with the Madrid Advanced Exploration Program, no new effects are anticipated. Treated sewage will be handled according to the existing Waste Water Treatment Management Plan for Doris North Project (HMBL 2012).

Underground Mine Water

The underground mine water will be managed in underground sumps and reused for drilling so no potential effects to surface water quality are expected. Madrid South is anticipated to intersect groundwater during underground operations. This underground contact water is anticipated to be saline and the underground mine water will be pumped to the surface and discharged to the Pollution Control Ponds.

Management of Surficial Diamond Drill Cuttings

Drilling fluids are a mix of rock cuttings from the drilling and water containing variable levels of drill mud, salt ($CaCl_2$) and drill additives. Drill cuttings management is employed to reduce environmental impact through the release of the drilling fluid, maximize drilling fluid and salt reuse, and increase efficiency in water consumption. Recirculation systems are especially important

to reduce impact to the environment at drill locations as it allows drill cuttings to be filtered out and then reuse the drill water.

Drill cuttings are pumped to a cuttings management containment system that allows the cuttings to settle and separate from the drill water. The clarified water is re-circulated through the system. If "brine free", cuttings sludge may be deposited in a natural depression in the vicinity of the drillhole, or transported by helicopter to a central cuttings management area. If the cuttings are contaminated with brine, they are flown to a separate contaminated cuttings management facility.

10.4.5.2 Sediment Quality

Dust-generating activities include the construction of roads, infrastructure pads and buildings as well as quarry and associated crushing/screening activities. As with surface water quality, sediment quality could be impacted by the deposition of particulate material onto stream or lake sediments.

In-stream construction activities, such as culvert installations could disturb and suspend lake and river sediments, causing their transport downstream or to other locations. During construction and operations, hydrocarbons could be introduced into lake or stream sediments if there was a spill or if not handled properly.

Fuel storage tanks and handling areas will be placed in HDPE lined containment designed to contain any hydrocarbon leakage. In addition, fuel transfer stations will be designed to meet the codes and guidelines. Facilities will also be monitored on a regular basis to identify any potential releases to the containment are identified and mitigated.

Mitigation measures in place to minimize potential effects of surface water quality will also minimize effects on sediment quality. This applies to mitigating the effects of dust deposition from on-land construction, sediment suspension from in-water construction, fuel storage and handling, discharge of complaint water to tundra from treatment plants or containment berms well as treated sewage discharge. See Section 10.4.5.1 for further detail on measures to mitigate surface water and sediment quality.

10.5 POTENTIAL EFFECTS AND PROPOSED MITIGATION FOR THE BIOLOGICAL ENVIRONMENT

10.5.1 Vegetation

Potential Project-related effects on vegetation during the construction, operations, closure/ temporary closure, and post-closure phases include: loss of ecosystems and vegetation to infrastructure development; degradation of ecosystems and vegetation through increased dust deposition, chemical spills, alteration of local hydrology, or the introduction of invasive species; and degradation of ecosystems and vegetation through discharge to the tundra. These effects have been identified as being negative and mitigable, except for the loss of ecosystems and vegetation within the infrastructure footprint. Proposed mitigation measures are described in the following.

Loss of vegetation will occur during the construction phase of the project. Plant cover will be removed and disturbed as infrastructure is built. Loss of ecosystems and vegetation will be minimised through

optimization of the mine development plans including the utilisation of existing infrastructure and access corridors associated with the Doris North Project. The total area that will be converted to roads, pads, and laydown areas amounts to approximately 25 ha across the Madrid area.

During construction and operations, vegetation may be degraded by dust deposition, which can slow plant growth and change the microclimate by altering the amount of snow cover or timing of spring melt. Spills could potentially affect plant cover, with the potential effects varying depending on the material, season, and plant community present. Potential effects of dust deposition or chemical spills on vegetation will be mitigated following the most recent Air Quality Management Plan and the Spill Contingency Plan.

Changes to surface water flows due to the construction of roads and pads and diversion of surface runoff water around infrastructure during the construction, operations, and closure/temporary closure phases and discharge to the tundra during the operations phase could potentially alter the plant communities present by changing overburden moisture. To minimize the potential for changes in moisture, where practical, road design and construction will prevent the ponding of water that may arise from the damming effect of the raised permafrost level in the road bed to maintain local hydrological patterns. Measures may include the installation of closed culverts to allow flow and minimal change to hydrologic system.

Discharge to the tundra could potentially alter local plant communities by changing overburden moisture, increasing erosion, or altering overburden chemistry. The quantity of and rate at which water is expected to be discharged to the tundra is unlikely to increase erosion. Erosion will be mitigated through the use of silt curtains and Pollution Control Ponds, as required. Potential effects of changes in overburden and vegetation chemistry may be realized in the area local to the discharge point.

Increased physical disturbances on site could potentially lead to the introduction of invasive plants. The introduction of invasive plant species to newly disturbed areas will be minimised by washing machinery and vehicles thoroughly prior to their use on site.

10.5.2 Terrestrial Fauna

Six terrestrial fauna or bird VECs were identified during the Doris North Project EIS consultation process (caribou, wolverine, grizzly bear, upland breeding birds, waterfowl, and raptors) and are therefore considered included in identifying the effects for the Madrid Advance Exploration Program application.

Potential Project-related effects on fauna during the construction, operations, closure/temporary closure, and post-closure phases are:

- habitat loss due to infrastructure development;
- changes in movement and behaviour due to sensory disturbance from blasting, human presence, vehicle and aircraft traffic;
- mortality due to vehicle and aircraft traffic; and
- mortality or reduced vigor from ingestion of contaminants deposited in food and water sources due to construction activities, vehicle traffic, and drilling activities.

These effects have been identified as being negative and mitigable. Proposed mitigation measures are described in the following.

Direct effects on local populations of terrestrial fauna and birds may result from habitat loss and/or alteration as a result of site construction, mortality associated with vehicle or aircraft collisions, and reduced vigour or mortality associated with the deposition and subsequent ingestion of contaminants in food and water sources.

Indirect effects on local populations of terrestrial fauna and birds may include changes in the movement and behaviour of terrestrial fauna due to sensory disturbance from blasting, human presence, increased light levels, vehicle and aircraft traffic. Avoidance of habitat due to sensory disturbance can result in functional habitat loss.

Habitat loss will occur due to the development of Project infrastructure and facilities such as ore and waste stockpiles, Pollution Control Ponds, buildings and the additional length of all-weather road. For the VECs with large home ranges (i.e., the caribou, grizzly bear, wolverine, waterfowl, and raptors), the localized habitat loss will be a relatively small area compared to the total area that is typically used within the annual life cycle. For upland breeding birds, localized habitat loss may result in a reduction in the number of breeding territories and productivity for the local breeding populations.

Activities from the Project which could result in changes to movement and behaviour include the following:

- blasting (noise and ground vibrations);
- human presence, increased light levels, and vehicle and aircraft traffic (noise and other sensory disturbance);
- project infrastructure and facilities;
- habitat fragmentation; and
- the additional all-weather road.

The all-weather site road, vehicle and aircraft traffic, quarry and underground blasting activities have the potential to alter terrestrial fauna and bird movements during local life cycle activities and seasonal migrations. Advanced exploration activities may also alter the behaviour (e.g., time spent feeding and resting) which could change the energy balance of individuals.

Mortality of the terrestrial fauna and birds could occur due to wildlife-vehicle and wildlife-aircraft interactions. These could potentially result from vehicle traffic, planes landing and taking off, and helicopter use. Mortality could occur during site clearing activities if sensitive wildlife periods (e.g., upland breeding bird reproduction) are not avoided. Mortality could also occur of nuisance animals if they are attracted to the infrastructure areas due to odours and camp waste.

The terrestrial fauna and birds may ingest chemicals of potential concern from the Project infrastructure area, water in the Pollution Control Ponds or receiving environments, from ingestion of dust on vegetation or soil/overburden, or via bioaccumulation through ingestion of prey species.

Implementation of best management practices are the optimal approach to reducing the risk of human/wildlife interaction due to increased traffic and personnel in the area. Management practices currently being followed for the Doris North Project for the terrestrial fauna and bird VECs will be implemented including:

- avoiding clearing during wildlife sensitive periods or using qualified personnel to conduct pre-clearing surveys if clearing occurs within sensitive wildlife periods, e.g., upland bird breeding period;
- vehicle speed limits will be implemented and enforced, wildlife has the right of way supported by an awareness notification system, and vehicles restricted to site roads and quarry footprints during construction and operations;
- a waste and wildlife attractant management protocol implemented such that wildlife do not have access to camp wastes, contaminated areas, and attractants;
- a policy of no feeding and no intentional attraction of wildlife is already in place for the Hope Bay Belt and is disseminated to all TMAC and contractor employees during employee orientation and enforced through worksite inspections;
- a littering policy will be developed and disseminated to all TMAC and contractor employees during employee orientation, continued throughout the life of the Project, and enforced;
- the Hope Bay Belt has already reduced individual serving disposable packaging and employees and contractors are encouraged to bring re-usable personal food and beverage containers to site; and
- a protocol for human-wildlife interactions including bear safety measures is already in place for the Hope Bay Belt and is disseminated to all employees and contractors as part of orientation and field safety training with lead management responses undertaken by identified supervisors, wildlife biologists and conservation officers.

10.5.3 Aquatic Organisms, Fish, and Fish Habitat

Four fish VECs were identified during the Doris North Project EIS consultation process (i.e., Arctic Char, Lake Trout, Lake Whitefish, and Ninespine Stickleback) and are therefore included in identifying effects of the Madrid Advanced Exploration Program. Potential Project-related effects on aquatic ecosystems, fish, and fish habitat during the construction, operations, closure/temporary closure, and post-closure phases are:

- reduction in habitat or de-oxygenation of water through water withdrawals for operations and dust suppression activities;
- reduction in habitat quality through reduced water or sediment quality associated with the introduction of nutrients or contaminants, including elevated TSS levels through dust-generating and in-water construction activities; and
- removal or alteration of aquatic habitat for infrastructure, including the installation of culvert water crossings.

These effects have been identified as being negative and mitigable. Proposed mitigation measures are described in the following.

To mitigate the potential effects of water drawdown on littoral zone habitat, stream habitat, and oxygen concentrations, large water supply sources (Patch Lake and Windy Lake; Volumes: 23,544,076 m^3 and 59,137,485 m^3) were selected for bulk sample activities at Madrid South and Madrid North. Changes in lake levels are not expected to result in detectable changes in flow characteristics, including water depth, in Windy or Patch outflows. For exploration activities, only waterbodies that meet the current criteria (> 15,000 m^2) and DFO guidelines regarding surface water withdrawals will be used as supply sources.

Project activities that could have potentially negative effects on surface water and sediment quality could also have negative effects on aquatic organisms, fish, and fish habitat in the following ways:

- a reduction in growth, survival, or reproduction (e.g., from sublethal toxicity associated with reduced water quality or food availability or oxygen deprivation due to excessive nutrient enrichment);
- enhancement of growth, survival, or reproduction (e.g., from minor nutrient enrichment);
- changes in species composition resulting from reduced, growth, survival, or reproduction of some organisms (e.g., from sublethal toxicity, lethal toxicity, or oxygen deprivation due to excessive nutrient enrichment);
- reductions in the abundance and density of aquatic organisms resulting from reduced, growth, survival, or reproduction of some organisms; and/or
- reductions in fish health or fish habitat quality (e.g., from sediment suspension and TSS loading or changes in food availability or quality).

The mitigation measures already described for water and sediment quality will help minimize the potential effects to aquatic organisms, fish, and fish habitat by minimizing changes to water and sediment. The effects associated with work in or around water (e.g., sedimentation) will be minimized through adherence to current management practices, standard operating procedures and regulatory guidelines. Elevated levels of TSS will be mitigated through the use of silt curtains and Pollution Control Ponds, as required, and mitigated at point source discharges of contact waters to tundra located > 31 m from any waterbody.

The effects of the removal or alteration of aquatic habitat for infrastructure, including the installation of culverts for road crossings, will be minimised primarily through project design and a range of specific and generally accepted techniques for sediment control, riparian care, site isolation, and timing windows. The location of infrastructure has been selected to minimise the loss of aquatic systems, with a particular focus on avoiding important fish habitat. No aquatic habitat loss is expected to occur as a result of site infrastructure. In addition, Madrid South and Madrid North waste rock piles and ore stockpiles have been designed with a minimum 31 m setback distance from adjacent waterbodies and the water that comes into contact with these facilities will be intercepted for management prior to release to the environment.

The Madrid North and Madrid South bulk sample sites fall within the Windy and Doris Watersheds. A new access road 4.7 km in length extending south from the existing Windy – Doris North Project Camp road is proposed to be built primarily within the Doris Watershed. A section less than 1 km in length would be in the Koignuk Watershed, but on top of a ridge far from any waterbodies; this section of road will not directly or indirectly impact the Koignuk Watershed. To allow water flow, closed culverts will be used for water crossings.

The proposed road corridor includes two water crossings. Crossing #1 (northern crossing) is non-fish bearing (confirmed by electrofishing and minnow trapping surveys) and closed culverts will be installed at this crossing. Crossing #2 (southern crossing) is fish-bearing (confirmed ninespine stickleback presence) and the lake located upstream (i.e., Wolverine Lake) contains Least Cisco and Ninespine Stickleback, whereas the downstream lake contains multiple fish species. Migration between these two lakes is considered limited and closed culvert installation is proposed. The scheduling of instream works will follow the recommended periods of least risk to the key regional fish species (i.e., Arctic Char, Lake Trout, Lake Whitefish, and Ninespine Stickleback).

Thus, the Project is not expected to cause any significant adverse effects on Arctic Char, Lake Trout, Lake Whitefish, and Ninespine Stickleback in the Project area.

10.6 HISTORICAL RESOURCES AND TRADITIONAL USES

Potential Project-related effects on historical resources and traditional use during the construction, operations, closure/temporary closure, and post-closure phases are:

- disturbance or loss of recorded and unrecorded archaeological sites or significant heritage resources;
- damage or removal of archaeological material;
- decrease in access to land for land users; and
- changes to the aesthetic quality of the area.

These effects have been identified as being negative and mitigable, as the footprint has been surveyed and the recorded archaeological sites are avoidable or mitigable with recovery in accordance with Territorial legislation. A "chance find" would also be negative and mitigable with the implementation of a "chance find" procedure.

Communication will be a major component of mitigation to changes to access to the area. This would inform other land users of activities associated with Project construction and operations, including restricted areas, blasting activities, and wildlife management. Communication will enable land users to adjust their activities accordingly, and stay informed regarding Project development. TMAC will also consider suggestions made by land users and residents of local communities in the development of mitigation and enhancements, in the interest of ensuring that these measures are meaningful and effective in the local context. To enhance communication, TMAC's regional office in Cambridge Bay will continue to act as a central local resource regarding the company's activities.

10.7 CUMULATIVE EFFECTS

Cumulative effects can arise from multiple activities that happen concurrently or sequentially and can have a greater combined impact on an environmental component than those of individual activities. The only anticipated interactions will occur between the Madrid Advanced Exploration Program, the existing Doris North Project, and the existing regional exploration program. There are no competitor holdings or lodges, or parks in proximity to the Madrid Advanced Exploration Program.

Activities associated with the Madrid Advanced Exploration Program overlap with activities at Doris North Project, however, they are substantially smaller in scale than the Doris North Project. The effects of the Madrid Advanced Exploration Program are expected to be minimal in combination with Dorth North Project activities due to the lower level of activity (approximately 70 personnel of the possible current level of 360 personnel within the Belt), smaller footprint of approximately 25 ha (of the total 209 ha), and the focused shorter timeframe (1.5 years each) of underground operations at two sites. Initial screening also indicates that the environmental effects are mitigable so there are no residual impacts from the Madrid Advanced Exploration Program.

Monitoring Plans (e.g., spill and fuel management, closure and restoration), visits by Beneficiaries so that they may see footprint and activities for themselves, and a commitment to mitigation measures such as avoidance, monitoring and adaptive management will reduce of the potential for cumulative effects.

10.8 ACCIDENTAL EVENTS AND MALFUNCTIONS

Potential Project-related effects on accidental events or malfunctions during the construction, operations, closure/temporary closure, and post-closure phases are impacts to groundwater, surface water, and aquatic ecosystems from accidental spills of fuel and chemicals and impacts to groundwater, surface water, and aquatic ecosystems from unplanned releases of underground mine water or effluent. These effects are identified as negative and mitigable. Proposed mitigation measures are described in the following.

The possibility of accidental spills or releases will be eliminated or reduced by implementation of best management practices, including containment measures, and standard operating procedures described in Section 8. Contingency plans for accidental spills (Spill Contingency Plan, Emergency Response Plan) and extreme weather conditions are currently in existence for the Doris North Project. The Emergency Response Plan was designed to avoid potential adverse environmental effects of incidents, malfunctions and other unplanned events such as spills, fires, or wildlife encounters. The Environmental Health and Safety Management System (Environmental Protection Plan) will implement measures to avoid or minimize any effects on the biophysical environment (HBML 2012b). These contingency plans will also be implemented for the bulk sample project activities.

10.9 TRANSBOUNDARY EFFECTS

The potential project related transboundary effects include potential environmental effects that could cross the geographical boundaries of Nunavut. Most effects from Madrid South and Madrid

North areas will remain in the localized area around the infrastructure. All of these geographical areas are within Nunavut, including all major watersheds.

10.10 ALTERNATIVES

Alternatives considered for the Madrid Advanced Exploration Program focussed on technical and cost considerations to identify the optimal site layout for each area as well as water balance and water quality within the Doris North Project TIA. A "go/no go" alternative is also considered.

10.10.1 Go / No Go

The reliability of a mine feasibility study is based on the quality of the information describing the proposed ore body. Detailed diamond drilling from surface can provide good general information about the deposit, however, it is prudent in the case of a potential underground mine to confirm the grade, continuity, and consistency of the gold mineralization in the rock prior to making major monetary and time commitments and applying for permits to construct and operate the mine. This can only be accomplished through an underground exploration program and the collection of a bulk sample of the mineralized rock. This is the next logical step in the exploration of the Madrid area and with its completion, the financial and technical risk to the Hope Bay Belt Phase 2 development is further reduced.

10.10.2 Site Layout Alternatives for Madrid South

TMAC considered three surface infrastructure alternatives at Madrid South location:

- Access from Doris North Project Portal. Access to Madrid South would be underground via the Doris North Project, Connector, and Central underground workings. No surface infrastructure would be required. This option was not selected as hauling waste rock and ore from Madrid South to Doris North Project using underground vehicle is not practical.
- Minimal Development. Only Madrid South portal would be constructed and all waste rock and the ore would be hauled to Doris North Project via the Doris-Windy All-weather Road. This option was not selected as hauling waste rock, for disposal, and ore, to be stockpiled, at Doris North Project is not practical.
- Full Development. The entire surface infrastructure required to support underground bulk sampling would be constructed as well as all the waste rock and ore stock would be stored at Madrid South. The ore would then be transported to Doris North Project for processing in the mill. This was selected as the preferred option.

10.10.3 Site Layout Alternatives for Madrid North

TMAC considered three surface infrastructure alternatives for the Waste Rock Stockpile at Madrid North location:

- South Waste Rock Stockpile. The waste rock stockpile would be placed in the gully located to the southwest of the portal. The Pollution Control Pond berm required to capture the contact water would be located on disturbed ground that has experienced permafrost

degradation and would tie into the Doris-Windy All-weather Road. To provide containment capacity the berm would need to be up to 7 m in height. This option was not selected because of the berm height.

- East Waste Rock Stockpile. The waste rock stockpile would be placed in the gully located to the south east of the portal. The Pollution Control Pond berm required to capture the contact water would be located in proximity to the Vent Raise with access from the Doris-Windy All-weather Road. To provide containment capacity the berm would need to be up to 6 m in height. This option was not selected because of the berm height and the proximity to the vent raise.
- North Waste Rock Stockpile. The waste rock stockpile as well as the ore stockpile would be placed in the large open area north of the portal. The Pollution Control Pond berm required to capture the contact water would only need to be 3 m in height. This option also provides suitable grades for access road construction to the Pollution Control Pond. This option was the preferred option.

11. PUBLIC CONSULTATION

11.1 INTRODUCTION

HBML and TMAC undertook a range of consultation and communication activities with local communities, land users, regulators, and resource managers over the past several years, including proposed changes to the Mine described in this document.

Communication and consultation activities included:

- community meetings;
- in-person meetings;
- site tours; and
- distribution of printed information materials (e.g., bulletins, project information sheets).

The remainder of this section focuses on the community meetings, including meeting locations, dates, and attendance, as well as providing a summary of the comments and questions raised. For all community meetings, comments and feedback pertaining to the information presented were documented and, where practicable, responses were provided by HBML or TMAC staff in attendance. Information on other communication and consultation activities is also briefly described below.

11.2 COMMUNITY MEETINGS

11.2.1 November / December 2009

In November and December, HBML conducted a community tour, providing a project update to the public in the Kitikmeot region. Meetings were held in Kugluktuk, Cambridge Bay, Gjoa Haven, Taloyoak and Kugaruk. A special meeting was held in Cambridge Bay with former residents of Umingmaktok and Kingaok. Over 220 attendees were present during these meetings, with the highest turnout being in Taloyoak. During these meetings, the potential of a bulk sample and advanced exploration work at Madrid was first discussed with community members, although no specific comments or questions on this topic were heard.

11.2.2 August 2010

In August 2010, HBML conducted a community tour and proposed amendments planned at that time were presented and discussed in advertised community meetings open to the public. The proposed amendments included the camp expansion and mine life extension. Environmental baseline studies conducted in the Doris North Project were also presented and discussed. Some additional information was provided on the possibility of further advanced exploration at Madrid South in particular including the need for support infrastructure. Community meeting locations included Cambridge Bay, Gjoa Haven, Kugaaruk, Kugluktuk, and Taloyoak, with the overall attendance totalling approximately 121 attendees with the largest attendance being in Gjoa Haven. Community Elders were in attendance at Gjoa Haven, Taloyoak, and Kugaaruk.

During the community meetings, no specific questions were asked regarding the proposed changes to the Madrid North and Madrid South area. Discussion topics included: opportunities for work, employment requirements, scheduling, training, opportunities for youth, possible site visits for local residents, activities in the Windy Lake area, climate change, mine abandonment, helicopter use and wildlife, and potential effects on human health.

11.2.3 June 2011

In order to specifically address the proposed Mine changes, a round of community meetings was held in June 2011. HBML visited five communities: Cambridge Bay, Gjoa Haven, Kugaaruk, Kugluktuk, and Taloyoak. Specific information pertaining to this amendment application was presented. The start of permitting a bulk sampling effort at Madrid South was specifically mentioned, including a timeline to begin work on this project aspect by early 2013.

Table 10.2-1 details the community meeting dates and the estimated number of attendees. The overall attendance totalled 52 individuals, with the largest attendance being in Taloyoak. Meeting attendance was lower than anticipated in Kuglukuk as many residents were away fishing. Elders were present at the meetings in Kugaaruk and Taloyoak.

Table 10.2-1. Public Meeting Dates and Attendance, June 2011

Date	Community	Attendance*
Monday, June 6, 2011	Kugluktuk	5
Tuesday, June 7, 2011	Cambridge Bay	13
Wednesday, June 8, 2011	Kugaaruk	15
Thursday, June 9, 2011	Taloyoak	19
Friday, June 10, 2011	Gjoa Haven	Postponed due to weather

**Attendance numbers estimated from draw prize entries and visual counts.*

Comments and questions pertaining specifically to the proposed mine changes were discussed in Cambridge Bay, Kugaaruk, and Taloyoak.

Comments and questions discussed at the meetings were focused on changes to the Doris North mine rather than the planned bulk sample application and generally pertained to employment opportunities, training, mine production timelines, Inuit benefits, environmental testing, and potential effects on human health and social issues. This feedback will be incorporated into future discussions and considered during on-going Project planning.

11.2.4 April 2013

In March 2013, TMAC acquired the Hope Bay Belt from Newmont Mining Corporation. In the following month, a community consultation tour was conducted throughout the Kitikmeot Region, including face-to-face meetings with Hamlet Councils when possible. Consultation and communications focussed on project history, background information on project acquisition, introductions to the TMAC Executive, and announcing 2013 project care and maintenance and exploration plans as well as general Hope Bay Belt development.

11.2.5 December 2014

In December 2014, TMAC personnel visited the five communities of Kugluktuk, Cambridge Bay, Gjoa Haven, Taloyoak, and Kugaaruk. TMAC brought information on the previous year's activities at Hope Bay, its exploration results for 2014, the environmental performance and future permitting activities. Specifically, the proposed Madrid Advanced Exploration Program was discussed in detail in all venues. Discussions were held with the public in scheduled public meetings, with regulators and municipal leaders. Communications focussed on providing an update to the Doris North Project and Hope Bay Belt development. Comments and questions generally pertained to employment opportunities, and potential effects to the land and local environment. This feedback will be incorporated into future discussions and considered during on-going Project planning.

11.3 OTHER COMMUNICATION AND CONSULTATION ACTIVITIES

A community newsletter was published and distributed in October 2010. The newsletter presented information pertaining to the 2010 sealift, summer field work, and employment information. It was intended that this publication would reach a larger audience, including those who may not be able to attend the community meetings or site visits.

In July 2011, 24 KIA staff were provided a site tour, including Community Liaison Officers. The tour was intended to familiarize KIA staff with the Hope Bay Belt such that accurate information regarding the Project could be provided to Beneficiaries through KIA representatives.

In August 2011, two Cambridge Bay Elders participated in archeological field studies.

12. CONCLUSIONS

TMAC Resources Inc. (TMAC) is proposing to undertake an advanced exploration program at the Madrid area (Madrid South and Madrid North), located within the Hope Bay Greenstone Belt (the Hope Bay Belt) in the Kitikmeot Region, Nunavut. The Madrid area of the belt is located approximately 130 km southwest of Cambridge Bay.

The intent of TMAC's proposed Madrid Advanced Exploration Program (the Program) is to:

- advance mineral resource definition;
- assess the effectiveness of the mining techniques for the Madrid deposits; and
- to validate the milling processes of the Doris mill in treating Madrid Ore.

The results of this Program will help validate economic feasibility of the Madrid area. Core Program activities are surface and subsurface diamond drilling, subsurface development and bulk sampling and associated Program infrastructure including rock quarries, all-weather access roads, portals and vents, waste rock and ore storage areas, and water management ponds.

Many of the proposed activities have occurred within the Hope Bay Belt under other authorizations and the Madrid Advanced Exploration Program is a relatively small sized Program. To minimize the project footprint and potential for impacts, the Madrid Advanced Exploration Program will utilize existing facilities at Doris North Project, including the Doris North Project camp and waste management facilities including the already permitted Tailings Impoundment Area.

The Program requires authorization from the NWB to allow water use and disposal of waste to water and submission of this application is to provide the Board with sufficient information to issue the Type B license to support bulk sampling and surficial exploration activities.

As presented in this application package, potential negative environmental effects to physical, biological and traditional resources can be mitigated through incorporation of design considerations and accepted management practices within the Belt. TMAC is confident that the activities can proceed in a manner that is protective of the sensitive environment in which we operate.

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Appendix 1

(for Chapter 1, Introduction)

No appendix for this chapter.

Appendix 2

(for Chapter 2, Minimum Requirements)

SIG for Madrid Advanced Exploration Program Type B Water Licence Application

2.0 Minimum Application Requirements (Application Checklist)

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	NWB Concordance Assessment
Minimum Application Requirements	1	General Water Licence Application Form (see the NWB's *Guide 4: Completing and Submitting a Water Licence Application for a New Licence*) or Application for Water Licence Amendment Form, if appropriate (see NWB's *Guide 7: Licensee Requirements Following the Issuance of a Water Licence*).	Y				With cover letter as preamble to Supplemental Information Report: Section 2.1 and Appendix 3	
	2	Information required to satisfy the requirements of the SIG including plans, reports and designs.	Y				Supplemental Information Report: Section 2.2 and Appendix 2	
	3	Executive summary in english.	Y				Supplemental Information Report: Section 2.3.1	
	4	Translated executive summary in appropriate language and dialect.	Y				Supplemental Information Report: Section 2.3.2 to 2.3.4	
	5	Application fee.	Y				Supplemental Information Report: Section 2.4	
	6	Water use fee.	Y				Supplemental Information Report: Section 2.5	
	7	A table indicating concordance of the application and supporting documents to the Guidelines. These generic Guidelines are provided in excel as a tool for applicants to provide the necessary concordance table.	Y				Supplemental Information Report: Section 2.6, 2.7 and Appendix 2	

Notes: Report title: ERM Rescan. 2014. Madrid Advanced Exploration Program: Type B Water Licence Application Supplemental Information Report. Prepared for TMAC Resources Inc. by ERM Consultants Canada Ltd.: Vancouver, British Columbia.
Electoric document: D.1 - 0194097-0007 (Madrid WLA Supplemental Report).pdf

Qualifications:

1 Applications that do not include all of the items listed above will be returned to the applicant as incomplete with a request for the deficient information.
2 If more than one licensable activity or facility is proposed that requires a water licence (eg. multiple water sources, waste deposits, structures, crossings, etc.) the required information must be provided for each activity or facility.
3 Information between all documents that make up the application package must be consistent and must be accurately cross referenced.
4 The application must distinguish between recommendations or options and actual commitments to chosen alternatives.
5 For additional guidance regarding the submission of electronic documentation, see the NWB's *Guide 6: Electronic Documentation: Submissions and Registry* .
6 The applicant, where practical, may combine components of the information requested in the SIG into more concise plans to provide clarity and eliminate duplication. If this practice is considered, then the applicant must clearly outline, through proper referencing and clearly detailed statements, how the NWB should consider the documents that have combined elements of information. Information management is the responsibility of the applicant.
7 The applicant must submit a concise executive summary of the application package. In addition, the Applicant shall submit an executive summary for each separate supporting document, report or study. All executive summaries shall be provided in English, Inuktitut and/or Inuinnaqtun (where applicable).

The applicant must complete the yellow columns of the worksheet(s). Blue columns are for NWB use only.

3.0 General Water Licence Application

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	If information is not available at the time of application, indicate when the information will be made available	NWB Concordance Assessment
Applicant	**1**	Provide the full name of the applicant and contact person including contact information (position, phone number, address, fax number and email address).	Y				General Water License Application block 1 Supplemental Information Report: Section 3.2		
Applicant Representative	**2**	Provide the name and contact information of any party submitting the application on behalf of the applicant (including position, phone number, address, fax number and email address).	Y				General Water License Application block 1 Supplemental Information Report: Section 3.3		
	3	Provide a signed letter authorizing a party to be the applicant's representative in the licensing process.	Y				Supplemental Information Report: Section 3.3.1		
Name of Project	**4**	Provide the name of the project.	Y				General Water License Application block 3 Supplemental Information Report: Section 3.1		
Location of Undertaking	**5**	Provide coordinates of the project extents taking into account the Local Project Area (LPA) and the Regional Project Area (RPA), where applicable.					General Water License Application block 4 Supplemental Information Report:		
	a	Provide location by Latitude and Longitude.	Y				Section 2.1.1 (Table 2.1-1)		
	b	Provide location by UTM coordinates, if available.	Y				Section 2.1.1 (Table 2.1-1)		
	c	Provide the distances to the nearest communities.	Y				Section 5.5		
	6	Indicate whether the drainage basin, in which the project is located, is shared with any other jurisdiction. If applicable, indicate which jurisdiction.	Y				Section 5.2		
Map	**7**	Provide a map at a 1:50,000 scale based on the National Topographic Series indicating the location of the undertaking, watercourses and the location of waste deposits. Additional maps at various scales may be provided if those maps will provide additional information or clarification. All additional maps must indicate the scale, map sheet number, and location of north.	Y				Supplemental Information Report: Section 3.6 (Figure 3.5-2); Section 4.2 (Figure 4.2-1); Section 4.3 (Figure 4.3-1)		
Nature of Interest in the Land	**8**	Provide the nature of the interest in the land associated with the proposed undertaking, including:							
	a	Sub-surface leases from Nunavut Tunngavik Incorporated (NTI) and/or Indian and Northern Affairs Canada (INAC) as well as surface authorizations from INAC for crown land use, a Designated Inuit Organization (DIO) for Inuit Owned Land (IOL) use, or the Government of Nunavut for Commissioner's land use. Provide the permit or licence numbers.	Y				General Water License Application block 6		
	b	The date or expected date of issuance of any authorization and the date of expiry.	Y				General Water License Application block 6		

3.0 General Water Licence Application

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	If information is not available at the time of application, indicate when the information will be made available	NWB Concordance Assessment
	9	Indicate whether the applicant is the name of the entity holding the authorization for the interest in the land and if not, provide the name of the entity holding the authorization.	Y				General Water License Application block 6 Supplemental Information Report: Section 3.6		
NPC Determination	10	Provide written confirmation from the NPC confirming that NPC's requirements under the NLCA regarding land use plan conformity (Article 11 of the NLCA) have been addressed.	NA	An approved Land Use Plan for the Kitikmeot Region is currently not in place					
NIRB Determination	11	Provide written confirmation from the NIRB confirming that NIRB's requirements under the NLCA regarding development impact assessment (Article 12 of the NLCA) have been or are in the process of being addressed. Documentation may include:					General Water License Application block 8 Supplemental Information Report:		
	a	Written confirmation from NIRB that the project proposal does not require screening;	Y				Section 10.2 and Appendix 10A		
	b	NIRB's screening determination;	Y				Section 10.2 and Appendix 10A		
	c	If a review is required, NIRB's recommendation to the Minister regarding the type of review;	Y				Section 10.2 and Appendix 10A		
	d	If a review is required, the Minister's written decision regarding the review of the development proposal;	Y				Section 10.2 and Appendix 10A		
	e	If a review is required, NIRB's project certificate;	Y				Section 10.2 and Appendix 10A		
	12	List of activities requested for exception in accordance with NLCA s. 12.10.2;	Y				Supplemental Information Report: Section 2.1.1		
	13	Indicate whether any Type B water licence application is for an activity to be considered for interim, short term approval in accordance with NLCA s. 13.5.5.	Y				Supplemental Information Report: Section 2.1.1		
Description of Undertaking	14	See section 4 of this SIG for specific requirements.					see SIG section 4		
Other Applicable Supplemental Information Guidelines	15	Indicate whether any other Supplemental Information Guidelines apply to the undertaking including the following:					General Water License Application block 11		
	a	Hydrostatic testing	NA	not applicable to Program					

3.0 General Water Licence Application

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	If information is not available at the time of application, indicate when the information will be made available	NWB Concordance Assessment
	b	Tannery	NA	not applicable to Program					
	c	Tourist / remote camp	NA	not applicable to Program					
	d	Landfarm and on-site storage of hydrocarbon contaminated soil	Y				Supplemental Information Report: Section 2.1.1 and 4.2.11.3		
	e	Onshore oil and gas exploration drilling	NA	not applicable to Program					
	f	Mineral exploration/remote camp	Y				General Water License Application block 11 Supplemental Information Report: Section 4.1.4, 4.2 and 4.3		
	g	Advanced exploration	Y				General Water License Application block 11 Supplemental Information Report: Section 4		
	h	Mine development	NA	not applicable to Program					
	i	Municipal	NA	not applicable to Program					
	j	General Water Works	Y				Supplemental Information Report: Section 4.2.7, 4.3.7 and 6		
	l	Power	NA	not applicable to Program					
Options (Alternatives)	**16**	Provide a brief explanation of the alternative methods or locations that were considered to carry out the project.	Y				Supplemental Information Report: Section 10.10		
Water Use	**17**	See section 6 of this SIG for specific requirements	Y				see SIG section 6		
Water Use: Quality and Quantity	**18**	See section 6 of this SIG for specific requirements	Y				see SIG section 6		
Waste Disposal	**19**	See section 7 of this SIG for specific requirements	Y				see SIG section 7		
Waste Disposal: Quality and Quantity	**20**	See section 7 of this SIG for specific requirements	Y				see SIG section 7		

3.0 General Water Licence Application

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	If information is not available at the time of application, indicate when the information will be made available	NWB Concordance Assessment
Other Authorizations	**21**	Provide a list of any authorizations required in relation to the project in addition to the water licence. For each additional authorization required for the project, provide the name of the authorization, the administering agency, the project activity requiring the authorization, the date or expected date of issuance and the date of expiry. Provide a description of how those authorizations may affect the NWB's water licensing process.	Y				General Water License Application block 16		
	22	Indicate whether an authorization has been obtained or sought from the Department of Fisheries and Oceans for dewatering or using any waterbodies for containment of waste	Y				Supplemental Information Report: Section 6.5		
	23	Provide formal applications to the Navigable Waters Protection Program (NWPP) for any works.	Y				Supplemental Information Report: Section 5.3.2, 5.4 and Appendix 5		
	24	Provide a timetable for filing the appropriate plans and procedures required by government parties.	Y				Supplemental Information Report: Section 8.1 (Table 8.1-1)		
	25	Indicate whether the applicant/ licensee holds any existing water licences. If applicable, provide the licence number and expiry date of any existing water licences.	Y				General Water License Application block 6 Supplemental Information Report: Section 10.2 (Table 10.2-1)		
Predicted Environmental Effect and Proposed mitigation measures	**26**	Identify the potential effect of water use and waste disposal on the following components:	Y				Supplemental Information Report:		
	a	Groundwater and Surface Water including:							
		changes in flow (including seasonal rate of flow)	Y				Section 10.4, 10.5 and Table 10.3-1		
		quantity	Y				Section 10.4.3, 10.4.4, 10.4.5.1 and Table 10.3-1		
		quality	Y				Section 10.4.5.1 and Table 10.3-1		
	b	Land including:							
		geologic structure change	Y				Section 10.4, 10.5 and Table 10.3-1		
		soil contamination	Y				Section 10.5 and Table 10.3-1		
		compaction, settling and erosion	Y				Section 10.5.1 and Table 10.3-1		
		alteration of the permafrost regime	Y				Section 10.4.2 and Table 10.3-1		
		riparian zone loss	Y				Section 10.5.1 and Table 10.3-1		
	c	Vegetation including:							
		species composition and abundance	Y				Section 10.5.1 and Table 10.3-1		
		non-native species introduction	Y				Section 10.5.1 and Table 10.3-1		
		accumulation of toxins and heavy metals (in relation to remediation objectives for closure)	Y				Section 10.5.2 and Table 10.3-1		
	d	Aquatic Ecosystems including:							
		fish	Y				Section 10.5.3 and Table 10.3-1		
		benthic invertebrates	Y				Section 10.5.3 and Table 10.3-1		

3.0 General Water Licence Application

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	If information is not available at the time of application, indicate when the information will be made available	NWB Concordance Assessment
		plankton	Y				Section 10.5.3 and Table 10.3-1		
	27	Identify effects separately for each project phase.	Y				Supplemental Information Report: Section 10.3 (Table 10.3-1)		
	28	Provide a description of the methods used to predict effects.	Y				Supplemental Information Report: Section 10.3 (Table 10.3-1)		
	29	Provide a cumulative effects assessment of the project's water use and waste disposal activities in relation to other activities in the same drainage basin.	Y				Supplemental Information Report: Section 10.7		
	30	Identify effects arising from accidental events or malfunctions.	Y				Supplemental Information Report: Section 10.8		
	31	Provide a description of all proposed mitigation, management and monitoring programs to mitigate adverse impacts.	Y				Supplemental Information Report: Section 10.4, 10.5 and Table 10.3-1		
	32	Provide a description of the measures to be taken to mitigate impacts on historical resources or traditional uses of water and procedures to be followed should artifacts be discovered.	Y				Supplemental Information Report: Sections 5.5, 10.6 and Appendix 10B		
	33	If applicable, provide a description of any potential transboundary effects.	Y				Supplemental Information Report: Section 10.9		
	34	See sections 5, 6, 7, and 8 of this SIG for additional information requirements	Y				See sections 5, 6, 7, and 8 of this SIG for additional information requirements		
Existing and Other User Water Rights	**35**	Provide the names, addresses, and nature of use for any known persons or properties that may be adversely affected by the proposed undertaking, including those that that hold licences for water use in precedent to the application, domestic users, in-stream users, authorized waste depositors, owners of property, occupiers of property, and/or holders of outfitting concessions, registered trapline holders, and holders of other rights of a similar nature.	NA	not applicable to Program					
	36	Provide a description of any potential effects of the project on the persons or properties identified in item 35 of this section.	NA	not applicable to Program					
	37	Provide a description of the measures incorporated into the project design to mitigate effects of the project on the persons or properties identified in item 35 of this section.	NA	not applicable to Program					
	38	Indicate whether compensation has been paid and/or agreement(s) for compensation have been reached with any existing or other users.	NA	not applicable to Program					
Inuit Water Rights	**39**	Provide a description of any potential effects of the project on the quality, quantity, or flow of waters flowing through Inuit Owned Land (IOL).	Y				General Water License Application block 19		
	40	Provide a description of the measures incorporated into the project design to mitigate effects of the project on the quality, quantity, or flow of waters flowing through IOL.	Y				General Water License Application block 19		

3.0 General Water Licence Application

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	If information is not available at the time of application, indicate when the information will be made available	NWB Concordance Assessment
	41	Indicate wheter an agreement to pay compensation for any loss or damage has been reached with one or more Designated Inuit Organization (DIO); or if the parties have been unable to reach an agreement on compensation	Y				General Water License Application block 19		
Consultation	**42**	Provide a summary of any consultation meetings including when the meetings were held, where and with whom.	Y				Supplemental Information Report: Section 11.2 and 11.3		
	43	Provide a summary of the results of consultation meetings including a list of concerns expressed and measures proposed to address concerns.	Y				Supplemental Information Report: Section 11.2 and 11.3		
Security	**44**	Provide a financial security assessment that is prepared in a manner consistent with principals respecting mine site reclamation and implementation found in the *Mine Site Reclamation Policy for Nunavut* , Indian and Northern Affairs Canada, 2002. The financial security assessment must include:					Supplemental Information Report:		
	a	An estimate of the total financial security for final reclamation equal to the total outstanding reclamation liability for land and water combined sufficient to cover the highest liability over the life of the undertaking;	Y				Section 9.2 (Table 9.2-1) and Appendix 9		
	b	The cost of having the necessary reclamation work done by a third-party contractor if the operator defaults;	Y				Section 9.2 (Table 9.2-1) and Appendix 9		
	c	Contingency factors appropriate to the particular work to be undertaken.	Y				Section 9.2 (Table 9.2-1) and Appendix 9		
Abandonment and Restoration	**45**	Provide plans for the abandonment and restoration of the project. Detail the costs to carry out the plan, and a proposal for financial assistance which covers the costs to carry out the plan.	Y				Supplemental Information Report: Section 9 and Appendix 9		
	46	Provide a list and description of any existing abandoned or restored site facilities.	Y				Supplemental Information Report: Section 9 and Appendix 9		
Financial Information	**47**	Provide a statement of financial responsibility.	Y				General Water License Application block 22 Supplemental Information Report: Section 3.3.3 and Appendix 3		
	48	If the applicant is an entity for which audited financial statements are issued, a copy of the most recent audited financial statements must be attached to the statement of financial responsibility.	Y						
	49	Provide the name of the corporation, limited company or other business entity, with a list of the officers of the company and a copy of the Certificate of Incorporation or evidence of registration of the company name.	Y						
Studies and Designs	**50**	Provide a list of studies, reports and plans relevant to the application that have been undertaken to date including:					Supplemental Information Report: Section 4, 5, 6, 7, and 9; Appendix 4, 5, 6, 7 and 9		
	a	Design rational, design requirements, design criteria, design parameters, design standards/analysis/method;	Y						
	b	Design assumptions and the limitations associated with such design assumptions;	Y						
	c	The inclusion of clear, definable engineering qualifiers with all design drawings and reports;	Y						
	d	Site specific data and analysis to support the design and management decisions made;	Y						
	e	Materials that appropriately delineate the particulars of a design or plan.	Y						

3.0 General Water Licence Application

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	If information is not available at the time of application, indicate when the information will be made available	NWB Concordance Assessment
	51	Provide construction methods and procedures regarding how infrastructure will be put in place on-site.	Y				Supplemental Information Report: Section 4.1 to 4.4		
	52	Provide a timetable for submission of preliminary and final-for-construction engineered designs (note: for construction designs are required for NWB approvals).	Y				Supplemental Information Report: Section 2.2		
	53	See sections 5, 6 and 7 of this SIG for additional information requirements	Y				See SIG section 5, 6, and 7		
Proposed Time Schedule	54	Provide the proposed start and completion dates for each phase of development (construction, operation, closure and post closure) and any anticipated periods of seasonal shut down.	Y				General Water License Application block 24 Supplemental Information Report: Section 3.4		
Proposed Term of Licence	55	Provide a proposed term of licence including the expected date of licence issuance and the expected date of licence expiry.	Y				General Water License Application block 24 and 25 Supplemental Information Report: Section 3.4		
Annual Reporting	56	Provide detailed information regarding the content of annual reports and a proposed outline or template of the annual report. The annual report should include the following:							
	a	Water related monitoring results;	Y				General Water License Application block 26		
	b	Comparison of water quality and quantity monitoring data with the water quality and quantity predictions presented in the application;	Y				General Water License Application block 26		
	c	A description of how the conditions in the NIRB project certificate related to the NWB mandate have been implemented;	Y				General Water License Application block 26		
	d	Project changes under adaptive management;	Y				General Water License Application block 26		
	e	Any actions taken in response to direction provided by the Inspector.	Y				General Water License Application block 26		
Renewals and Amendments	57	If the application is for a renewal or amendment of an existing licence provide the water licence number and the date of water licence expiry.	Y				Supplemental Information Report: Section 10.2 (Table 10.2-1)		
	58	If the application is for a renewal or amendment of an existing licence, provide a compliance assessment/status report. This report must document the status of compliance for each condition of the existing water licence taking into consideration inspector dialogues and inspector directions, responses to inspector dialogues and inspector directions, spills that may have occurred, and any reporting requirements. The report must indicate when facilities were inspected by regulatory agencies and list any spills that may have occured including a description, location shown on a map, and the action taken to address the affected area.	NA						

Notes: Report title: ERM Rescan. 2014. Madrid Advanced Exploration Program: Type B Water Licence Application Supplemental Information Report. Prepared for TMAC Resources Inc. by ERM Consultants Canada Ltd.: Vancouver, British Columbia.
Electoric document: D.1 - 0194097-0007 (Madrid WLA Supplemental Report).pdf

4.0 Project Description

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	If information is not available at the time of application, indicate when the information will be made available	NWB Concordance Assessment
Description of Undertaking	**1**	Provide a complete description of the undertaking with detailed site plan(s) of all project infrastructure for the Local Project Area (LPA) and/or the Regional Project Area (RPA), where applicable. Include maps and/or aerial photos with scales that allow the determination of distances between the objects depicted. Differentiate any temporary components from permanent components. Consider the following in providing the description:					Supplemental Information Report:		
	a	Raw water intake;	Y				Section 4.4.2, 6.1.1, 6.1.2 and 6.6		
	b	Water storage and treatment facilities including distribution systems;	Y				Section 4.2.7, 4.2.8, 4.3.7, 4.3.8 and 6.4		
	c	Existing water bodies/courses and any changes to these water bodies/courses that may have or may occur as a result of water use or waste disposal facilities. Provide an outline of the drainage basin and drainage patterns within the RPA;	Y				Section 6.3 to 6.6, 10.4.3 to 10.4.4 and 10.4.5.1		
	d	Location of receiving water bodies and drainage pathways;	Y				Section 5.2		
	e	Transportation access routes and details of water course crossings;	Y				Section 4.1.1, 4.2.1, 4.3.1 and 6.5		
	f	Locations of environmental monitoring sites;	Y				Section 8.1 (Table 8.1-2)		
	g	Traditional water use and land use areas that may be impacted by the project;	Y				Section 10.6		
	h	Sewage treatment facilities;	Y				Section 4.2.11.1, 4.3.11 and 7.1 (Table 7.1-1)		
	i	Wastewater treatment area and discharge outlet locations;	Y				Section 4.2.11.1, 4.3.11, 4.4.3 and 7.1 (Table 7.1-1)		
	j	Solid waste disposal areas and drainage patterns;	Y				Section 4.2.11.1, 4.3.11 and 7.1 (Table 7.1-1)		
	k	Incinerators	Y				Section 4.2.11.2		
	l	Landfarm (see the NWB's SIG for Landfarm and on-site storage of hydrocarbon contaminated soil (I3));	Y				Section 4.2.11.3		
	m	Waste rock piles (PAG and non-PAG);	Y				Section 4.2.3, 4.3.3 and 8.3		
	n	Stockpiles;	Y				Section 4.2.2, 4.3.2 and 8.3		
	o	Mill or processing plant	Y				Section 4.1.2		
	p	Tailings containment areas;	Y				Section 4.1.3		
	q	Laydown areas;	Y				Section 4.2.4 and 4.3.4		
	r	Quarries;	Y				Section 4.2.5, 4.3.5 and 7.2		
	s	Hazardous waste disposal area;	Y				Section 4.2.11.3, 4.3.11 and 7.1 (Table 7.1-1)		
	t	Waste discharge distribution lines;	Y				Section 4.2.11 and 4.3.11		
	u	Fuel and chemical storage;	Y				Section 4.2.10.2, 4.2.10.3 and 4.3.10		
	v	Explosives manufacturing and storage;	Y				Section 4.2.10.1 and 4.3.10		
	w	Abandoned and/or restored facilities;	NA	not applicable to the Project					
	x	Existing on site infrastructure	Y				Section 4.1		
	y	Others:	NA	not applicable to the Program					

4.0 Project Description

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Exploration Activities	**2**	Indicate the status of the exploration activity on the date of application as one of the following					Supplemental Information Report:		
	a	Design	Y				Section 3.5.1		
	b	Under construction	Y				Section 3.5.1		
	c	In operation	Y				Section 3.6 and 3.7		
	d	Suspended	NA	not applicable to the Program					
	e	Care and maintenance	Y				Section 3.6		
	f	Abandoned	NA	not applicable to the Program					
	g	Other:	NA	not applicable to the Program					
	3	If a change in the status of the exploration activity is expected, indicate the nature and anticipated date of such change.	Y				Supplemental Information Report: Section 3.4		
	4	Indicate the type (or proposed type) of exploration operation and provide a description of the method.	Y				Supplemental Information Report:		
	a	Reverse circulation to obtain bulk sample	NA	not applicable to the Program					
	b	Trenching	Y				Section 4.4.5		
	c	Conventional open pit	NA	not applicable to the Program					
	d	Decline	Y				Section 4		
	e	Conventional underground	Y				Section 4		
	f	Strip mining activity	NA	not applicable to the Program					
	g	Other: (describe)	Y				Section 4.4.1 (Diamond Drilling); Section 4.4.4 (Airborne, Surficial and Downhole Geophysics); Section 4.4.5 (Prospecting, Mapping and Sampling)		
	5	Indicate the size (in tonnes) and number of samples that will be obtained. Indicate whether smaller samples are to be collected from different locations to form one large bulk sample and provide the location of each sample.	Y				Supplemental Information Report: Section 4		
	6	Indicate the present (or proposed) average rate of exploratory production from all mineralized sources in tonnes of ore / day.	Y				Supplemental Information Report: Section 4.1.2		
Milling/ Processing Activities	**7**	Provide a copy of the mill or processing plant flow sheet. Indicate the points of addition of the various reagents (chemicals) that will be used.	NA	not applicable to the Program			Supplemental Information Report: Section 4.1.2		
	8	Indicate the capacity of the mill	NA	not applicable to the Program			Supplemental Information Report: Section 4.1.2		
	9	Indicate the proposed rate of milling (tonnes/day)	NA	not applicable to the Program			Supplemental Information Report: Section 4.1.2		
	10	If applicable, indicate whether the (proposed) milling circuit is in whole or in part based on autogenous grinding.	NA	not applicable to the Program			Supplemental Information Report:		
Camp	**11**	Classify the camp as one of following:							

4.0 Project Description

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	a	Mobile (self propelled)	NA	not applicable to the Program					
	b	Temporary	Y				Section 4.1.4		
	c	Seasonally occupied	NA	not applicable to the Program					
	d	Permanent	Y				Section 4.1.4		
	e	Other: (describe)	Y				Section 4.2.7 (Windy Lake exploration camp being decommissioned); Section 4.3 (historic Wolverine Camp)		
	12	Provide the design, maximum and average populations of the camp	Y				Section 4.1.4		
	13	Provide a description of how the location of the camp was selected. Indicate whether assistance from the Regional Inuit Association Land Manager was obtained in selecting the site.	Y				Section 4.1.4 and 5.5		

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5.0 Baseline Information

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	If information is not available at the time of application, indicate when the information will be made available	NWB Concordance Assessment
Environmental Setting	**1**	Provide a description of the regional and local setting using maps and/or aerial photos with scales that allow the determination of distances between the objects depicted.	Y				Supplemental Information: Section 3.5 (Figure 3.5-1 and 3.5-2)and 5.1 to 5.5		
	2	Provide a brief history of the property development which took place before the present company gained control of the site. Include shafts, adits, mills, waste dumps, chemical storage areas, tailings disposal areas, and effluent discharge locations. Make references to a detailed map.	Y				Supplemental Information: Section 3.6 (Figure 3.5-2, 4.2-1 and 4.3-1) and Appendix 4		
	3	Provide a description of the site conditions, including:					Supplemental Information Report:		
	a	location	Y				Section 5.2, Appendix 5		
	b	topography	Y				Section 5.3.1, Appendix 5		
	c	geologic conditions	Y				Section 5.2, Appendix 5		
	d	hydrologic characteristics	Y				Section 5.2, Appendix 5		
	e	climate conditions and predicted future climate trends	Y				Section 5.2, Appendix 5		
	f	seismicity	Y				Section 5.2, Appendix 5		
	g	permafrost conditions	Y				Section 5.2, Appendix 5		
	4	Provide a description of the regional and local surface water regime and drainage area and outline the drainage basin on an attached map.	Y				Supplemental Information: Section 5.2, Appendix 5 and Figure 3.5-2		
	5	Provide a description of the groundwater regime.	Y				Supplemental Information: Section 5.2, Appendix 5		
	6	Provide baseline data and an evaluation of baseline data describing surface and groundwater quality in the project area (physical, chemical, and biological characteristics).	Y				Supplemental Information: Section 5.2, Appendix 5		
	7	Provide a description of the usual break-up and freeze-up periods.	Y				Supplemental Information: Section 5.2, Appendix 5		
	8	Provide a description of streambed material, streambank material, and streambank vegetation,	Y				Supplemental Information: Section 5.3.2, Appendix 5		
	9	Indicate the slope of the banks of any water course affected by the application	Y				Supplemental Information: Section 5.3.2, Appendix 5		
	10	Provide a decription of the meander pattern for any channel affected by the application	NA	not applicable to the Program					
	11	Provide the following streamflow data in cubic metres per second for each watercourse included in the application:					Supplemental Information: Section 5.2, Appendix 5		
	a	mean annual flow;	Y						
	b	mean summer flow;	Y						
	c	minimum summer flow;	Y						
	d	minimum annual flow;	Y						
	e	mean annual flood;	Y						
	f	maximum summer flood;	Y						
	g	mean summer flood;	Y						
	12	Provide bathymetric information for water bodies affected by the application.	Y				Supplemental Information Report: Section 5.2, Appendix 5		
	13	Provide a description of the ground condition for design and engineering of earthwork infrastructure, including (if applicable, provide test pit/ drill hole logs and laboratory test results):	Y				Supplemental Information Report:		
	a	Waste rock facilities	Y				Appendix 4		

5.0 Baseline Information

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	b	Tailings containment area	NA	not applicable to the Program			Appendix 4		
	c	Landfills	NA	not applicable to the Program			Appendix 4		
	d	Landfarms	NA	not applicable to the Program			Appendix 4		
	e	Fuel and chemical storage facilities	Y				Appendix 4		
	f	Explosives management areas and facilities	Y				Appendix 4		
	g	Roads	Y				Appendix 4		
	h	Quarries or borrow pits	Y				Appendix 4		
	i	Hazardous waste facilities	Y				Appendix 4		
	j	Wastewater treatment facilities	Y				Appendix 4		
	k	Ore stockpiles	Y				Appendix 4		
	l	Overburden piles	Y				Appendix 4		
	14	Provide results of any assessment of the permeability of any faults and taliks beneath water bodies.	Y				Supplemental Information: Section 5.2, 7.3 and Appendix 7A		
	15	Provide a description of the historical uses of the waters affected by the project.	Y				Supplemental Information: Section 5.5, Appendix 5		
	16	Provide a description of any traditional uses of water in the project area.	Y				Supplemental Information: Section 5.5, Appendix 5		
	17	Indicate whether fish, shellfish, or other wildlife are present and harvested in or near discharge areas and, if applicable, indicate the species harvested and the level of harvest.	Y				Supplemental Information: Section 5.4, Appendix 5		
	18	Provide a description of the results of any consultation with Elders regarding the collection of baseline data.	Y				Supplemental Information: Section 4.3.1.1, 11.2, 11.3, Appendix 5		
Geology and Minerology	**19**	Provide a description of the physical nature of the mineralization, including known dimensions and approximate shape	Y				Supplemental Information: Section 5.2, Appendix 5		
	20	Provide a description of the host rock in the general vicinity of the mineralization (from the surface to the mineralized zone)	Y				Supplemental Information: Section 5.2, Appendix 5		
	21	Provide a geological description of the mineralized zone. (If possible, include the percentage of metals)	Y				Supplemental Information: Section 5.2, Appendix 5		
	22	Provide a description of the geochemical tests which have been (or will be) performed on the ore, host rock, and waste rock to determine their relative acid generation and contaminant leaching potential. Outline methods used (or to be used) and provide test results in an attached report (ie. static test, kinetic tests).	Y				Supplemental Information: Section 4, Section 8, Appendix 5 and Appendix 8		
	23	Provide an estimate of the percentage of sulphide in the mineralization including:					Supplemental Information Report:		
	a	Pyrite	Y				Section 5.2, Appendix 5 and Section 8.3, Appendix 8B		
	b	Pyrrhotite	Y				Section 5.2, Appendix 5 and Section 8.3, Appendix 8B		
	c	Pyrite / Pyrrhotite mixture	Y				Section 5.2, Appendix 5 and Section 8.3, Appendix 8B		
	d	Arsenopyrite	Y				Section 5.2, Appendix 5 and Section 8.3, Appendix 8B		

5.0 Baseline Information

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	24	Provide a description of the geochemical tests which have been (or will be) performed on quarrry or borrow material to determine the relative acid generation and contaminant leaching potential. Outline methods used (or to be used) and provide test results in an attached report (ie. static test, kinetic tests).	Y				Supplemental Information Report: Section 8.4, Appendix 8C		
Fisheries	**25**	The applicant is advised to consult with DFO regarding fish and fish habitat related issues and to visit DFO's website at http://www.dfo-mpo.gc.ca/habitat/habitat-eng.htm. Indicate whether the applicant has consulted with DFO and provide the results of any consultation.	Y				Supplemental Information Report: Section 5.1, Appendix 5		
	26	If applicable, provide baseline data and an evaluation of baseline data describing fish and fish habitat in the project area.					Supplemental Information:		
	27	If applicable, provide a fisheries assessment including:							
	a	Detailed area description (including photographic record);	Y				Section 5.3.2, 5.4, Appendix 5		
	b	Description of fish habitat (including river or lake bottom substrates such as silt, sand, or cobble);	Y				Section 5.3.2, 5.4, Appendix 5		
	c	Presence of sensitive habitats (spawning, migration corridors etc.);	Y				Section 5.3.2, Appendix 5		
	d	Description of aquatic and riparian vegetation;	Y				Section 5.3.2, Appendix 5		
	e	Fish community and lifestage present;	Y				Section 5.4 (Table 5.4-1), Appendix 5		
	f	Depth and width of watercourse;	Y				Appendix 5		
	g	Max/min water flows, currents, tides;	Y				Appendix 5		
	h	Turbidity and sediment loads (total suspended solids);	Y				Section 5.3.2, Appendix 5		
	i	Sport, commercial, subsistence fishery present.	Y				Section 5.5, Appendix 5		
Studies	**28**	Provide a list of baseline studies, reports and plans relevant to the application that have been undertaken to date including:					Supplemental Information Report		
	a	Geotechnical studies;	Y				Section 5.2, Appendix 5		
	b	Geochemical studies;	Y				Section 5.2, Appendix 5		
	c	Water quality studies;	Y				Section 5.2, 5.3 and Appendix 5		
	d	Hydrological and hydrogeological studies;	Y				Section 5.2, Appendix 5		
	e	Traditional use studies;	Y				Section 5.5, Appendix 5		
	f	Aquatic studies;	Y				Section 5.3.2, Appendix 5		
	g	Meteorological studies;	Y				Section 5.2, Appendix 5		

Notes: Report title: ERM Rescan. 2014. Madrid Advanced Exploration Program: Type B Water Licence Application Supplemental Information Report. Prepared for TMAC Resources Inc. by ERM Consultants Canada Ltd.: Vancouver, British Columbia.
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6.0 Water Use: Quality, Quantity, Predicted Environmental Impact and Proposed Mitigation Measures

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	If information is not available at the time of application, indicate when the information will be made available	NWB Concordance Assessment
Water Use	**1**	Provide a detailed description of all types of water uses including: (See the NWB definition of "use" in the NWB Guide 2: Terminology and Definitions). Categorize water consumption use(s) as either mining/industrial use and/or domestic use.					Supplemental Information Report:		
	a	Obtain water for domestic purposes	Y				Section 6.1 (Table 6.1-1)		
	b	Obtain water for industrial purposes	Y						
		drilling	Y				Section 4.2.7, 4.3.7, 6.1.1		
		mill or processing plant	NA	not applicable to the Program					
		ice road construction	Y				Section 4.2.7, 4.3.7		
		other: (describe)	NA	not applicable to the Program					
	c	To cross a water course	Y				Section 6.5		
	d	To alter the flow of water, or store water	Y				Section 4.2.7, 4.2.8, 4.3.7, 4.3.8, 6.4		
	e	Flood control	NA	not applicable to the Program					
	f	To divert a watercourse	NA	not applicable to the Program					
	g	To modify the bed or bank of a watercourse	NA	not applicable to the Program					
	h	Others:	NA	not applicable to the Program					
Water Use: Quality and Quantity *Water Intake* **Identify uses as either domestic or industrial**	**2**	Provide the name of the primary water source(s) as well as the name of any alternative water source(s).	Y				Supplemental Information Report: Section 6.1 (Table 6.1-1)		
	3	Provide a description of the source(s) of water and the location of the water source(s) as shown on a map.	Y				Supplemental Information Report: Section 3.5.1, Figure 3.5-2 and Section 6.1		
	4	Indicate the type of water source(s) as lake, river, well, or other type.	Y				Supplemental Information Report: Section 6.1		
	5	Provide a description of the quality of the water from the source(s) for each season (summer, fall, winter, spring).	Y				Supplemental Information Report: Section 6.3 and Appendix 5		
	6	Provide the capacity of the water source(s).	Y				Supplemental Information: Section 6, Section 10, (Table 10.4-1)		
	7	Provide the acquisition rate in cubic metres per day and cubic metres per year from each water source.	Y				Supplemental Information: Section 6.1 (Table 6.1-1) and Section 10.4 (Table 10.4-1)		
	8	Provide a description of the water intake method(s) including the intake facility, the operating capacity of the pump used, the details of any screening to exclude fish, and the distance the pump will be placed from the ordinary high water mark of the watercourse.	Y				Supplemental Information: Section 4.2.7, 4.3.7 and Appendix 4, Section 6.6		
	9	Provide a description of the general condition of any existing water intake facility. Rate the condition of the facility as satisfactory or unsatisfactory and explain the rating.	NA	not applicable to the Program					

6.0 Water Use: Quality, Quantity, Predicted Environmental Impact and Proposed Mitigation Measures

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	If information is not available at the time of application, indicate when the information will be made available	NWB Concordance Assessment
	10	Indicate whether water is drawn from the source(s) intermittently or continuously and if intermittently indicate during what months it is drawn and for what period it is drawn (days/weeks/months).	Y				Supplemental Information: Section 4.2.7, 4.2.8, 4.3.7, 4.3.8, Appendix 6, Appendix 8		
	11	Indicate the amount of water to be returned to the source.	NA	not applicable to the Program					
	12	Provide a description of the methods to ensure water returned to any source is of an acceptable quality.	NA	not applicable to the Program					
	13	Provide a description of any hydrostatic testing programs, including water sources, and treatment/disposal requirements. If applicable, refer to the NWB's SIG for Hydrostatic Testing.	NA	not applicable to the Program					
	14	Indicate the quantities of water required for ice road construction and provide a description of the methods of ice road construction.	Y				Supplemental Information Report: Section 6.2		
	15	Provide a description of any measures to reduce water consumption.	Y				Supplemental Information: Section 8.1, Appendix 8A and Section 10.4.4		
Water Storage	**16**	Provide a description of any water storage facilities including the type (reservoir/pond, storage tank), location, design, and the water storage volume in cubic meters.	Y				Supplemental Information: Sections 4.2.7, 4.2.8, 4.3.7, 4.3.8, Section 8, Appendix 8A		
	17	If the water storage facility is a reservoir, indicate whether the reservoir is lined, the type of liner and when it was or will be installed.	NA	not applicable to the Program					
	18	Indicate whether a storage reservoir is created in a natural channel. If applicable, provide plan and profile drawings of the reservoir including the size of the drainage basin upstream of the reservoir, topographical plan showing the drainage area boundary, number of hectares flooded, surface area of the reservoir at full capacity, storage capacity, and details of shoreline protection.	NA	not applicable to the Program					
	19	Provide a plan showing representative cross sections of the reservoir.	NA	not applicable to the Program					
	20	Provide a description of the general condition of any existing water storage facility and provide an explanation if it is unsatisfactory.	NA	not applicable to the Program					
Water Distribution	**21**	Provide a description of water distribution systems (ie. piped water, trucked).	Y				Supplemental Information: Section 4.2, 4.3, 8.1, 8.2 and Appendix 8A		
	22	Provide a description of the general condition of any existing water distribution system and provide an explanation if it is unsatisfactory.	NA	not applicable to the Program					
Watercourse Crossings	**23**	Provide a description of any watercourse crossings including pipelines, bridges, culverts or roads and its purpose.	Y				Supplemental Information: Section 4.2, 4.3, Appendix 4 and Section 6.5		
	24	Provide a plan of any watercourse crossing showing cross section and elevations	Y				Supplemental Information: Figure 3.5-2, Section 4, Appendix 4 and Section 6.5		
Watercourse Trainings	**25**	Provide a description of any watercourse trainings including channel and bank alterations, culverts, spurs, erosion control, and artificial accretion, and its purpose.	NA	not applicable to the Program					
Flood Control	**26**	Provide a description of any flood control structures and its purpose.	NA	not applicable to the Program					

6.0 Water Use: Quality, Quantity, Predicted Environmental Impact and Proposed Mitigation Measures

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	If information is not available at the time of application, indicate when the information will be made available	NWB Concordance Assessment
Diversions	**27**	Provide a description of any diversions including ditches and dikes and its purpose.	Y				Supplemental Information: Section 4.2.7, 4.2.8, 4.3.7, 4.3.8 and Appendix 4		
Alterations in flow	**28**	Provide a description of any activities or structures that could alter the flow of a watercourse including dams, spillways, berms, cofferdams, and dikes, and its purpose.	Y				Supplemental Information: Section 4.2.7, 4.2.8, 4.3.7, 4.3.8 and Appendix 4		
	29	Indicate whether the natural storage capacity or water level of any lake or pond will be altered.	Y				Supplemental Information: Section 4.2.7, 4.2.8, 4.3.7, 4.3.8 and Appendix 4		
	30	If the alteration involves a dam, provide a plan showing the length, height, cross section and elevations of the dam and the location and preliminary designs of spillways, canals, sluice pipes, and any other outlet work.	Y				Supplemental Information: Section 3.6, 4.1.3		
Dewatering	**31**	Provide a description of dewatering programs, if planned, including estimated quantities, qualities, dewatering flow rates, methods and schedule of withdrawl, end use or discharge location.	NA	not applicable to the Program					
Identification	**32**	Indicate whether there are any signs identifying past or present water intake, storage, distribution systems and/or waterwork structures presently in the project area.	NA	not applicable to the Program					
Modifications	**33**	Indicate whether any changes are planned for the water intake, storage, distribution systems and/or waterwork structures. If applicable, see item 36 of this section.	NA	not applicable to the Program					
Proposed Water Works	**34**	For each water work component provide the design plans stamped for construction. Design plans shall consider the following:							
	a	Name of the water body(s) affected.	Y				Supplemental Information Report: Section 4, Appendix 4; Section 8, Appendix 8		
	b	Site photos, site map, or air photos of the location.	Y						
	c	Description of the existing condition of the site (see Section 5)	Y						
	d	Indicate whether any structure will be placed in water on a temporary, seasonal or permanent basis and provide a description of when and how the structure will be removed.	Y						
	e	The design flood flow in cubic metres per second and its return period for the type of structure proposed.	Y						
	f	An explanation of the rationale for the selected design flow flood and its return period.	Y						
	g	Design drawings in plan and profile, drawn to scale, including all relevant dimensions.	Y						
	h	Detaills of design parameters including seismic design criteria if applicable.	Y						
	i	In water work timing restriction for fisheries.	Y						
	j	Start and completion dates for construction.	Y						
	k	Construction schedule and sequence taking into account any timing restrictions.	Y						
	l	Construction methods.	Y						
	m	Equipment to be used.	Y						
	n	A description of the source, type, and composition of material used in construction.	Y						
	o	The quantity of material to be either placed into or removed from the watercourse.	Y						
	p	Sedimentation and erosion control measures.	Y						
	q	Construction monitoring plans.	Y						
	r	Construction quality assurance and quality control measures.	Y						

6.0 Water Use: Quality, Quantity, Predicted Environmental Impact and Proposed Mitigation Measures

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	If information is not available at the time of application, indicate when the information will be made available	NWB Concordance Assessment
	s	Assessment of impacts to fish and fish habitat (see item 43 of this Section).	Y						
	t	Bank stabilization measures (including the size range of material if applicable).	Y						
	u	Operation and maintenance plans including instrumentation, monitoring and inspection requirements.	Y						
	v	Contingency plans.	Y						
	w	Re-vegetation plans	Y						
	x	Proposed post construction monitoring (photos taken of the site before construction, during construction, and after construction; photos should be taken from the same reference point for easy comparison)	Y						
	y	Abandonment and restoration plans (see items 45-46 of Section 3).	Y						
	35	Final plans and drawings for construction must be stamped by a Professional Engineer licensed to practice in Nunavut. (See Section 7 of the NWB's Guide 4: Completing and Submitting a Water Licence Application for more information regarding design drawings).	Y				Supplemental Information Report: Section 4, Appendix 4		
	36	If geotextile is used or a similar material to prevent the transport of sediment into a watercourse, provide the technical specifications for the proposed material as well as the location, extent and placement method for the material.	Y				Geomembrane use: Supplemental Information Report: Section 4.2.7, 4.3.7, Appendix 4		
	37	If rip rap is used or a similar material for erosion protection, provide information regarding the minimum and maximum sizes of the material and the gradation between those limits. Indicate the quantity to be used and its source.	Y				Stockpile: Supplemental Information Report: Section 4.2.2, 4.3.2 Waste Rock: Supplemental Information Report: Section 4.2.3, 4.3.3		
Predicted Environmental Effects and Proposed mitigation measures	**38**	Provide a description of the effects of water usage on the source from which water will be drawn including the potential for drawdown.	Y				Supplemental Information Report: Section 5.2, 10.4.4, 10.5.3		
	39	Provide a description of any expected changes in surface water flow or storage including changes downstream of the project.	Y				Supplemental Information Report: Section 5.2, 10.4.5.1		
	40	If the cross-section of any watercourse is changed, provide a description of the change and its effect on the flow capacity of the channel.	Y				Supplemental Information Report: Section 5.2, 10.4.5.1		
	41	If the course of any channel is changed, provide a description of measures to maintain stream bed and bank stability.	NA	not applicable to the Program					
	42	Provide a description of measures of preventing surface water from coming into contact with waste and measures of managing surface water that does come into contact with waste (surface water management plan).	Y				Supplemental Information Report: Section 8 and 10.4.3		
	43	Provide a description of measures of preventing groundwater from coming into contact with waste and measures of managing groundwater that does come into contact with waste (groundwater management plan).	Y				Supplemental Information Report: Section 7, Appendix 7, Section 8 and Appendix 8		
Fisheries	**44**	If applicable, provide a description of any potential impacts to fish and/or fish habitat. (Indirect effects may include project effects, water quality, or aquatic organisms. Direct effects may include degradation or alteration of fish habitat). The applicant is advised to consult with DFO regarding fish and fish habitat related issues and to visit DFO's website at http://www.dfo-mpo.gc.ca/habitat/habitat-eng.htm.					Supplemental Information Report:		
	a	Potential effects on fish or fish habitat;	Y				Section 10.5.3		
	b	The area in square metres to be impacted;	Y				Section 10.5.3		

6.0 Water Use: Quality, Quantity, Predicted Environmental Impact and Proposed Mitigation Measures

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	If information is not available at the time of application, indicate when the information will be made available	NWB Concordance Assessment
	c	Measures to avoid sensitive periods and habitat areas (i.e., spawning beds, migration corridors);	Y				Section 10.5.3		
	d	Measures to avoid physical impacts on habitat;	Y				Section 10.5.2		
	e	Measures to maintain flows and fish passage;	Y				Section 10.4.4, 10.5.3		
	f	Measures to avoid sedimentation;	Y				Section 10.4.5.2		
	g	Measures to avoid spills;	Y				Section 10.4.5.1, 10.4.5.2, 10.5.1		
	h	Detailed habitat no-net-loss plan and site restoration plan;	Y				Section 10.5.3, Appendix 5		
Studies	**45**	Provide a list of studies, reports and plans relevant to the application that have been undertaken to date, including:	Y				Supplemental Information Report:		
	a	Options analysis;	Y				Section 4, Appendix 4, Section 10.10		
	b	Water management plan including water balance analysis;	Y				Section 8, Appendix 8		
	c	Fisheries assessment;	Y				Section 10.5.3		
	d	Construction plan and construction schedule for water works;	Y				Section 8, Appendix 8		
	e	Implementation schedule for construction of works.	Y				Section 8, Appendix 8		
	f	Construction quality assurance and quality control plans;	NA	to be completed and submitted to NWB 60 days prior to start of construction					
	g	Operation and maintenance plan;	Y				Section 8, Appendix 8		
	h	Preliminary abandonment and reclamation plans for existing and proposed facilities;	Y				Section 9, Appendix 9		
	i	Final abandonment and reclamation plans for facilities to be closed;	Y				Section 9, Appendix 9		
	j	Monitoring plans (See Section 8).	Y				Section 8, Appendix 8		

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Electoric document: D.1 - 0194097-0007 (Madrid WLA Supplemental Report).pdf

7.0 Waste Disposal: Quality, Quantity, Predicted Environmental Impact and Proposed Mitigation Measures

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	If information is not available at the time of application, indicate when the information will be made available	NWB Concordance Assessment
Waste Disposal	**1**	Provide a detailed description of all types of waste and all forms of waste disposal including: (see the NWB definition of Waste in the NWB *Guide 2: Terminology and Definitions*)					General Water License Application block 15 Supplemental Information Report:		
	a	Sewage	Y				Section 4.2.11.1, 4.3.11, 7.1 (Table 7.1-1)		
	b	Grey water	Y				Section 4.2.11.1, 4.3.11, 7.1 (Table 7.1-1)		
	c	Solid waste	Y				Section 4.2.11.2, 4.3.11, 7.1 (Table 7.1-1)		
	d	Sludge	Y				Section 4.2.11.1, 4.3.11, 7.1 (Table 7.1-1)		
	e	Hazardous waste including waste oil	Y				Section 4.2.11.1, 4.3.11, 7.1 (Table 7.1-1)		
	f	Contaminated soil, snow, ice and/or water	Y				Section 4.2.11.1, 4.3.11, 7.1 (Table 7.1-1)		
	g	Bulky items/ scap metal	Y				Section 7.1 (Table 7.1-1)		
	h	Mill or processing plant waste	Y				Section 4.2.7, 4.3.7, 7.1 (Table 7.1-1)		
	i	Mine water	Y				Section 4.2.7, 4.3.7, 7.1 (Table 7.1-1)		
	j	Discharge from dewatered areas	Y				Section 4.2.7, 4.3.7, 7.1 (Table 7.1-1)		
	k	Other: (describe)	NA	not applicable to the Program					
Waste Disposal: Quality and Quantity	**2**	For each type of waste, provide the composition, chemical characteristics and quantity generated. Also provide the location, rate, timing, frequency and duration of the deposit.	Y				Supplemental Information Report: Section 7.1 (Table 7.1-1)		
	3	For each type of waste, provide the proposed methods and processes for collecting, storing, treating and discharging the waste. Indicate the capacity of these facilities.	Y				Supplemental Information Report: Section 7.1 (Table 7.1-1)		
	4	Provide a description of any measures to minimize the production of wastes.	Y				Supplemental Information Report: Section 7.1 (Table 7.1-1)		
Identification	**5**	Indicate whether there are signs identifying any past or present wastewater disposal sites, solid waste disposal sites, or any other waste disposal sites presently in the project area.	NA	not applicable to the Program					
Modifications	**6**	Indicate whether any changes are planned for the wastewater, solid waste, or any other waste facilities. If applicable, see item 7 of this Section.	NA	not applicable to the Program					
Proposed waste facilities	**7**	For each proposed waste facility provide design plans. The designs shall consider the following:							
	a	Site photos, site map, or air photos of the site.	Y						
	b	Description of the existing condition of the site (see Section 5).	Y						

7.0 Waste Disposal: Quality, Quantity, Predicted Environmental Impact and Proposed Mitigation Measures

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	If information is not available at the time of application, indicate when the information will be made available	NWB Concordance Assessment
	c	A description of the types of waste entering the facility (if applicable, provide a description of the source, type, and quantity of the waste);	Y				Supplemental Information Report: Section 4, Appendix 4 and Section 7, Appendix 7, Section 8 and Appendix 8, Section 9 and Appendix 9		
	d	The concentration of waste entering the facility;	Y						
	e	The geochemical characterization of waste entering the facility, where applicable;	Y						
	f	Distance of the facility from watercourses and fish bearing waters.	Y						
	g	All sources of seepage encountered near watercourse and fish bearing waters as well as the volumes (m3/day) and direction of any seepage;	Y						
	h	Existing and proposed drainage modifications.	Y						
	i	Details of retaining structures.	Y						
	j	Level of treatment (primary, secondary or tertiary).	Y						
	k	By products of treatment which may require further treatment, characterization, handling and disposal.	NA	not applicable to the Program					
	l	Capacity and retention time of the facility;	NA	not applicable to the Program					
	m	Identification of final discharge point (last point of control).	Y						
	n	Method and type of discharge (seasonal, annual, continuous) including details of all decant, siphon mechanisms etc.	Y						
	o	Estimated rates for discharge.	Y						
	p	Restrictions on discharge.	Y						
	q	Discharge effluent criteria proposed;	Y						
	r	Receiving water quality objectives.	Y						
	s	Capacity of the receiving environment;	Y						
	t	Details regarding direction and path of wastewater flow from the area or infrastructure.	Y						
	u	Design drawings in plan and profile, drawn to scale, including all relevant dimensions.	Y						
	v	Details of design parameters including seismic design if applicable.	NA	not applicable to the Program					
	w	Start and completion dates for construction.	Y						
	x	Construction schedule and sequence taking into account any timing restrictions.	Y						
	y	Construction methods.	Y						
	z	Equipment to be used.	Y						
	aa	A description of the source, type, and composition of the material to be used in construction.	Y						
	bb	Construction monitoring plans.	Y						
	cc	Construction quality assurance and quality control measures.	Y						
	dd	Operation and maintenance plans.	Y						
	ee	Contingency plans.	Y						
	ff	Abandonment and restoration plans (see items 45-46 of Section 3).	Y						
	8	Final plans and drawings for construction must be stamped by a Professional Engineer licensed to practice in Nunavut. (See Section 7 of the NWB's *Guide 4: Completing and Submitting a Water Licence Application* for more information regarding design drawings).	Y				Supplemental Information Report: Section 4, Appendix 4		
	9	Provide an assessment of alternatives for any proposed tailings containment facility.	NA	not applicable to the Program					
	10	Provide a description of the general condition of any existing waste facilities and provide an explanation if it is unsatisfactory.	NA	not applicable to the Program					
Predicted Environmental Effects and Proposed mitigation measures	**11**	Provide detailed treatment plans for discharges from any tailings containment area, attenuation pond, reclaim pond, sewage disposal area, sumps or dewatered area. Water treatment plans should include estimates of treatment efficiency for each parameter of concern and a description of pH adjustment methods.	Y				Supplemental Information Report: Section 8.1 (Table 8.1-1), Appendix 8		

7.0 Waste Disposal: Quality, Quantity, Predicted Environmental Impact and Proposed Mitigation Measures

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	12	Clearly outline proposed discharge criteria, how the criteria were developed, standards to be applied, and how these criteria will be used to prevent ecological effects in the receiving environment.	Y				Supplemental Information Report: Section 8.1 (Table 8.1-1), Appendix 8		
	13	If waste is expected to infiltrate into the ground, provide a description of the sub-surface soil compositions and provide information on groundwater elevations for the project area. Also provide the proximity between the proposed waste disposal system and the groundwater elevation.	NA	not applicable to the Program					
	14	Provide detailed contingency plans for the treatment of turbid water during dewatering activities and/or increased suspended solids during any rewatering activities.	Y				Supplemental Information Report: Section 8.1 (Table 8.1-1), Appendix 8		
Operations and Maintenance	**15**	Provide operation and maintenance plans for any tailings containment areas.	Y				Supplemental Information Report: Section 8.1 (Table 8.1-1), Appendix 8		
	16	If the project includes sewage and/or solid waste disposal, provide an Operations and Maintenance Manual in accordance with the "Guidelines for the Preparation of an Operations and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories, 1996".	NA	not applicable to the Program					
Hazardous Materials	**17**	Provide a description of the type and quantities of drill additives, mill reagents, petroleum products, chemicals and/or hazardous materials on site. (MSDS sheets are not required to be submitted as part of the water licence application).	Y				Supplemental Information Report: Section 4.2.10 and 4.2.11; 4.3.10 and 4.3.11; 7.2		
	18	Provide details regarding the handling and storage of hazardous or potentially hazardous materials.	Y				Supplemental Information Report: Section 4.2.10 and 4.2.11; 4.3.10 and 4.3.11; Section 7 (Table 7.2-1)		
Emergency Response and Spill Contingency	**19**	Provide designs for the fuel tank farm facilities including a description of the nearest water bodies. Provide an evaluation of impacts and mitigation measures in case of a fuel spill.	Y				Supplemental Information Report: Section 8.1, 10.4.5.1, 10.4.5.2		
	20	Provide an Emergency Response and Spill Contingency Plan (ERSCP) that includes mechanisms and processes for addressing potential or actual failure of structures, response equipment and material storage, and programs for providing appropriate training to workers. The plan shall address all licensed facilities.	Y				Supplemental Information Report: Section 8.1 (Table 8.1-1)		
	21	Plan(s) shall address phases of the project including construction, operation, and care & maintenance.	Y				Supplemental Information Report: Section 8.1 (Table 8.1-1)		
	22	Provide an explanation of how the applicant will ensure project contractors meet the applicant's due diligence standards with respect to oil and hazardous material spill prevention, preparedness, response, and restoration.	NA	Established contracting procedures incorporate due dilegence to best management practices and regulatory requirements. Site orientation of all employees and constractors will be implemented					

7.0 Waste Disposal: Quality, Quantity, Predicted Environmental Impact and Proposed Mitigation Measures

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Studies	**23**	Provide a list of studies, reports and plans relevant to the application that have been undertaken to date including design and management decisions. Studies, reports and plans may include:					Supplemental Information Report:		
	a	Options analysis;	Y				Section 4, Appendix 4		
	b	Wastewater treatment assessment;	Y				Section 4 and 6		
	c	Geotechnical and geothermal assessment;	Y				Section 4		
	d	Snow drift assessment;	Y				Section 5		
	e	Weather data for purposes of design;	Y				Section 5		
	f	Wastewater management;	Y				Section 7 and 8.1 (Table 8.1-1)		
	g	Solid waste management;	Y				Section 8.1 (Table 8.1-1)		
	h	Contaminated soil and/or water management	Y				Section 8.1 (Table 8.1-1)		
	i	Quarry Management;	Y				Section 8.4 (Table 8.1-1)		
	j	Hazardous waste management;	Y				Section 8.1 (Table 8.1-1)		
	k	Operation and maintenance plan;	Y				Section 8.1 (Table 8.1-1)		
	l	Spill contingency and emergency response plans;	Y				Section 8.1 (Table 8.1-1)		
	m	Construction plan and construction schedule for waste management infrastructure;	Y				Section 4 and Section 8		
	n	Implementation schedule for construction of works;	Y				Section 4 and Section 8		
	o	Preliminary abandonment and reclamation plans for existing and proposed facilities;	Y				Section 9		
	p	Final abandonment and reclamation plans for facilities to be closed;	Y				Section 9		
	q	Monitoring plans (see Section 8);	Y				Section 8		

Notes: Report title: ERM Rescan. 2014. Madrid Advanced Exploration Program: Type B Water Licence Application Supplemental Information Report. Prepared for TMAC Resources Inc. by ERM Consultants Canada Ltd.: Vancouver, British Columbia.
Electoric document: D.1 - 0194097-0007 (Madrid WLA Supplemental Report).pdf

8.0 Monitoring

Section Title	Section No.	Information Requirement	Indicate whether Information Requirement is applicable by inserting ' Y ' or ' NA '	If 'NA' provide justification	Insert Title, Author and Date of Document where information is provided (see Notes below)	Insert electronic file name of document where information is provided (See Notes below)	Insert Section of document where information is provided	If information is not available at the time of application, indicate when the information will be made available	NWB Concordance Assessment
Monitoring	1	Provide a Monitoring Plan including a description of the methods, procedures, standards, and schedules proposed. Monitoring may be required for water use; effluent; surface and/or groundwater water quality, quantity, or flow; ground temperature; ground settlement; etc.	Y				Supplemental Information Report: Section 8.1 to 8.5 (Table 8.1-1)		
	2	Indicate who is responsible for sampling including that person's position, contact information and level of training.	Y				Supplemental Information Report: Section 8.1 to 8.5, Appendix 8		
	3	Indicate the name and contact information of the certified laboratory performing the analysis of samples.	Y				Supplemental Information Report: Section 8.1 to 8.5, Appendix 8		
	4	Provide an Inspection Plan including a description of the methods, procedures, standards, and schedules proposed. Inspections may be required for engineered facilities related to the management of water and waste as well as spills.	Y				Supplemental Information Report: Section 8.1 to 8.5, Appendix 8		
	5	Provide a Quality Assurance/ Quality Control (QA/QC) Plan that addresses both field sampling and laboratory analyses.	Y				Supplemental Information Report: Section 8.1 to 8.5 (Table 8.1-1), Appendix 8		
	6	Provide a summary table that details the monitoring plan. The table should include stations numbers, location, parameter(s) and frequency. Provide a map detailing the location of monitoring sites.	Y				Supplemental Information Report: Section 8.1 (Table 8.1-2)		

Notes: Report title: ERM Rescan. 2014. Madrid Advanced Exploration Program: Type B Water Licence Application Supplemental Information Report. Prepared for TMAC Resources Inc. by ERM Consultants Canada Ltd.: Vancouver, British Columbia.

Electoric document: D.1 - 0194097-0007 (Madrid WLA Supplemental Report).pdf

Appendix 3

(for Chapter 3, General Water Licence Application)

Proponent information:

- Corporate registration
- List of officers
- Financial details

95 Wellington Street West
Suite 1010
P.O. Box 44
Toronto, Ontario M5J 2N7
416-628-0216

January 10, 2014

Phyllis Beaulieu, Manager of Licensing
Nunavut Water Board
PO Box 119
Gjoa Haven, NU
X0B 1J0

Re: Authorized Representative for TMAC Resources Inc., Hope Bay Belt Licenses, Permits and Applications

Dear Phyllis,

I am pleased to advise you that for authorizations and applications associated with exploration and the development of mining operations and support facilities within the Hope Bay Belt, John Roberts, Vice President Environmental Affairs will serve as the authorized representative for TMAC Resources Inc. (TMAC).

If you have any questions regarding this application please contact me at the coordinates provided below.

Yours truly,



Catharine Farrow
Chief Executive Officer

Phone: 416-628-0126
Fax: 416-644-9337
e-mail : catharine.farrow@tmacresources.com

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À l'usage exclusif du ministère

Ministry of Government Services
Ontario

Ministère des Services gouvernementaux

Ontario Corporation Number
Numéro de la société en Ontario

2348005

CERTIFICATE
This is to certify that these articles are effective on

CERTIFICAT
Ceci certifie que les présents statuts entrent en vigueur le

MARCH 11 MARS, 2013

Director / Directrice
Business Corporations Act / Loi sur les sociétés par actions

ARTICLES OF AMENDMENT
STATUTS DE MODIFICATION

Form 3
Business Corporations Act

Formule 3
Loi sur les sociétés par actions

1. The name of the corporation is: (Set out in BLOCK CAPITAL LETTERS)
Dénomination sociale actuelle de la société (écrire en LETTRES MAJUSCULES SEULEMENT) :

TMAC RESOURCES INC.

2. The name of the corporation is changed to (if applicable): (Set out in BLOCK CAPITAL LETTERS)
Nouvelle dénomination sociale de la société (s'il y a lieu) (écrire en LETTRES MAJUSCULES SEULEMENT) :

N/A

3. Date of incorporation/amalgamation:
Date de la constitution ou de la fusion :

2012/10/30

(Year, Month, Day)
(année, mois, jour)

4. **Complete only if there is a change in the number of directors or the minimum / maximum number of directors.**
Il faut remplir cette partie seulement si le nombre d'administrateurs ou si le nombre minimal ou maximal d'administrateurs a changé.

Number of directors is/are: Nombre d'administrateurs :		minimum and maximum number of directors is/are: nombres minimum et maximum d'administrateurs :	
Number Nombre		minimum and maximum minimum et maximum	
	or ou		

5. The articles of the corporation are amended as follows:
Les statuts de la société sont modifiés de la façon suivante :

See pages 1A to and including 1N attached hereto and forming part of these Articles of Amendment.

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The Articles of the Corporation be and they are hereby amended by:

(a) providing that the issued and outstanding 1,000,000 common shares of the Corporation (the "**Common Shares**") be divided, on the basis of 12.6 Common Shares for each issued and outstanding Common Share, into 12,600,000 Common Shares;

(b) increasing the authorized capital of the Corporation by creating an unlimited number of non-voting common shares (the "**Non-Voting Common Shares**");

(c) declaring that the authorized capital of the Corporation, after giving effect to the foregoing, shall consist of an unlimited number of Common Shares and an unlimited number of Non-Voting Common Shares; and

(d) providing that the rights, privileges, restrictions and conditions attached to the Common Shares and Non-Voting Common Shares are as follows:

I. COMMON SHARES

The rights, privileges, restrictions and conditions of the Common Shares are as set out in this Part I and in Part III. Unless otherwise indicated, any reference to "**Section**" in this Part I refers to a section of this Part I.

1. Definitions

For purposes of this Part I, the following definitions shall apply:

1.1 "**business day**" means a day on which securities may be traded on the stock exchange on which the Common Shares are then listed or if such shares are not then listed, a day other than a Saturday, a Sunday or any other day on which the principal chartered banks located in Toronto, Ontario are not open for business;

1.2 "**Common Shares**" means the common shares in the share capital of the Corporation;

1.3 "**Corporation**" means TMAC Resources Inc;

1.4 "**Non-Voting Common Shares**" means the non-voting common shares in the share capital of the Corporation;

1.5 "**Offer**" means an offer to purchase Non-Voting Common Shares which must, by reason of applicable securities legislation or by-laws, regulations or policies of a stock exchange on which the Common Shares or Non-Voting Common Shares are listed, be made to each holder of Non-Voting Common Shares whose last address on the records of the Corporation is

in a province or territory of Canada to which the relevant requirement applies;

1.6 "**Offer Date**" means the date on which an Offer is made;

1.7 "**Redemption Date**" has the meaning given thereto in Section 5.4;

1.8 "**Redemption Period**" means the period of time commencing on the seventh business day after the Offer Date and terminating on the last date upon which holders of Non-Voting Common Shares may accept the Offer; and

1.9 "**Redemption Price**" means the value of the consideration offered under an Offer which, in the case of non cash consideration shall be determined solely by the board of directors of the Corporation, acting reasonably.

2. Voting Rights

The holders of Common Shares shall be entitled to notice of, to attend and to one vote per Common Share held at any meeting of the shareholders of the Corporation (other than meetings of a class or series of shares of the Corporation other than the Common Shares as such).

3. Dividends

The holders of Common Shares shall be entitled to receive dividends as and when declared by the board of directors of the Corporation on the Common Shares as a class, provided that no dividend may be declared in respect of, or any other benefit conferred upon the holders of, Common Shares unless concurrently therewith the same dividend per share in respect of, or the same benefit per share, is conferred upon the holders of, the Non-Voting Common Shares determined as if all Non-Voting Common Shares had been converted to Common Shares as of the date of determination.

4. Participation upon Liquidation, Dissolution or Winding Up

The holders of Common Shares and the holders of Non-Voting Common Shares shall be entitled, in the event of the liquidation, dissolution or winding up of the Corporation, whether voluntary or involuntary, or any other distribution of the assets of the Corporation among its shareholders for the purpose of winding-up its affairs, to share rateably in such assets of the Corporation as are available for distribution.

5. Redemptions

5.1 Subject to the provisions of this Section 5 and applicable law, if an Offer is made, each outstanding Common Share shall be redeemed by the Corporation at the Redemption Price per Common Share at the option of the holder as provided in Section 5.4. The redemption right provided for in this Section 5.1 may be exercised by notice in writing given to the Corporation during the Redemption Period accompanied by the share

certificate or certificates representing the Common Shares in respect of which the holder desires to exercise such right of redemption, and such notice shall be executed by the holder of the Common Shares registered on the books of the Corporation, or by his duly authorized attorney, and shall specify the number of Common Shares which the holder desires to have redeemed. The holder shall pay any governmental or other tax imposed on or in respect of such redemption. Upon receipt by the Corporation of such notice and share certificate or certificates, the Corporation shall issue or cause to be issued a cheque for the aggregate Redemption Price to be paid to such holder (less any tax required to be withheld) in accordance with Sections 5.2 and 5.4. If less than all of the Common Shares represented by any share certificate are to be redeemed, the holder shall be entitled to receive a new share certificate representing in the aggregate the number of Common Shares represented by the original share certificate which are not to be redeemed.

5.2 The redemption right provided for in Section 5.1 shall not come into effect if:

(a) one or more shareholders of the Corporation who did not make or act in concert with the person or persons making the Offer and who, in the aggregate, beneficially own, directly or indirectly, or exercise control or direction over, not less than 50% of the outstanding Non-Voting Common Shares, determine within five business days after the Offer Date that he or they will continue to so own or exercise control or direction over, in the aggregate, 50% or more of the outstanding Non-Voting Common Shares;

(b) contemporaneously with the Offer, an offer is made to the holders of Common Shares upon the same terms and conditions as those contained in the Offer, including the consideration to be paid to the holders of Non-Voting Common Shares and the offer is for the same percentage of Common Shares as the percentage of Non-Voting Common Shares sought to be acquired under the Offer, excluding in each case the number of shares then owned by the offeror;

(c) the board of directors of the Corporation determines within five business days after the Offer Date that the Offer is not bona fide or is made primarily for the purpose of causing the redemption right provided for in Section 5.1 to come into effect and not primarily for the purpose of acquiring Non-Voting Common Shares; or

(d) the Offer is not completed in accordance with its terms;

provided that:

(e) in the case of Section 5.2(a), within six business days after the Offer Date, a certificate signed by or on behalf of one or more shareholders of the Corporation is delivered to the Secretary of the Corporation confirming that: (A) such shareholders did not make or act in concert with the person or persons making the Offer; (B) such shareholders beneficially own, directly or indirectly, or exercise control or direction over in the aggregate not less than 50% of the outstanding Non-Voting Common Shares; and (C) such shareholders have determined that they will not accept the Offer and provided further that upon any variation of the Offer, including an increase in price, such shareholders of the Corporation shall be deemed not to have accepted the Offer as varied and the certificate delivered by or on behalf of them as described above shall be deemed to continue to apply and no further certificate need be filed for purposes of these share provisions unless and until one or more of such shareholders determine to accept the Offer as varied and the result of such acceptance would be to reduce the aggregate holdings of the remaining shareholders who delivered such certificate to less than 50% of the outstanding Non-Voting Common Shares in which case a certificate to that effect signed by or on behalf of such shareholders who determine to accept the Offer as varied shall be delivered to the Corporation forthwith after such determination and, in any event, not less than five business days prior to termination of the Redemption Period;

(f) in the case of Section 5.2(c), provided that the Corporation has appointed a transfer agent for the Common Shares, the Secretary of the Corporation delivers to the transfer agent for the Common Shares within six business days after the Offer Date a certified copy of a resolution of the board of directors of the Corporation determining that the Offer is not bona fide or is made primarily for the purpose of causing the redemption right provided for in Section 5.1 to come into effect and not primarily for the purpose of acquiring the Non-Voting Common Shares and stating the reason for such determination; and

(g) as soon as reasonably possible after the receipt of a certificate under Section 5.2(e) or a certified copy of a resolution under Section 5.2(f), the Corporation shall send to the holders of Common Shares notice of and a brief description of the effect of the determination under Section 5.2(a) or Section 5.2(c), as the case may be.

5.3 If the events described in Sections 5.2(a), (b) or (c) shall not have occurred within five business days after the Offer Date, or if any amended certificate as described in Section 5.2(e) shall have been delivered, the Corporation shall send as soon as reasonably possible to the holders of

Common Shares a notice containing a brief description of the rights of such holders hereunder.

5.4 The redemption of any Common Shares delivered to the Corporation for redemption pursuant to Section 5.1 shall be subject to the provisions of this Section 5.4 and the Corporation shall make all arrangements necessary or desirable to give effect to this Section 5.4. All Common Shares delivered for redemption pursuant to Section 5.1 shall be redeemed subject to completion of the Offer but no cheques representing the Redemption Price for the Common Shares so redeemed shall be delivered to the holders of such Common Shares unless and until the Offer is completed in accordance with its terms. Upon completion of the Offer (the "**Redemption Date**"), the Corporation shall deliver to the holders of such Common Shares payment representing the Redemption Price for the Common Shares so redeemed. If the Offer is not completed, the right provided in Section 5.1 shall not be effective and the Corporation shall return or issue and deliver to the holders entitled thereto share certificates representing Common Shares delivered to the Corporation pursuant to Section 5.1.

5.5 Any cheque representing payment of the Redemption Price not presented to the Corporation's bankers for payment, or otherwise not claimed within six years after the Redemption Date, shall be irrevocably forfeited to the Corporation.

5.6 From and after the Redemption Date, the Common Shares redeemed shall cease to be entitled to dividends, and the parties that were the holders thereof shall not be entitled to exercise any of the rights of shareholders in respect of such redeemed shares, unless payment of the Redemption Price shall not be duly made by the Corporation.

5.7 All Common Shares which are redeemed, in accordance with the rights, privileges, restrictions and conditions attaching to the Common Shares, shall, subject to applicable law, be deemed to be returned to the authorized but unissued capital of the Corporation.

6. Capital Reorganization

Neither the Non-Voting Common Shares nor the Common Shares shall be subdivided, consolidated, reclassified or otherwise changed unless, contemporaneously therewith, the shares of the other of such classes are subdivided, consolidated, reclassified or otherwise changed in the same proportion and in the same manner.

II. NON-VOTING COMMON SHARES

The rights, privileges, restrictions and conditions of the Non-Voting Common Shares are as set out in this Part II and in Part III. Unless otherwise indicated, any reference to "**Section**" in this Part II refers to a section of this Part II.

1. Definitions

For purposes of this Part II, the following definitions shall apply:

1.1 "**Act**" means the *Business Corporations Act* (Ontario), as now enacted;

1.2 "**affiliate**" has the meaning given thereto in the Act;

1.3 "**business day**" means a day on which securities may be traded on the stock exchange on which the Common Shares are then listed or if such shares are not then listed, a day other than a Saturday, a Sunday or any other day on which the principal chartered banks located in Toronto, Ontario are not open for business;

1.4 "**Closing Date**" has the meaning given thereto in the Transaction Agreement dated January 25, 2013 between the Corporation and Hope Bay Mining Ltd., as amended, restated or supplemented from time to time;

1.5 "**Common Shares**" means the common shares in the share capital of the Corporation;

1.6 "**Conversion Rights**" has the meaning given thereto in Section 7.1(b);

1.7 "**Conversion Time**" has the meaning given thereto in Section 7.4;

1.8 "**Corporation**" means TMAC Resources Inc.;

1.9 "**Non-Voting Common Shares**" means the non-voting common shares in the share capital of the Corporation;

1.10 "**Offer**" means an offer to purchase Common Shares which must, by reason of applicable securities legislation or by-laws, regulations or policies of a stock exchange on which the Common Shares are listed, be made to each holder of Common Shares whose last address on the records of the Corporation is in a province or territory of Canada to which the relevant requirement applies;

1.11 "**Offer Date**" means the date on which an Offer is made;

1.12 "**Redemption Date**" has the meaning given thereto in Section 5.4;

1.13 "**Redemption Period**" means the period of time commencing on the seventh business day after the Offer Date and terminating on the last date upon which holders of Common Shares may accept the Offer; and

1.14 "**Redemption Price**" means the value of the consideration offered under an Offer which, in the case of non cash consideration shall be determined solely by the board of directors of the Corporation, acting reasonably.

2. Voting Rights

2.1 The holders of Non-Voting Common Shares shall be entitled to receive notice of and to attend any meeting of the shareholders of the Corporation provided that, except as required by law, the holders of Non-Voting Common Shares shall not be entitled as such to vote at any meeting of the shareholders of the Corporation. The holders of the Non-Voting Common Shares shall be entitled to receive all informational documents and other communications:

(a) required to be sent to the holders of Common Shares by applicable law or by any stock exchange on which the Common Shares are listed; and

(b) voluntarily sent by the Corporation to the holders of Common Shares in connection with any meeting of shareholders of the Corporation.

2.2 Without limiting Section 2.1, the holders of Non-Voting Common Shares shall not be entitled as such to vote separately as a class upon, nor entitled to dissent in respect of, any proposal to amend the articles of the Corporation to:

(a) increase or decrease any maximum number of authorized shares of such class, or increase any maximum number of authorized shares of a class or series having rights or privileges equal or superior to the shares of such class;

(b) effect an exchange, reclassification or cancellation of the shares of such class; or

(c) create a new class or series of shares equal or superior to the shares of such class.

3. Dividends

The holders of Non-Voting Common Shares shall be entitled to receive dividends as and when declared by the board of directors of the Corporation on the Non-Voting Common Shares as a class, provided that no dividend may be declared in respect of, or any other benefit conferred upon the holders of, Non-Voting Common Shares unless concurrently therewith the same dividend per share in respect of, or the same benefit per share, is conferred upon the holders of, the Common Shares determined as if all Non-Voting Common Shares had been converted to Common Shares as of the date of determination.

4. Participation upon Liquidation, Dissolution or Winding Up

The holders of Non-Voting Common Shares and the holders of Common Shares shall

be entitled, in the event of the liquidation, dissolution or winding up of the Corporation, whether voluntary or involuntary, or any other distribution of the assets of the Corporation among its shareholders for the purpose of winding-up its affairs, to share rateably in such assets of the Corporation as are available for distribution.

5. Redemptions

5.1 Subject to the provisions of this Section 5 and applicable law, if an Offer is made, each outstanding Non-Voting Common Share shall be redeemed by the Corporation at the Redemption Price per Non-Voting Common Share at the option of the holder as provided in Section 5.4. The redemption right provided for in this Section 5.1 may be exercised by notice in writing given to the Corporation during the Redemption Period accompanied by the share certificate or certificates representing the Non-Voting Common Shares in respect of which the holder desires to exercise such right of redemption, and such notice shall be executed by the holder of the Non-Voting Common Shares registered on the books of the Corporation, or by his duly authorized attorney, and shall specify the number of Non-Voting Common Shares which the holder desires to have redeemed. The holder shall pay any governmental or other tax imposed on or in respect of such redemption. Upon receipt by the Corporation of such notice and share certificate or certificates, the Corporation shall issue or cause to be issued a cheque for the aggregate Redemption Price to be paid to such holder (less any tax required to be withheld) in accordance with Sections 5.2 and 5.4. If less than all of the Non-Voting Common Shares represented by any share certificate are to be redeemed, the holder shall be entitled to receive a new share certificate representing in the aggregate the number of Non-Voting Common Shares represented by the original share certificate which are not to be redeemed.

5.2 The redemption right provided for in Section 5.1 shall not come into effect if:

(a) one or more shareholders of the Corporation who did not make or act in concert with the person or persons making the Offer and who, in the aggregate, beneficially own, directly or indirectly, or exercise control or direction over, not less than 50% of the outstanding Common Shares, determine within five business days after the Offer Date that he or they will continue to so own or exercise control or direction over, in the aggregate, 50% or more of the outstanding Common Shares;

(b) contemporaneously with the Offer, an offer is made to the holders of Non-Voting Common Shares upon the same terms and conditions as those contained in the Offer, including the consideration to be paid to the holders of Common Shares and the offer is for the same percentage of Non-Voting Common Shares as

the percentage of Common Shares sought to be acquired under the Offer, excluding in each case the number of shares then owned by the offeror;

(c) the board of directors of the Corporation determines within five business days after the Offer Date that the Offer is not bona fide or is made primarily for the purpose of causing the redemption right provided for in Section 5.1 to come into effect and not primarily for the purpose of acquiring Common Shares; or

(d) the Offer is not completed in accordance with its terms;

provided that:

(e) in the case of Section 5.2(a), within six business days after the Offer Date, a certificate signed by or on behalf of one or more shareholders of the Corporation is delivered to the Secretary of the Corporation confirming that: (A) such shareholders did not make or act in concert with the person or persons making the Offer; (B) such shareholders beneficially own, directly or indirectly, or exercise control or direction over in the aggregate not less than 50% of the outstanding Common Shares; and (C) such shareholders have determined that they will not accept the Offer and provided further that upon any variation of the Offer, including an increase in price, such shareholders of the Corporation shall be deemed not to have accepted the Offer as varied and the certificate delivered by or on behalf of them as described above shall be deemed to continue to apply and no further certificate need be filed for purposes of these share provisions unless and until one or more of such shareholders determine to accept the Offer as varied and the result of such acceptance would be to reduce the aggregate holdings of the remaining shareholders who delivered such certificate to less than 50% of the outstanding Common Shares in which case a certificate to that effect signed by or on behalf of such shareholders who determine to accept the Offer as varied shall be delivered to the Corporation forthwith after such determination and, in any event, not less than five business days prior to termination of the Redemption Period;

(f) in the case of Section 5.2(c), provided that the Corporation has appointed a transfer agent for the Non-Voting Common Shares, the Secretary of the Corporation delivers to the transfer agent for the Non-Voting Common Shares within six business days after the Offer Date a certified copy of a resolution of the board of directors of the Corporation determining that the Offer is not bona fide or is made primarily for the purpose of causing the redemption right provided for in Section 5.1 to come into effect and not primarily for

the purpose of acquiring the Common Shares and stating the reason for such determination; and

(g) as soon as reasonably possible after the receipt of a certificate under Section 5.2(e) or a certified copy of a resolution under Section 5.2(f), the Corporation shall send to the holders of Non-Voting Common Shares notice of and a brief description of the effect of the determination under Section 5.2(a) or Section 5.2(c), as the case may be.

5.3 If the events described in Sections 5.2(a), (b) or (c) shall not have occurred within five business days after the Offer Date, or if any amended certificate as described in Section 5.2(e) shall have been delivered, the Corporation shall send as soon as reasonably possible to the holders of Non-Voting Common Shares a notice containing a brief description of the rights of such holders hereunder.

5.4 The redemption of any Non-Voting Common Shares delivered to the Corporation for redemption pursuant to Section 5.1 shall be subject to the provisions of this Section 5.4 and the Corporation shall make all arrangements necessary or desirable to give effect to this Section 5.4. All Non-Voting Common Shares delivered for redemption pursuant to Section 5.1 shall be redeemed subject to completion of the Offer but no cheques representing the Redemption Price for the Non-Voting Common Shares so redeemed shall be delivered to the holders of such Non-Voting Common Shares unless and until the Offer is completed in accordance with its terms. Upon completion of the Offer (the "**Redemption Date**"), the Corporation shall deliver to the holders of such Non-Voting Common Shares payment representing the Redemption Price for the Non-Voting Common Shares so redeemed. If the Offer is not completed, the right provided in Section 5.1 shall not be effective and the Corporation shall return or issue and deliver to the holders entitled thereto share certificates representing Non-Voting Common Shares delivered to the Corporation pursuant to Section 5.1.

5.5 Any cheque representing payment of the Redemption Price not presented to the Corporation's bankers for payment, or otherwise not claimed within six years after the Redemption Date, shall be irrevocably forfeited to the Corporation.

5.6 From and after the Redemption Date, the Non-Voting Common Shares redeemed shall cease to be entitled to dividends, and the parties that were the holders thereof shall not be entitled to exercise any of the rights of shareholders in respect of such redeemed shares, unless payment of the Redemption Price shall not be duly made by the Corporation.

5.7 All Non-Voting Common Shares which are redeemed, in accordance with

the rights, privileges, restrictions and conditions attaching to the Non-Voting Common Shares, shall, subject to applicable law, be deemed to be returned to the authorized but unissued capital of the Corporation.

6. Capital Reorganization

Neither the Common Shares nor the Non-Voting Common Shares shall be subdivided, consolidated, reclassified or otherwise changed unless, contemporaneously therewith, the shares of the other of such classes are subdivided, consolidated, reclassified or otherwise changed in the same proportion and in the same manner.

7. Conversion Rights

7.1 Each Non-Voting Common Share shall be convertible into one Common Share without the payment of additional consideration as follows:

(a) at the election of the holder thereof at any time and from time to time prior to the date that is 24 months following the Closing Date provided that the holder thereof and its affiliates collectively hold less than 49.9% of the Common Shares on a non-diluted basis (and will hold 49.9% or less of the Common Shares on a non-diluted basis upon such conversion), further provided that this limitation will not apply if the redemption right provided for in Section 5.1 comes into effect and after such time the holder may convert any or all Non-Voting Common Shares held into Common Shares without restriction; and

(b) automatically on the date that is 24 months following the Closing Date (collectively, the "**Conversion Rights**").

7.2 In the event of a notice of redemption of any Non-Voting Common Shares pursuant to Section 5.1, the Conversion Rights of the shares designated for redemption shall terminate at the close of business on the Redemption Date, unless the Redemption Price is not fully paid on such Redemption Date, in which case the Conversion Rights for such shares shall continue until such price is paid in full. In the event of a liquidation, dissolution or winding up of the Corporation, the Conversion Rights shall terminate at the close of business on the last full day preceding the date fixed for the payment of any such amounts distributable on such event to the holders of Common Shares and Non-Voting Common Shares.

7.3 No fractional Common Shares shall be issued upon conversion of Non-Voting Common Shares. In lieu of any fractional shares to which the holder would otherwise be entitled, the Corporation shall pay cash equal to such fraction multiplied by the fair market value of a Common Share as determined in good faith by the board of directors of the Corporation. Whether or not fractional shares would be issuable upon such conversion shall be determined on the basis of the total number of Non-Voting

Common Shares the holder is at the time converting into Common Shares and the aggregate number of Common Shares issuable upon such conversion.

7.4 In order for a holder of Non-Voting Common Shares to voluntarily convert Non-Voting Common Shares into Common Shares, such holder shall surrender the certificate or certificates for such Non-Voting Common Shares (or, if such registered holder alleges that such certificate has been lost, stolen or destroyed, a lost certificate affidavit and agreement reasonably acceptable to the Corporation to indemnify the Corporation against any claim that may be made against the Corporation on account of the alleged loss, theft or destruction of such certificate), at the office of the transfer agent for the Non-Voting Common Shares (or at the principal office of the Corporation if the Corporation serves as its own transfer agent), together with written notice that such holder elects to convert all or any number of the Non-Voting Common Shares represented by such certificate or certificates in accordance with Section 7.1(a). Such notice shall state such holder's name or the names of the nominees in which such holder wishes the certificate or certificates for Common Shares to be issued. If required by the Corporation, certificates surrendered for conversion shall be endorsed or accompanied by a written instrument or instruments of transfer, in form satisfactory to the Corporation, duly executed by the registered holder or his, her or its attorney duly authorized in writing. The close of business on the date of receipt by the transfer agent for the Non-Voting Common Shares (or by the Corporation if the Corporation serves as its own transfer agent) of such certificates (or lost certificate affidavit and agreement) and notice shall be the time of conversion (the "**Conversion Time**"), and the Common Shares issuable upon conversion of the shares represented by such certificates shall be deemed to be outstanding of record as of such date. The Corporation shall, as soon as practicable after the Conversion Time, (i) issue and deliver to such holder of Non-Voting Common Shares, or to his, her or its nominees, a certificate or certificates for the number of full Common Shares issuable upon such conversion in accordance with the provisions hereof and a certificate for the number (if any) of the Non-Voting Common Shares represented by the surrendered certificate that were not converted into Common Shares, and (ii) pay in cash such amount as provided in Section 7.3 in lieu of any fraction of a Common Share otherwise issuable upon such conversion.

7.5 The Corporation shall at all times when the Non-Voting Common Shares shall be outstanding, reserve and keep available out of its authorized but unissued share capital, for the purpose of effecting the conversion of the Non-Voting Common Shares, such number of its duly authorized Common Shares as shall from time to time be sufficient to effect the conversion of all outstanding Non-Voting Common Shares; and if at any time the number of authorized but unissued shares of Common Shares shall not be

sufficient to effect the conversion of all then outstanding Non-Voting Common Shares, the Corporation shall take such corporate action as may be necessary to increase its authorized but unissued Common Shares to such number of shares as shall be sufficient for such purposes, including, without limitation, engaging in best efforts to obtain the requisite shareholder approval of any necessary amendment to the articles of the Corporation.

7.6 All Non-Voting Common Shares which shall have been surrendered for conversion as herein provided shall no longer be deemed to be outstanding and all rights with respect to such shares shall immediately cease and terminate at the Conversion Time, except only the right of the holders thereof to receive Common Shares in exchange therefor, to receive payment in lieu of any fraction of a share otherwise issuable upon such conversion as provided in Section 7.3 and to receive payment of any dividends declared but unpaid thereon.

7.7 If there shall occur any reorganization, recapitalization, reclassification, consolidation or merger involving the Corporation in which the Common Shares (but not the Non-Voting Common Shares) are converted into or exchanged for securities, cash or other property (for greater certainty, other than a transaction covered by Section 6), then, following any such reorganization, recapitalization, reclassification, consolidation or merger, each Non-Voting Common Share shall thereafter be convertible in lieu of the Common Share into which it was convertible prior to such event into the kind and amount of securities, cash or other property which a holder of a Common Share issuable upon conversion of such Non-Voting Common Share immediately prior to such reorganization, recapitalization, reclassification, consolidation or merger would have been entitled to receive pursuant to such transaction; and, in such case, appropriate adjustment (as determined in good faith by the board of directors of the Corporation) shall be made in the application of the provisions in this Section 7 with respect to the rights and interests thereafter of the holders of the Non-Voting Common Shares, to the end that the provisions set forth in this Section 7 shall thereafter be applicable, as nearly as reasonably may be possible, in relation to any securities or other property thereafter deliverable upon the conversion of the Non-Voting Common Shares.

III. ADDITIONAL TERMS

In addition to the rights, privileges, restrictions and conditions of the common shares (the "**Common Shares**") in the share capital of TMAC Resources Inc. (the "**Corporation**") and of the non-voting common shares (the "**Non-Voting Common Shares**") in the share capital of the Corporation respectively set out in Part I and Part II, the rights, privileges, restrictions and conditions of the Common Shares and the Non-Voting Common Shares shall include those as set out in this Part III.

1.1 A holder of Common Shares or of Non-Voting Common Shares may require the Corporation to acquire some or all of the Common Shares or Non-Voting Common Shares held by such holder in order to satisfy a liability owing by the holder to the Corporation under an indemnity or otherwise.

1.2 The value of the Common Shares and the Non-Voting Common Shares to be transferred to the Corporation shall be 75% of the market price of the Common Shares as of the date of the Acquisition Notice (as defined below), unless otherwise agreed in writing between the Corporation and the holder. The market price for these purposes is the "market price" determined pursuant to section 1.3 of Ontario Securities Commission Rule 62-504 or any successor provision.

1.3 The right provided for in this Part III may be exercised by notice (the "**Acquisition Notice**") in writing given to the Corporation accompanied by the share certificate or certificates representing the Common Shares and Non-Voting Common Shares in respect of which the holder desires to exercise such right, and such Acquisition Notice shall be executed by the holder of the Common Shares and Non-Voting Common Shares, as the case may be, registered on the books of the Corporation, or by his duly authorized attorney, and shall specify the number of Common Shares and Non-Voting Common Shares which the holder desires to have the Corporation acquire. The holder shall pay any governmental or other tax imposed on or in respect of such transfer. Upon receipt by the Corporation of such Acquisition Notice and share certificate or certificates, the Corporation shall register such transfer on the books of the Corporation and deliver to the holder a full and final release in respect of the amount of the applicable liability that has been satisfied by such transfer. If less than all of the Common Shares or Non-Voting Common Shares represented by any share certificate are to be acquired, the holder shall be entitled to receive a new share certificate representing in the aggregate the number of Common Shares or Non-Voting Common Shares represented by the original share certificate which are not to be acquired.

1.4 From and after the date of receipt of the Acquisition Notice, the Common Shares and Non-Voting Common Shares acquired by the Corporation shall cease to be entitled to dividends, and the parties that were the holders thereof shall not be entitled to exercise any of the rights of shareholders in respect of such acquired shares.

1.5 All Common Shares and Non-Voting Common Shares which are redeemed, in accordance with the rights, privileges, restrictions and conditions attaching to the Common Shares and Non-Voting Common Shares, shall, subject to applicable law, be deemed to be returned to the authorized but unissued capital of the Corporation.

6. The amendment has been duly authorized as required by sections 168 and 170 (as applicable) of the *Business Corporations Act*.
La modification a été dûment autorisée conformément aux articles 168 et 170 (selon le cas) de la *Loi sur les sociétés par actions*.

7. The resolution authorizing the amendment was approved by the shareholders/directors (as applicable) of the corporation on
Les actionnaires ou les administrateurs (selon le cas) de la société ont approuvé la résolution autorisant la modification le

2013/03/08

(Year, Month, Day)
(année, mois, jour)

These articles are signed in duplicate.
Les présents statuts sont signés en double exemplaire.

TMAC RESOURCES INC.

(Print name of corporation from Article 1 on page 1)
(Veuillez écrir le nom de la société de l'article un à la page une).

By/
Par :

(Signature)
(Signature)

Gordon Morrison

President and Chief Technology Officer

(Description of Office)
(Fonction)

CORPORATE GOVERNANCE INFORMATION

Officers Contact Information

1. Catharine Farrow, Chief Executive Officer
   372 Bay Street Suite 901, Toronto, ON M5H 2W9
   Office phone: 416-628-0216

2. Ron Gagel, Executive VP & Chief Financial Officer
   372 Bay Street Suite 901, Toronto, ON M5H 2W9
   Office phone: 416-628-0216

3. Grant Goddard, Chief Operating Officer
   372 Bay Street Suite 901, Toronto, ON M5H 2W9
   Office phone: 416-628-0216

4. Jay Goldman, Secretary
   2100 Scotia Plaza, 40 King Street West, Toronto, ON M5H 3C2
   Office phone: 416-860-6474

5. Dave King, VP Exploration & Geoscience
   372 Bay Street Suite 901, Toronto, ON M5H 2W9
   Office phone: 416-628-0216

6. Terry MacGibbon, Executive Chairman
   372 Bay Street Suite 901, Toronto, ON M5H 2W9
   Office phone: 416-628-0216

7. Julia Micks, Executive VP Human Resources
   372 Bay Street Suite 901, Toronto, ON M5H 2W9
   Office phone: 416-628-0216

8. Gord Morrison, President & Chief Technology Officer
   372 Bay Street Suite 901, Toronto, ON M5H 2W9
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9. Maarten Theunissen, VP Finance
   372 Bay Street Suite 901, Toronto, ON M5H 2W9
   Office phone: 416-628-0216



TMAC Resources Inc.

Audited Financial Statements
For the period from October 30, 2012, date of incorporation, to December 31, 2013
(Expressed in Canadian dollars, except where otherwise indicated)

MANAGEMENT'S RESPONSIBILITY FOR FINANCIAL REPORTING

Management acknowledges responsibility for the preparation and presentation of financial statements of TMAC Resources Inc. (the "**Company**") which have been prepared in accordance with International Financial Reporting Standards as issued by the International Accounting Standards Board. The financial statements reflect management's best estimates and judgments based on currently available information and for the choice of accounting principles and methods that are appropriate to the Company's circumstances.

Management has developed and maintains a system of internal controls in order to ensure, on a reasonable and cost effective basis, the reliability of its financial information.

The Board of Directors is responsible for reviewing and approving the financial statements together with other financial information of the Company and for ensuring that management fulfills its financial reporting responsibilities. The Audit Committee, whose members are independent directors of the Company, assists the Board of Directors in fulfilling this responsibility. The Audit Committee meets with management and the external auditors periodically. The Audit Committee reviews the internal controls over the financial reporting process, the financial statements and the auditors' report. The Audit Committee reports its findings to the Board of Directors for its consideration in approving the financial statements together with other financial information of the Company for issuance to shareholders. The Audit Committee also has the responsibility of engaging the external auditors.

The financial statements have been audited by KPMG LLP. Their report outlines the scope of their examination and opinion on the financial statements.

Management recognizes its responsibility for conducting the Company's affairs in compliance with established financial standards, and applicable laws and regulations, and for maintaining proper standards of conduct for its activities.





Catharine Farrow
Chief Executive Officer
Officer

Ronald P. Gagel
Executive Vice President and Chief Financial

April 28, 2014
Toronto, Canada

KPMG LLP
Chartered Accountants
Bay Adelaide Centre
333 Bay Street Suite 4600
Toronto ON M5H 2S5

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INDEPENDENT AUDITORS' REPORT

To the Shareholders of TMAC Resources Inc.

We have audited the accompanying financial statements of TMAC Resources Inc., which comprise the statement of financial position as at December 31, 2013, the statements of profit or loss, changes in shareholders' equity and cash flows for the period from October 30, 2012, date of incorporation, to December 31, 2013, and notes, comprising a summary of significant accounting policies and other explanatory information.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with International Financial Reporting Standards as issued by the International Accounting Standards Board, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditors' Responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with Canadian generally accepted auditing standards. Those standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on our judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, we consider internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

KPMG LLP is a Canadian limited liability partnership and a member firm of the KPMG network of independent member firms affiliated with KPMG International Cooperative ("KPMG International"), a Swiss entity.
KPMG Canada provides services to KPMG LLP.

Opinion

In our opinion, the financial statements present fairly, in all material respects, the financial position of TMAC Resources Inc. as at December 31, 2013, and its financial performance and its cash flows for the period from October 30, 2012, date of incorporation, to December 31, 2013 in accordance with International Financial Reporting Standards as issued by the International Accounting Standards Board.

KPMG LLP

Chartered Professional Accountants, Licensed Public Accountants
April 28, 2014
Toronto, Canada

STATEMENT OF FINANCIAL POSITION

As at December 31, 2013
(Expressed in Canadian dollars)

	Notes	As at December 31, 2013 $000s
Assets		
Current assets		
Cash and cash equivalents		17,837
Amounts receivable	4	406
Consumables, materials and supplies	5	7,097
Prepaid expenses		850
		26,190
Non-current assets		
Property, plant and equipment	6	483,696
Goodwill	7	80,600
Other	8	2,798
		567,094
Total assets		**593,284**
Liabilities		
Current liabilities		
Accounts payable and accrued liabilities	9	1,803
Newmont Loan	10	14,369
Other liabilities	11	-
		16,172
Non-current liabilities		
Provision for environmental rehabilitation	12	16,681
Deferred tax liabilities	13	80,300
		96,981
Total liabilities		**113,153**
Equity		
Share capital	14	482,788
Reserves	14	496
Accumulated deficit		(3,153)
		480,131
Total equity and liabilities		**593,284**

Commitments and contingencies (note 20)
Subsequent events (note 21)

The accompanying notes form an integral part of these financial statements.

Approved on behalf of the board of directors



A. Terrence MacGibbon
Executive Chairman



Andrew P. Adams
Director

STATEMENT OF PROFIT OR LOSS

For the period from October 30, 2012, date of incorporation, to December 31, 2013
(Expressed in Canadian dollars)

	Notes	Period ended December 31, 2013 $000s
General and administrative		
Salaries and wages		1,220
Professional fees and consulting		591
Travel		155
Investor relations		33
Office, regulatory and general		130
Loss before the following		**2,129**
Finance income	**15**	(170)
Finance expense	**15**	381
Foreign exchange loss		1
Business development expenses	**3**	1,176
Loss before income taxes for the period		**3,517**
Deferred income tax expense	**13**	(364)
Net loss and comprehensive loss for the period		**3,153**
Net loss per share	**14(d)**	
Basic		$0.04
Diluted		$0.04
Weighted average number of shares (thousands)		
Basic and diluted		82,519

The accompanying notes form an integral part of these financial statements.

STATEMENT OF CHANGES IN SHAREHOLDERS' EQUITY

For the period from October 30, 2102, date of incorporation, to December 31, 2013
(Expressed in Canadian dollars)

	Notes	Shares #000s	Share Capital $000s	Reserves $000s	Deficit $000s	Total $000s
Balance as at October 30, 2012		**-**	**-**	**-**	**-**	**-**
Private placement and share split	**14**	12,600	-	-	-	-
Issued on purchase of Hope Bay	**3**	57,400	450,000	-	-	450,000
Initial Equity Financing	**14**	11,497	32,788	-	-	32,788
Initial Equity Financing Rights	**14**	1,022	-	-	-	-
Equity component of Newmont Loan, net of tax	**10**	-	-	496	-	496
Net loss for the period		-	-	-	(3,153)	(3,153)
Balance as at December 31, 2013		**82,519**	**482,788**	**496**	**(3,153)**	**480,131**

The accompanying notes form an integral part of these financial statements.

STATEMENT OF CASH FLOWS

For the period from October 30, 2012, date of incorporation, to December 31, 2013
(Expressed in Canadian dollars)

	Notes	Period ended December 31, 2013 $000s
Net loss for the period		**(3,153)**
Operating activities		
Adjusted for:		
Finance income	**15**	(170)
Finance expense	**15**	381
Unrealized foreign exchange loss		1
Deferred tax expense	**13**	(364)
Increase (decrease) in non-cash working capital:		
Amounts receivable		(406)
Prepaid expenses		(211)
Trade and other payables		103
Operating cash flows before interest and tax		**(3,819)**
Cash tax paid		-
Cash interest paid		(32)
Cash flows from operating activities		**(3,851)**
Investing activities		
Additions to property, plant and equipment	**6**	(26,150)
Interest received		170
Cash flows used in investing activities		**(25,980)**
Financing activities		
Private placement, net of issue costs	**14(b)**	32,669
Newmont Loan	**10**	15,000
Cash flows from financing activities		**47,669**
Effects of exchange rate changes on cash and cash equivalents		(1)
Net increase in cash and cash equivalents for the period		**17,837**
Cash and cash equivalents at the beginning of the period		-
Cash and cash equivalents at the end of the period		**17,837**

The accompanying notes form an integral part of these financial statements.

1. NATURE OF OPERATIONS AND GOING CONCERN

TMAC Resources Inc. ("**TMAC**" or the "**Company**") was incorporated on October 30, 2012, in the Province of Ontario, Canada, and is involved in the exploration, evaluation and development of the Hope Bay mineral property in the Kitikmeot Region of Nunavut, Canada ("**Hope Bay**") (note 3). TMAC's registered address is 40 King Street West, Suite 2100, Toronto, Ontario, M5H 3C2. These financial statements are for the fourteen month period from October 30, 2012, date of incorporation, to December 31, 2013.

TMAC's efforts are devoted to the exploration, evaluation and development of Hope Bay. The recoverability of the amount paid for the acquisition of, and investment in, Hope Bay is dependent upon the discovery of economically recoverable reserves and resources, the preservation of the Company's interest in the underlying mineral licences and mining lease agreements, the ability to obtain necessary financing to complete the exploration, evaluation and development of Hope Bay and the attainment of profitable operations thereat or, alternatively, the disposal of whole or part of Hope Bay or TMAC's interests therein on an advantageous basis.

For the fourteen month period ended December 31, 2013, the Company reported a loss and deficit of $3,153,000. As at December 31, 2013, TMAC did not have sufficient funds available, from existing cash on hand, to maintain its mineral investments, meet its exploration and evaluation and administrative costs and repay its financial obligations for at least one year; however, subsequent to year end, the Company completed a private placement (the "**Second Equity Financing**") on April 28, 2014 (note 21) and raised sufficient funds to maintain TMAC's current business plans and repay its financial obligations for at least one year. Although the Company has been successful in raising funds to date, as evidenced by the financings in March 2013 and April 2014, there can be no assurance that adequate funding will be available in the future or available under terms favourable to the Company to develop for production Hope Bay. These financial statements have been prepared on the going concern basis. Accordingly, they do not give effect to adjustments that would be necessary should the Company be unable to continue as a going concern and, therefore, be required to realize its assets and liquidate its liabilities and commitments in other than the normal course of business at amounts different from those in these financial statements.

2. BASIS OF PRESENTATION AND SIGNIFICANT ACCOUNTING POLICIES

(a) Statement of compliance

The financial statements have been prepared in accordance with International Financial Reporting Standards ("**IFRS**") as issued by the International Accounting Standards Board ("**IASB**").

The board of directors (the "**Board**") approved these financial statements on April 28, 2014.

(b) Basis of presentation

The financial statements have been prepared on the historical cost basis, except for the financial instruments that are measured at fair value, as explained in the accounting policies below. Historical cost is generally based on the fair value of the consideration given in exchange for assets.

(c) Functional and presentation currency and foreign currency transactions

The financial statements are presented in Canadian dollars. The functional currency of TMAC is the Canadian dollar.

Transactions denominated in a foreign currency have been translated into Canadian dollars at exchange rates on the date of the transaction. Monetary assets and liabilities denominated in a foreign currency at the period end date are translated to the functional currency at the rate of exchange at that date. Any conversion differences are recorded as exchange gains or losses in the Statement of Profit or Loss.

(d) Measurement uncertainty - critical accounting judgments and estimation uncertainties

The preparation of financial statements in conformity with IFRS requires management to make judgments, estimates and assumptions that affect the amounts reported in the financial statements and related notes. These judgments, estimates and assumptions are based on management's experience and knowledge of the relevant facts and circumstances. Actual results may differ from those estimates. Information about areas of judgment and key sources of uncertainty and estimation is contained in the description of the accounting policies and/or the notes to the financial statements.

Judgments, estimates and underlying assumptions are reviewed on an ongoing basis. Revisions to accounting estimates are recognized in the period in which the estimates are revised.

The key areas where judgments, estimates and assumptions have been made in the reporting period or that have a significant risk of causing a material adjustment to the carrying amounts of assets and liabilities within the next financial year are summarized below.

(i) Estimated reserves and resources

Reserves and resources are estimates of the amount of metal that can be extracted from the Company's properties, considering both economic and legal factors. Estimating the quantity and/or grade of reserves and resources requires the analysis of drilling samples and other geological data. Calculating reserve and resource estimates requires decisions on assumptions about geological, technical and economic factors, including quantities, grades, production techniques, recovery rates, production costs, transportation costs, commodity demand, commodity prices and foreign exchange rates.

Estimates of reserves and resources may change from period to period as the economic assumptions used to estimate reserves and resources change from period to period, and as a result of additional geological data generated during the course of operations. Changes in reported reserves and resources may affect TMAC's financial position in a number of ways, including the following:

- Asset carrying values may be affected due to changes in estimated future cash flows; and,
- Prospective depreciation charges in the Statement of Profit and Loss may change when such charges are determined by the unit-of-production basis, or when the useful lives of assets change.

(ii) Determination of useful lives of assets for depreciation purposes

Significant judgment is involved in the determination of useful life and residual values for long-lived assets that drive the calculation of depreciation charges. Changes in the judgment of useful lives and residual values may impact the depreciation calculations.

(iii) Impairment of property, plant and equipment

Judgment is involved in assessing whether there are any indications that an asset or cash generating unit ("**CGU**") may be impaired. This assessment is made based on an analysis of, amongst other factors, changes in the market or business environment, events that have transpired that have impacted the asset or CGU and information from internal reporting.

For the purpose of determining the recoverable amount of an asset or CGU, if indicators of impairment exist, operating results and net cash flow forecasts are determined by estimating the expected future revenues and costs, including the future cash costs of production, capital expenditures, site closure and environmental rehabilitation. These include net cash flows expected to be realized from the extraction, processing and sale of mineral resources that do not currently qualify for inclusion in proven and probable ore reserves when there is a high degree of confidence in the economic extraction of such non-reserve material. This expectation is usually based on preliminary drilling and sampling of areas of mineralization that are contiguous with existing reserves and resources.

Judgment is also required in estimating the discount rate applied and future commodity prices used for impairment testing. The long-term commodity prices are derived from forward prices and analysts' commodity price forecasts. These assessments often differ from current price levels and are updated periodically.

Impairment testing is done at the CGU level. TMAC expects to have multiple possible mining areas and management must exercise judgment in determining what constitutes a CGU and the degree of aggregation of various assets. These factors impact the impairment analysis performed as the results of the impairment analysis might differ based on the composition of the various CGU.

(iv) Fair value of assets and liabilities acquired in business combinations

In a business combination the identifiable assets and liabilities are measured at fair value on the date of acquisition. The determination of the fair value of the assets and liabilities is based, to a considerable extent, on management's judgments and estimates, as of the acquisition date, of the amount of mineral reserves and resources acquired, the exploration potential for areas with no identified mineral reserves and resources, future commodity prices, future operating costs and capital expenditure requirements and discount rates. Any excess of acquisition cost over the fair value of the identifiable net assets is recognized as goodwill.

(v) Determining if an acquisition is a business

A business combination is defined as an acquisition of assets and liabilities that constitute a business. A business consists of inputs, including non-current assets, and processes, including operational processes, that when applied to those inputs have the ability to create outputs that provide a return to the Company and its shareholders. When acquiring a set of activities or assets in the exploration and development stage, which may not have outputs, judgment is required to consider other factors to determine whether the set of activities or assets is a business. Those factors include, but are not limited to, whether the set of activities or assets:

- Has begun planned principal activities;
- Has employees, intellectual property and other inputs and processes that could be applied to those inputs;
- Is pursuing a plan to produce outputs; and,
- Will be able to obtain access to customers that will purchase the outputs.

Not all of the above factors need to be present for a particular integrated set of activities or assets in the exploration and development stage to qualify as a business.

(vi) Environmental rehabilitation costs

Environmental rehabilitation obligation provisions represent management's best estimate of the present value of the future costs to close and rehabilitate the mine site. Significant estimates and assumptions are made in determining the amount of future environmental rehabilitation costs. These estimates and assumptions deal with uncertainties such as: requirements of the relevant legal and regulatory framework; the magnitude of possible contamination; determination of the appropriate discount rate; and, the timing, extent and costs of required mine closure and environmental rehabilitation activities. These uncertainties may result in future actual expenditures that differ from the amounts currently provided. Management assesses the provision for environmental rehabilitation on an annual basis or when new information becomes available.

(vii) Taxation

The provision for income taxes and composition of income tax assets and liabilities requires management's judgment as to the types of arrangements considered to be a tax on income in contrast to an operating cost. The application of income tax legislation also requires judgments in order to interpret the various legislations and apply those interpretations to the Company's transactions.

Management judgments and estimates are required in assessing whether deferred income tax assets and liabilities are recognized in the Statement of Financial Position. Judgments are made as to whether future taxable profits will be available in order to recognize certain deferred income tax assets. Assumptions about the generation of future taxable profits depend on management's estimates of future cash flows resulting from estimates of future production and sales volumes, commodity prices, reserves and resources, operating costs and other capital management transactions. These judgments, estimates and assumptions are subject to risks and uncertainties and, therefore, there is a possibility that changes in circumstances will alter expectations, which may impact the amount of deferred income tax assets and liabilities recognized in the Statement of Financial Position and the benefit of other tax losses and temporary differences not yet recognized.

There are a number of factors that can significantly impact TMAC's effective tax rate including the geographic distribution of income, varying rates in different jurisdictions within Canada, the non-recognition of deferred income tax assets, mining allowance, foreign currency exchange rate movements, changes in tax laws and the impact of specific transactions and assessments. Due to the number of factors that can potentially impact the effective tax rate and the sensitivity of the tax provision to these factors, it is expected that TMAC's effective tax rate will fluctuate in future periods.

(viii) Share-based payments

The fair value of shared-based payments is calculated using an appropriate option pricing model. The main assumptions used in the model include the estimated life of the option, the expected volatility of the Company's share price (using historical volatility of similar publicly traded companies as a reference), the expected dividends, the expected forfeiture rate and the risk-free rate of interest. The resulting value calculated is not necessarily the value that the holder of the option could receive in an arm's length transaction, given that there is no market for the options and they are not transferrable.

(ix) Functional currency

Judgment is required to determine the functional currency of an entity. These judgments are continuously evaluated and are based on management's experience and knowledge of the relevant facts and circumstances.

(x) Compound financial instruments

The fair value of the liability component of convertible debt is determined using management's best estimate of what the interest of a similar loan without a conversion option would be.

(xi) Contingencies

Contingencies can be either possible assets or possible liabilities arising from past events which, by their nature, will only be resolved when one or more future events not wholly within the control of the Company occur or fail to occur. The assessment of such contingencies inherently involves the exercise of significant judgment and estimates of the outcome of future events. In assessing loss contingencies related to legal proceedings that are pending against TMAC or unasserted claims that may result in such proceedings, or regulatory or government actions that may negatively impact TMAC's business or operations, the Company and its legal counsel evaluate the perceived merits of any legal proceedings or unasserted claims or actions as well as the perceived merits of the nature and amount of relief sought or expected to be sought, when determining the amount, if any, to recognize as a provision or on assessing the impact on the carrying value of assets. Contingent assets are not recognized in the financial statements.

(e) Business combinations

Business combinations are accounted for by applying the acquisition method of accounting, whereby the identifiable assets and liabilities are recognized and measured at their fair value on the date of acquisition. Mineral rights that can be reliably valued are recognized in the assessment of fair values on acquisition. Goodwill is recognized either when the purchase price exceeds the fair value of the identifiable net assets or when there are deferred income taxes arising on the business combination. When certain information relating to the fair value is not finalized at the time of reporting, provisional fair values allocated at a period end date are finalized as soon as the relevant information is available, within a period not to exceed twelve months from the acquisition date with retroactive restatement of the impact of adjustments to those provisional fair values effective as at the acquisition date. Costs related to business combination acquisitions are expensed as incurred.

(f) Cash and cash equivalents

Cash and cash equivalents consist of cash held with major Canadian financial institutions in the form of cash and guaranteed investment certificates with investment terms that are less than 90 days at the time of acquisition

(g) Consumables, materials and supplies and other assets

Consumables and materials and supplies inventories are valued on a weighted average basis and measured at the lower of acquisition cost and net realizable value.

Other assets is comprised of gold ore on surface and is valued at the lower of production cost and net realizable value. Net realizable value is the estimated selling price in the ordinary course of business, less the estimated costs of completion and selling expenses.

(h) Property, plant and equipment

Property, plant and equipment are carried at cost less accumulated depreciation and accumulated impairment charges, if any.

(i) General

Property, plant and equipment costs include the fair value of consideration paid, including cash and shares, if any, on acquisition. Exploration expenditures relate to the initial search for deposits with economic potential. Evaluation expenditures arise from a detailed assessment of deposits or projects that have been identified as having economic potential. When a decision is made that an exploration and evaluation project has advanced to the development for production stage, the accumulated costs associated with that project are reclassified to project under development. Development costs are capitalized and include the costs associated with bringing the project to the production stage. When a decision is made that a project under development has advanced to the production stage, the accumulated costs associated with that project are reclassified as mining operations. At the production stage, the capitalization of certain mine construction costs ceases and they are either capitalized to inventory or expensed. Other costs related to property, plant and equipment additions or improvements and underground mine development that have a future economic benefit, or exploration and evaluation expenditures that meet the criteria for capitalization, are capitalized.

The amount of property acquisition costs and their related deferred exploration and evaluation and development expenditures represent historic expenditures incurred and are not intended to reflect present or future fair values.

Upon sale or abandonment of any mineral interest, the cost and related accumulated depreciation are written-off and any gains or losses thereon are included in the Statement of Profit or Loss.

(ii) Property

Property includes its purchase price and, prior to the commencement of production, any government fees and taxes and usage fees for aboriginal organizations thereon to maintain the property in good standing.

(iii) Plant, equipment and mobile equipment

Plant, equipment and mobile equipment include its purchase price, any costs directly attributable to bringing plant, equipment and mobile equipment to the location and condition necessary for it to be capable of operating in the manner intended by management and the estimated mine closure and environmental rehabilitation costs associated with dismantling and removing the asset.

(iv) Exploration and evaluation

Exploration and evaluation costs are capitalized and are comprised of costs that are directly attributable to:

- researching and analyzing existing exploration data;
- conducting geological studies, exploration drilling and sampling;
- examining and testing extraction and treatment methods; and,
- activities in relation to evaluating the technical feasibility and commercial viability of extracting a mineral resource.

(v) Development costs

Development costs are capitalized until the mineral property is determined to be in production, becomes inactive, is assessed as impaired or is sold or abandoned. Development costs include accessing the ore body, designing and constructing the production infrastructure, borrowing costs relating to construction and other costs that can be directly attributed to bringing the assets to the condition necessary for their intended use. This includes costs associated with the commissioning period before the asset is in production and can operate at the level intended by management.

(vi) Depreciation

The carrying amounts of property, plant and equipment are depreciated to their estimated residual value over the estimated useful life of the specific assets to which they relate.

Accumulated property costs are not depreciated prior to the commencement of production.

Estimates of residual values and useful lives and the method of depreciation are reassessed annually. Any change in estimate is taken into account in the determination of remaining depreciation charges. Depreciation commences on the date when the asset is available for use in the location and condition necessary to be operated in the manner intended by management, as follows:

- Property - based on reserves and resources in the mine plan on a unit-of-production basis;
- Plant and equipment - straight-line over the estimated useful life of the asset or on a unit-of-production basis based on the usage of the asset;
- Buildings - straight-line over the estimated useful life of the asset or on a unit-of-production basis based on the usage of the asset; and,
- Mobile equipment – straight-line over 2 to 5 years based on the estimated useful life in years or on a unit-of-production basis based on the usage of the asset.

(vii) Impairment

At the end of each reporting period, the Company reviews its property, plant and equipment at the CGU level to determine whether there is any indication of impairment. On an annual basis, the Company will perform an impairment test on its property, plant and equipment. In addition, when property, plant and equipment in the exploration and evaluation stage are reclassified to project under development, the Company will perform an impairment test.

If the recoverable amount of an asset or CGU is estimated to be less than its carrying amount, the carrying amount is reduced to the recoverable amount. Impairment is recognized immediately in the Statement of Profit or Loss. If the circumstances leading to the impairment change, and an impairment subsequently reverses, the carrying amount is increased to the revised estimate of recoverable amount but only to the extent that it does not exceed the carrying value that would have been determined if no impairment had previously been recognized. Any subsequent reversal of an impairment loss is recognized in the Statement of Profit or Loss.

The recoverable amount for property, plant and equipment is generally determined based on its fair value less costs of disposal, which represents the present value of the estimated future cash flows expected to arise from the continued use of the asset, including any expansion prospects, and its eventual disposal, using assumptions that an independent market participant may take into account. The Company's weighted average cost of capital is used as a starting point for determining the discount rate.

(i) Goodwill

Goodwill arising on a business combination, including goodwill resulting from the required deferred tax adjustment, is carried at cost as established at the date of acquisition of the business, less accumulated impairment charges, if any.

Goodwill is tested for impairment on an annual basis and whenever there is an indication of impairment. For the purposes of impairment testing, goodwill is allocated to the same CGU as the assets acquired in the business combination through which it was created.

(j) Leases

Leases in which a significant portion of the risks and rewards of ownership are retained by the lessor are classified as operating leases. Payments made under operating leases (net of any incentives received from the lessor) are charged to the Statement of Profit or Loss on a straight-line basis over the period of the lease.

Leases of property and equipment where the Company has substantially all the risks and rewards of ownership are classified as finance leases. Finance leases are capitalized at the lease's commencement at the lower of the fair value of the leased property and the present value of the minimum lease payments. Each lease payment is allocated between the liability and finance charges. The corresponding rental obligations, net of finance charges, are included in other long-term payables. The interest element of the finance cost is charged to the Statement of Profit or Loss over the lease period so as to produce a constant periodic rate of interest on the remaining balance of the liability for each period.

(k) Provisions

(i) General

Provisions are recognized when TMAC has a present legal or constructive obligation as a result of past events and it is probable that an outflow of resources that can be reliably estimated will be required to settle the obligation. Where a provision is measured using the cash flows estimated to settle the obligation, its carrying amount is the present value of those cash flows. The increase in provisions due to the effect of the time value of money is recognized as a finance expense in the Statement of Profit or Loss.

(ii) Environmental rehabilitation

The mining, extraction and processing activities of the Company normally give rise to obligations for environmental rehabilitation. A provision is recognized for environmental rehabilitation costs, which include the dismantling and demolition of infrastructure, removal of residual materials and remediation of disturbed areas, in the financial period when the related environmental disturbance occurs, based on the estimated future costs using information available at the period end date.

At the time of establishing the provision, a corresponding asset is capitalized when it gives rise to a future benefit and depreciated over future production from the operations to which it relates. The provision is discounted to its present value using a risk free rate relevant to the jurisdiction in which the rehabilitation has to be performed. The unwinding of the discount is included in finance expense. Costs arising from unforeseen circumstances, such as the contamination caused by unplanned discharges, are recognized as an expense and liability when the event gives rise to an obligation which is probable and can be reliably estimated.

The provision is reviewed at the end of each reporting period for changes to obligations, legislation or discount rates that impact estimated costs or timing of the obligation. The cost of the related asset is adjusted for changes in the provision resulting from changes in the estimated cash flows or discount rate and the adjusted cost of the asset is depreciated prospectively.

(l) Income taxes

TMAC uses the asset and liability method of accounting for income taxes. Deferred income tax assets and liabilities are determined based on the differences between the financial reporting and tax bases of assets and liabilities and on losses carried forward. Deferred income tax assets and liabilities are measured using the substantially enacted tax rates that are expected to be in effect when the differences are expected to reverse or losses are expected to be utilized. The effect on deferred income tax assets and liabilities of a change in the enacted tax rate is included in income in the period in which the change is substantially enacted. Deferred income tax assets are recorded to recognize tax benefits only to the extent that, based on available evidence, it is probable that they will be realized. This evaluation requires management to make judgments as to whether it is probable that a tax asset may be realized in the future.

Deferred income tax assets and liabilities are offset if there is a legally enforceable right to offset current income tax assets against current income tax liabilities and when they relate to income taxes levied by the same taxation authority where there is an intention to settle the balances on a net basis.

(m) Share capital

(i) Common shares

TMAC's common shares **("Common Shares")** are classified as equity. Incremental costs directly attributable to the issuance of Common Shares, net of any tax effects, are recognized as a deduction from equity.

(ii) Flow-through common shares

From time to time TMAC may finance a portion of its exploration activities through the issuance of flow-through Common Shares. Canadian income tax legislation permits a company to issue flow-through instruments whereby the income tax deductions relating to qualified Canadian exploration expenditures ("**CEE**") as defined in the Income Tax Act (Canada) are claimed by the investors rather than by the company. Shares issued on a flow-through basis typically include a premium related to the tax benefits provided to the investors. The Company estimates the portion of the proceeds attributable to the premium as being the excess of the subscription price over the fair value of the shares without the flow-through feature at the time of issuance. The premium is recorded as a deferred liability and is included in income at the time the CEE are incurred.

(n) Share-based payments

Employees, directors, senior executives and consultants of the Company are eligible to receive a portion of their remuneration in the form of share-based payment arrangements whereby employees render services as consideration for equity instruments ("**share-based payments**").

The fair value of a share-based payment is recorded as an expense or a component of property, plant and equipment, based on the nature of the services for which it was awarded, over the vesting period of the award with a corresponding increase recorded in contributed surplus. The fair value of the share-based payments for employees, directors and senior executives is determined using the Black-Scholes option pricing model. The fair value of a share-based payment for a consultant is determined based on the fair value of the goods and services received and requires management to make estimates of the value of the goods and services received. Upon exercise of a share option, consideration paid by the option holder, together with the amount previously recognized in contributed surplus, is recorded as an increase to share capital.

(o) Earnings (loss) per share

Earnings (loss) per share calculations are based on the weighted average number of Common Shares and Common Share equivalents issued and outstanding during the period. Diluted earnings (loss) per share is calculated using the treasury stock method. Under this method, the dilutive effect of earnings (loss) per share is recognized on the use of proceeds that could be obtained from the exercise of options, warrants and similar instruments, if dilutive. It assumes that proceeds would be used to purchase common shares at the average market price for the period.

(p) Financial instruments

All financial instruments are initially recognized at fair value in the Statement of Financial Position.

(i) Financial assets

Financial assets are initially recorded at fair value and designated upon inception into one of the following four categories: held to maturity; available for sale; loans and receivables; or, at fair value through profit or loss ("**FVTPL**").

Financial assets classified as loans and receivables and held to maturity are measured at amortized cost using the effective interest method less any allowance for impairment.

Financial assets classified as available for sale are measured at fair value with unrealized gains and losses recognized in other comprehensive income. When the asset is disposed of, or is determined to be impaired, the cumulative gain or loss previously accumulated in other comprehensive income is reclassified to profit or loss.

Transaction costs associated with FVTPL financial assets are expensed as incurred, while transaction costs associated with all other financial assets are included in the initial carrying amount of the asset.

Interest income from a financial asset is recognized when it is probable that the economic benefits will be realized by the Company and the amount of income can be measured reliably. Interest income is accrued on a time basis by reference to the principal outstanding and the effective interest rate applicable.

(ii) Financial liabilities

Financial liabilities are initially recorded at fair value and designated upon inception as FVTPL or other financial liabilities.

Financial liabilities classified as other financial liabilities are initially recognized at fair value less directly attributable transaction costs. After initial recognition, other financial liabilities are subsequently measured at amortized cost using the effective interest method.

Financial liabilities classified as FVTPL include financial liabilities held for trading and financial liabilities designated upon initial recognition as FVTPL. Derivatives, including separated embedded derivatives, are also classified as held for trading unless they are designated as effective hedging instruments.

Transaction costs on financial liabilities classified as FVTPL are expensed as incurred. Fair value changes on financial liabilities classified as FVTPL are recognized through the Statement of Comprehensive Profit of Loss.

(iii) Compound financial instruments

Compound financial instruments are comprised of instruments that can be converted into a fixed number of shares at the option of the holder.

The liability component of a compound financial instrument is recognized initially at the fair value of a similar liability that does not have an equity conversion option. The equity component is recognized initially as the difference between the fair value of the compound financial instrument as a whole and the fair value of the liability component. Any directly attributable transaction costs are allocated to the liability and equity components in proportion to their initial carrying amounts.

Subsequent to initial recognition, the liability component of a compound financial instrument is measured at amortized cost using the effective interest rate method. The equity component of a compound financial instrument is not re-measured subsequent to initial recognition.

Interest related to the financial liability is recognized in the Statement of Profit or Loss. On conversion, the financial liability is reclassified to equity and no gain or loss is recognized.

(iv) Impairment of financial assets

The Company assesses at each period end date whether there are indications that a financial asset is impaired.

If there is objective evidence that an impairment loss on financial assets carried at amortized cost has been incurred, the amount of the loss is measured as the difference between the asset's carrying amount and the present value of estimated future cash flows discounted at the financial asset's original effective interest rate. The carrying amount of the financial asset is then reduced by the amount of the impairment. The amount of the loss is recognized in the Statement of Comprehensive Profit or Loss.

If, in a subsequent period, the amount of the impairment loss decreases and the decrease can be related objectively to an event occurring after the impairment was recognized, the previously recognized impairment loss is reversed to the extent that the carrying value of the financial asset does not exceed what the amortized cost would have been had the impairment not been recognized. Any subsequent reversal of an impairment loss is recognized in the Statement of Comprehensive Profit or Loss.

(q) Borrowing costs

Borrowing costs directly related to financing an acquisition, exploration, construction or development of qualifying assets are capitalized to the cost of those assets until such time they are substantially ready for their intended use.

Where funds have been borrowed specifically to finance an asset, the amount capitalized is the actual borrowing cost incurred. Where the funds used to finance an asset form part of general borrowings, the amount capitalized is calculated using a weighted average of rates applicable to relevant general borrowings of the Company during the period.

Transaction costs related to the establishment of a loan facility are capitalized and amortized over the life of the loan facility using the effective interest rate method, or set off against the fair value of the loan facility. Other borrowing costs are recognized in the Statement of Profit or Loss in the period in which they are incurred.

(r) Related party transactions

Parties are considered to be related if one party has the ability, directly or indirectly, to control the other party or exercise significant influence over the other party in making financial and operating decisions, or if they are subject to common control or common significant influence. Related parties may be individuals or corporate entities. A transaction is considered to be a related party transaction when there is a transfer of resources or obligations between related parties. Related party transactions that are in the normal course of business and have commercial substance are measured at the exchange amount.

(s) Segment reporting

Operating segments are reported in a manner consistent with the internal reporting provided to the chief decision maker. The chief decision maker has been identified as the executive leadership team, which comprises the Executive Chairman, Chief Executive Officer, President and certain other senior executives. The executive leadership team is responsible for allocating resources and assessing the performance of operating segments.

(t) Adoption of new and revised international financial reporting standards

At the date of authorization of the financial statements for the period ended December 31, 2013, the following standards and interpretations, which are applicable to the Company, are effective from January 1, 2013, except for the amendments to IFRS 9 for which the effective date is to be determined and IAS 36 and IFRIC 21 which are effective January 1, 2015. Early adoption is permitted and the Company elected to adopt all applicable new standards, other than the amendments to IFRS 9, effective October 30, 2012, date of incorporation. The Company is currently assessing the impact of the amendments to IFRS 9 and IAS 36 and the IFRIC 21 new standard on its financial statements.

(i) IFRS 9, Financial instruments

IFRS 9, *Financial Instruments*, (**"IFRS 9"**) will replace IAS 39, *Financial Instruments: Recognition and Measurement for classification and measurement of financial assets and liabilities*.

IFRS 9 requires all recognized financial assets to be subsequently measured at amortized cost or fair value. Debt investments that are held within a business model whose objective is to collect the contractual cash flows, and that have contractual cash flows that are solely payments of principal and interest on the principal outstanding, are generally measured at amortized cost at the end of subsequent accounting periods. All other debt investments and equity investments are measured at their fair values at the end of subsequent accounting periods. A fair value option is provided for financial instruments otherwise measured at amortized cost. This standard also requires a single impairment method to be used, replacing the multiple impairment methods in IAS 39. In November 2013, the IASB issued amendments to IFRS 9.

(ii) IFRS 10, Consolidated financial statements

IFRS 10, *Consolidated Financial Statements,* (**"IFRS 10")** replaces the consolidation requirements in IAS 27, *Consolidated and Separate Financial Statements*, and SIC-12 *Consolidation - Special Purpose Entities*. While TMAC does not have subsidiaries and, therefore, does not have consolidated financial statements, the principles of financial statements are contained within IFRS 10.

(iii) IFRS 13, Fair value measurement

IFRS 13, *Fair Value Measurement*, (**"IFRS 13"**) defines fair value, and sets out in a single IFRS a framework for measuring fair value and related disclosures about those fair value measurements. IFRS 13 does not determine when an asset, a liability or an entity's own equity instrument is measured at fair value. Rather, with limited exceptions, the measurement and disclosure requirements of IFRS 13 apply when another IFRS requires or permits the item to be measured at fair value.

(iv) IAS 19, Employee benefits

Amendments to IAS 19*, Employee Benefits,* ("**IAS 19**") require the recognition of changes in the defined benefit obligation and in plan assets when those changes occur, eliminating the corridor approach and accelerating the recognition of past service costs. TMAC does not have any defined benefit obligations.

(v) IAS 32, Financial instruments: presentation

Amendments to IAS 32*, Financial Instruments: Presentation,* ("**IAS 32**") clarifies that an entity has a legally enforceable right to offset financial assets and financial liabilities if that right is not contingent on a future event and it is enforceable both in the normal course of business and in the event of default, insolvency or bankruptcy of the entity and all counterparties.

(vi) IAS 36, Impairment of assets

IAS 36, *Impairment of Assets,* ("**IAS 36**") was amended by the IASB in May 2013. The amendments require the disclosure of the recoverable amount of impaired assets when an impairment loss has been recognized or reversed during the period and additional disclosures about the measurement of the recoverable amount of impaired assets when the recoverable amount is based on fair value less costs of disposal, including the discount rate when a present value technique is used to measure the recoverable amount.

(vii) IFRIC 21, Levies

Amendments to IFRIC 21*, Levies,* ("**IFRIC 21**") provided guidance on the accounting for levies within the scope of IAS 37, *Provisions, Contingent Liabilities and Contingent Assets*. The main features of IFRIC 21 are: (i) the obligating event that gives rise to a liability to pay a levy is the activity that triggers the payment of the levy, as identified by the legislation, and (ii) the liability to pay a levy is recognized progressively if the obligating event occurs over a period of time.

3. ACQUISITION OF HOPE BAY

On November 30, 2012, Newmont Mining Corporation (collectively with its subsidiaries "**Newmont**") and TMAC entered into a letter agreement whereby TMAC agreed to purchase 100% of Hope Bay from Hope Bay Mining Ltd. ("**HBML**"), a wholly-owned subsidiary of Newmont, subject to HBML retaining a 1% net smelter royalty (the "**Newmont NSR**") on any metals produced from Hope Bay and a specified surrounding area of interest. A formal agreement of purchase and sale entitled "Transaction Agreement" between HBML and TMAC was entered into on January 25, 2013 and was amended at the time of closing of the transaction on March 12, 2013 (the "**Closing**") by way of an "Amending Agreement", dated March 12, 2013, (collectively the "**Transaction Agreement**").

Pursuant to the Transaction Agreement, all of the Hope Bay assets were vended to TMAC for an aggregate purchase consideration of $450,000,000 (the "**Purchase Consideration**") in exchange for the issuance by TMAC of 57,400,000 Common Shares (the "**Payment Shares**") to HBML representing 82% of the 70,000,000 Common Shares of TMAC then outstanding. HBML transferred $300,000,000 of tax attributes to TMAC as part of the Purchase Consideration. In addition, TMAC assumed environmental rehabilitation liabilities for Hope Bay.

TMAC established two types of Common Shares: Voting Common Shares (the "**Voting Shares**") and Non-Voting Common Shares (the "**Non-Voting Shares**") (note 14). Newmont's 57,400,0000 Common Shares were split between Voting Shares and Non-Voting Shares such that Newmont's ownership of Voting Shares was 49.9% of the Voting Shares outstanding, and TMAC's management owned the remaining 18% or 12,600,000 Common Shares of the 70,000,000 Common Shares issued and outstanding at Closing. Pursuant to the Transaction Agreement, should at any time the total number of Common Shares owned by HBML result in Newmont beneficially owning more than 49.9% of the aggregate issued and outstanding Common Shares immediately following completion of the Initial Equity Financing, as defined below, the number of Voting Shares held by Newmont will instead equal an amount which results in Newmont's ownership of Voting Shares being 49.9% of the aggregate issued and outstanding Voting Shares (on a non-diluted basis) at such time, and the remaining Payment Shares shall be Non-Voting Shares.

The Transaction Agreement also contains certain post-Closing terms and conditions including:

- As a condition of Closing, TMAC was to complete a private placement in the amount of $30,000,000 to $35,000,000, the funds for which were to pay for the acquisition costs incurred to purchase Hope Bay along with providing funds to conduct exploration, evaluation, environmental and administrative activities. Immediately after Closing, a private placement of Common Shares for an aggregate amount of $35,000,000 was completed (the "**Initial Equity Financing**")(note 14);
- TMAC shall use commercially reasonable efforts to complete an initial public offering of TMAC Common Shares (the "**IPO Financing**") by December 31, 2013 and to have the Common Shares, including the Payment Shares (but not including the Non-Voting Shares), approved for listing on the Toronto Stock Exchange (**"TSX"**). Despite using commercially reasonable efforts, market conditions did not permit TMAC to complete the IPO Financing by December 31, 2013; and
- TMAC agreed to indemnify Newmont for any funds expended in connection with draws made on the letters of credit associated with Newmont's environmental rehabilitation obligations for Hope Bay under the permits that are held by Aboriginal Affairs and Northern Development Canada, the Department of Fisheries and Oceans and the Kitkmeot Inuit Association (**"KIA"**) (the "**Letters of Credit**")(note 18). TMAC shall arrange for replacement bonds and/or letters of credit on or before the earlier of 30 days following the closing of the IPO Financing and June 30, 2014.

In addition, a number of ancillary agreements were entered into between Newmont and TMAC on March 12, 2013, including:

- TMAC obtained a commitment from an affiliate of HBML (the "**Commitment Letter**") to provide a non-revolving loan in the principal amount of up to $15,000,000 (the "**Newmont Loan**"). TMAC made a drawdown of $15,000,000 on December 18, 2013. (notes 10, 18 and 21);
- Newmont Royalty Agreement that provides for the 1% Newmont NSR smelter royalty retained by HBML on all saleable metals produced by TMAC from Hope Bay and an area of interest surrounding the Hope Bay property (note 18);
- Transition Services Agreement whereby TMAC can request assistance from Newmont at TMAC's expense for certain services for a specified period of time ending on September 30, 2013 (note 18); and,
- Investor Rights Agreement providing Newmont and TMAC certain rights with respect to the board of directors of TMAC and the Common Shares of TMAC (note 18).

The aggregate fair values of assets acquired and liabilities assumed on acquisition date were as follows:

	$000s
Purchase price:	
57,400,000 Common Shares	450,000
Net assets acquired:	
Consumables, materials and supplies	7,919
Property	203,660
Plant and equipment	246,547
Mobile equipment	5,456
Ore in stockpiles	2,798
Goodwill	80,600
Environmental rehabilitation liabilities	(16,380)
Deferred tax liabilities	(80,600)
Total net assets	**450,000**

In accordance with IFRS 3, "*Business Combinations*", the acquisition of Hope Bay by TMAC was determined to be a business combination with TMAC being the acquirer of Hope Bay and, accordingly, was accounted for under the acquisition method of accounting. The results of operations are included in the Statement of Profit or Loss from the date of the acquisition.

Fair values have been estimated using a variety of methods as listed below for significant balances:

Asset Acquired or Liability Assumed	Method of Determining Fair Value	Fair Value $000s
Consumables, materials and supplies	Estimated primarily using a replacement cost approach based on inventory records and the selling price for comparable items.	7,919
Property	Estimated discounted cash flows and value of comparable transactions to estimate the fair value of mineral resources and licenses based on a third party valuation report.	203,660
Plant and equipment	Estimated primarily using a replacement cost approach based on fixed asset records and asset valuation reports.	246,547
Mobile equipment	Estimated primarily using a replacement cost approach based on fixed asset records and asset valuation reports.	5,456
Ore in stockpiles	Based on estimated recoverable value of contained metal less estimated processing, refining, shipping, and selling costs.	2,798
Goodwill	Estimated pursuant to IFRS.	80,600
Environmental rehabilitation liabilities	Estimated from a third party environmental rehabilitation liability report using assumptions about inflation rates, life of assets and discount rate.	16,380
Deferred tax liabilities	Estimated based on assumed marginal tax rates on difference between Purchase Consideration and transferred tax attributes.	80,600

From the date of Closing of the acquisition, no revenues and a net loss of $nil were generated by the Hope Bay operations. Had the acquisition taken place at the beginning of the fiscal year, TMAC's pro forma revenue from Hope Bay would be $nil and pro forma net loss would have been $nil for the fourteen months ended December 31, 2013. TMAC incurred transaction costs totaling $1,176,000 related to the acquisition of Hope Bay all of which were expensed in the Statement of Profit or Loss in the current period.

4. Amounts receivable

	December 31, 2013 $000s
Recoverable sales tax	404
Other	2
	406

5. Consumables, materials and supplies

	December 31, 2013 $000s
Consumables	5,864
Materials and supplies	1,233
	7,097

6. Property, plant and equipment

December 31, 2013	Property $000s	Plant and equipment $000s	Mobile equipment $000s	Exploration and evaluation $000s	Total $000s
Cost					
Balance at October 30, 2012	-	-	-	-	-
Acquisition of Hope Bay (note 3)	203,660	246,547	5,456	-	455,663
Additions					
- Acquisition and engineering	-	1,293	506	-	1,799
- Camp and logistics	-	658	459	8,214	9,331
- Capitalized depreciation	-	-	-	498	498
- Drilling and Assaying	-	-	-	10,789	10,789
- Environment	-	-	-	3,290	3,290
- Evaluation	-	-	-	612	612
- Geology	-	-	-	689	689
- Property holding	1,523	-	-	-	1,523
Balance at December 31, 2013	**205,183**	**248,498**	**6,421**	**24,092**	**484,194**
Accumulated depreciation					
Balance at October 30, 2012	-	-	-	-	-
Depreciation	-	287	211	-	498
Balance at December 31, 2013	**-**	**287**	**211**	**-**	**498**
Net book value at December 31, 2013	**205,183**	**248,211**	**6,210**	**24,092**	**483,696**

All property, plant and equipment are currently in the exploration and evaluation stage.

Hope Bay is located approximately 685 kilometres ("**km**") northeast of Yellowknife, Northwest Territories and approximately 125 km southwest of Cambridge Bay, Nunavut Territory and is situated east of Bathurst Inlet, Nunavut Territory. Hope Bay lies approximately 160 km above the Arctic Circle, comprises an area of 1,101 km^2 and forms one large contiguous block of land that is approximately 80 km by 20 km in size. Hope Bay mineral tenure includes Federal (the "**Crown**") mineral claims, Crown mining leases, pending Crown mining leases and Inuit exploration agreements.

Nunavut Tunngavik Inc. ("**NTI**"), the organization which coordinates and manages Inuit responsibilities set out in the Nunavut Land Claims Agreement ("**NLCA"**), holds the surface title and mineral rights to Inuit-Owned Lands in the Kitikmeot region of Nunavut, including the surface rights over the entire Hope Bay area and mineral rights over selected portions of Hope Bay as described above. The KIA administers the surface rights and the Inuit Impact Benefit Agreement ("**IIBA**") associated with Hope Bay. The IIBA provides guidelines for Inuit employment and Inuit contractor involvement at Hope Bay, and provides for certain payments to the KIA for administration of the IIBA. In addition, TMAC assumed from Newmont the rights and obligations of the surface rights lease agreement (the "**Commercial Lease**") with the KIA that governs surface access rights and compensation that is payable to the KIA for

that access. The Commercial Lease, which has a five year term commencing September 13, 2013, permits TMAC to commence production at the Doris deposit. Payments to the KIA for use of the surface lands are incurred for quarrying fees, water usage, habitat disturbance and wildlife conservation.

Hope Bay is comprised of the Roberts Bay port, the Doris, Madrid and Boston gold bearing mineral deposits and other areas of mineralized interest. Roberts Bay is located approximately five km from the Doris site and is the port entry point from the north-west passage. The facility includes a cargo offloading jetty, a diesel fuel offloading facility, fuel storage facility, and a large lay down area for equipment and supplies. Existing infrastructure at Hope Bay includes gravel airstrips at Doris and Boston, power plants, camp facilities at both Doris and Boston, an all year haul road from Doris to Madrid, and permitted tailings facility. In addition, a partially completed expandable 800 tonne per day modular mill is currently stored in Durban, South Africa and mill grinding equipment is stored in Baltimore, USA.

NTI owns approximately 50% of the subsurface minerals at Hope Bay with the other 50% owned by the Crown. The ownership of mineral rights is allocated approximately as follows: Doris - 100% by NTI; Madrid - 50%/50% shared mineral rights between NTI and the Crown; Boston and southwards -100% owned by the Crown. As NTI is a private owner of the Inuit owned subsurface mineral rights, royalty rates for the NTI's mineral rights are governed by production leases granted by NTI. A production lease is a necessary prerequisite in order to commence production. While a production lease is not finalized, terms for similar leases with NTI should result in TMAC paying NTI an annual 12% net profits interest royalty from any production, this amount being effectively set by a limit in allowable deductions. Crown lands are subject to a sliding scale net profits interest royalty of up to 13%; however, there is no limit to the allowable deductions.

Newmont has retained the 1% Newmont NSR on commercial production from the Hope Bay Project area of interest. TMAC has a right of first refusal on any sale of the Newmont NSR (note 18).

Newmont has general security agreements in place for each of the Newmont Loan and the Letters of Credit (note 18).

Cash additions of assets in the exploration and evaluation stage, adjusted for non-cash working capital movements, amounted to $26,150,000.

7. Goodwill

The goodwill balance of $80,600,000 relates to the acquisition of Hope Bay (note 3) and is the result of the requirement under business combinations accounting to recognize a deferred income tax liability for the difference between the fair value of the identifiable assets and liabilities acquired and their tax base (note 3). Goodwill has been allocated to the Hope Bay CGU for impairment testing purposes. An impairment test was performed on the CGU at December 31, 2013. The recoverable amount was determined by estimating the fair value less costs of disposal through a discounted cash flow analysis on the Doris, Madrid and Boston deposits over 12 years along with a comparable transaction value analysis for the rest of the Hope Bay property. The following significant assumptions were used in the discounted cash flow analysis: US$1,350/ounce for the price of gold based on an average of analysts' forecasts; 6% discount rate; and, 1.066 foreign exchange rate for the Canadian dollar relative to the United States dollar based on market forecasts. The test showed no impairment for Hope Bay at December 31, 2013.

The effects of a change in any single assumption does not fairly reflect the impact on a CGU's fair value as the assumptions are interdependent. For example, a change in the gold price could result in a change in the mine plan and future capital expenditures.

8. Other

Other assets consists of an ore stockpile on surface valued at $2,798,000 that also represents its net realizable value.

9 Trade and other payables

	December 31, 2013 $000s
Trade payables	659
Accrued liabilities	1,144
	1,803

10. Newmont Loan

	Period ended December 31, 2013 $000s
Proceeds from drawdown on December 19, 2013	15,000
Convertible option classified as equity	(679)
Accrued interest	48
	14,369

Deferred taxes of $183,000 were recognized on the $679,000 convertible option value, resulting in a net adjustment of $496,000 in the Statement of Changes in Shareholders' Equity.

The terms of the Newmont Loan are as follows:

- A non-revolving facility and has a principal amount of up to $15,000,000;
- Bears interest at 5%, calculated and compounded monthly, and payable at the time of repayment;
- Repayment is due at the earlier of the IPO Financing and December 31, 2014;
- Payment is to be in cash or, at Newmont's option, converted into Common Shares ("**Conversion Shares**") issued from treasury at a deemed conversion price of $3.00 per share. In the event that Conversion Shares are required to be issued to Newmont and such issuance would result in Newmont beneficially owning more than 49.9% of the aggregate issued and outstanding Voting Shares, the number of Voting Shares issued will instead equal an amount which results in Newmont collectively beneficially owning 49.9% of the aggregate issued and outstanding Voting Shares (on a non-diluted basis) at such time, and the remaining Conversion Shares shall be Non-Voting Shares; and,
- Is secured by a general security agreement in favor of Newmont.

On April 28, 2014 TMAC repaid the Newmont Loan (note 21).

11. Other liabilities

Other liabilities relate to the premium attributed to the proceeds received from the issuance of flow-through Common Shares.

	Period ended December 31, 2013 $000s
Balance at October 30, 2012	-
Premium from flow-through Common Shares issued	511
Reduction for qualifying exploration expenditures incurred	(511)
	-

12. Provision for environmental rehabilitation

	Period ended December 31, 2013 $000s
Balance at October 30, 2012	-
Business combination (note 3)	16,380
Accretion	301
	16,681

Provision is made for mine closure and environmental rehabilitation costs, which include the dismantling and demolition of infrastructure, removal of residual materials and remediation of disturbed areas, in the financial period when the related environmental disturbance occurs based on the estimated future costs using information available at the period end date.

Assumptions:

	December 31, 2013 $000s
Undiscounted and un-inflated amount of estimated cash flows	24,719
Payable in years	35
Inflation rate	1.3%
Discount rate	2.5%

Newmont provided Letters of Credit associated with TMAC's environmental rehabilitation obligations under the permits that are held by Aboriginal Affairs and Northern Development Canada, the Department of Fisheries and Oceans and the KIA (note 18).

13. Income taxes

	December 31, 2013 $000s
Current income tax expense	-
Deferred income tax expense (recovery)	364
Income tax expense (recovery)	**364**

Reconciliation between the tax expense and accounting profit for the year:

	Period ended December 31, 2013 $000s
Earnings (loss) before income taxes	**(3,517)**
Canadian federal and provincial income tax rates	27%
Income tax expense (recovery) at statutory rates	**(949)**
Non-deductible expenses (non-taxable income)	3
Nunavut mining royalties	(79)
Flow-through share renunciation (net of $511 premium)	661
Deferred income tax expense (recovery)	**(364)**
Effective tax rate	**10%**

Reconciliation of the deferred tax balance movement:

	Period ended December 31, 2013 $000s
Balance at October 30, 2012	-
Acquisition of Hope Bay (note 3)	80,600
Private placement – share issue costs (note 14)	(630)
Newmont Loan (note 10)	183
Premium on flow-through shares (note 11)	511
Deferred tax recovery in Statement of Profit or Loss	(364)
Balance at December 31, 2013	**80,300**

The significant components of TMAC's deferred income tax assets and liabilities are as follows:

Deferred income tax liabilities (assets)	December 31, 2013 $000s
Inventory	1,187
Property, plant and equipment	101,555
Newmont Loan	177
Provision for environmental rehabilitation	(6,546)
Deferred Nunavut royalties	(14,796)
Tax losses	(795)
Share issue costs	(483)
Net deferred income tax liabilities	**80,300**

Deferred taxes of $183,000 were recognized on the $679,000 convertible option value of the Newmont Loan (note 10), resulting in a net adjustment of $496,000 in the Statement of Changes in Shareholders' Equity.

Deferred taxes of $630,000 were recognized on the share issue costs of $2,331,000 in the Statement of Changes in Shareholders' Equity (note 14(v)).

TMAC had federal and provincial non-capital loss carryforwards totaling approximately $2.9 million that expire in 2033.

14. Share capital and reserves

(a) Authorized

TMAC is authorized to issue an unlimited number of Voting Shares and an unlimited number of Non-Voting Shares.

The Non-Voting Shares have equivalent rights to the Voting Shares in all respects except that they do not have the right to vote and they are convertible on a one-for-one basis into Voting Shares at the election of the holder (should the holder and its affiliates hold less than 49.9% of the Voting Shares on a non-diluted basis and then only to the extent that the holder and its affiliates would hold no more than 49.9% of the Voting Shares), and, automatically convert into Voting Shares on March 12, 2015.

(b) Issued and outstanding

TMAC had the following issued and outstanding Common Shares at December 31, 2013 (note 21):

	Number of Voting shares #	Number of Non-Voting Shares #	Total Number of Common Shares #	Value of Common Shares $000s
Common shares at incorporation on October 30, 2012 (i)	**100**	**-**	**100**	**-**
Private placement (ii)	999,900	-	999,900	-
Share split (iii)	11,600,000	-	11,600,000	-
Acquisition of Hope Bay (iv)	24,000,305	33,399,695	57,400,000	450,000
Initial Equity Financing (v)	11,496,499	-	11,496,499	32,788
Common shares on March 31, June 30, and September 30, 2013	**48,096,804**	**33,399,695**	**81,496,499**	**482,788**
Initial Equity Financing Rights (v)	-	-	1,022,024	-
Common shares on December 31, 2013	**48,096,804**	**33,399,695**	**82,518,523**	**482,788**

(i) Incorporation

TMAC was incorporated on October 30, 2012 with the issuance of 100 Common Shares with an aggregate value of $1.00.

(ii) Private placement

On January 22, 2013, TMAC issued 999,900 Common Shares to various executive officers and the sole director of the Company and the TMAC Share Purchase Trust at a nominal value.

(iii) Share split

On March 8, 2013, the shareholders approved a resolution whereby the 1,000,000 then issued and outstanding Common Shares were divided on the basis of 1 existing Common Share for 12.6 Common Shares, thereby issuing an additional 11,600,000 Common Shares to the existing shareholders, all of which were officers and/or a director of TMAC.

In addition, on March 8, 2013, the shareholders approved a resolution whereby the authorized share capital was increased by creating an unlimited number of Non-Voting Shares.

(iv) Acquisition of Hope Bay

On March 12, 2013, pursuant to the Transaction Agreement TMAC issued 57,400,000 Common Shares to Newmont for an aggregate Purchase Consideration of $450,000,000 (note 3).

(v) Initial Equity Financing

Immediately after Closing of the Transaction Agreement (note 3), TMAC completed a private placement of 10,220,240 Common Shares (the "**Non-FT Shares**") at $3.00/share, for gross proceeds of $30,661,000, and 1,276,259 of flow-through Common Shares (the "**FT Shares**") at $3.40/share, for gross proceeds of $4,339,000, for an aggregate amount of $35,000,000. Costs associated with the completion of the Non-FT Shares issuance totaled $2,331,000 ($1,701,000 after deferred income taxes of $630,000) and were charged to share capital on the Statement of Changes in Shareholders' Equity.

The subscription agreement for the FT Shares requires TMAC to incur $4,339,000 of qualifying CEE and renounce the CEE to the FT Shares shareholders with an effective date of December 31, 2013 (note 21). The $0.40/share premium of the FT Shares over the Non-FT Shares resulted in an other liability in the amount of $511,000 which amount reduced share capital (note 11).

The subscription agreement for the Non-FT Shares states that each Non-FT Share had attached to it one right (a "**Right**") that entitled the shareholder to receive one-tenth of a Common Share of TMAC for no additional consideration in the event that a "Liquidity Event" (as hereinafter defined) did not occur on or before October 31, 2013. The Rights were issued as separate certificates and were not tradable separately from the Non-FT Shares. "**Liquidity Event**" essentially means either: (i) the Common Shares being listed on the TSX or TSX Venture Exchange or such other major stock exchange; or (ii) all of the issued and outstanding Common Shares having been sold, transferred or exchanged, pursuant to a take-over bid, amalgamation, plan of arrangement or other business combination, for cash or securities that are not subject to any restricted period or hold period under applicable Securities Laws in Canada; or (iii) any combination of the events or circumstances described in clauses (i) and (ii) such that all of the Common Shares shall be subject to one or more of clause (i) or (ii). Accordingly, should TMAC not complete a Liquidity Event prior to the close of business on October 31, 2013, the Right would automatically be exercised granting 10% more Common Shares to all Non-FT Shareholders. TMAC did not complete a Liquidity Event by October 31, 2013 and, accordingly, the Rights were exercised and 1,022,024 Common Shares were issued.

(c) Share-based payment plans

TMAC has a share option purchase plan (the "**SOP**") and a restricted share plan (the "**RSP**"), (collectively the "**Share Plans**").

(i) Share option purchase plan

On January 22, 2013, the shareholders of TMAC adopted the SOP under which the Board is authorized to grant share purchase options of Common Shares ("**Options**") to directors, officers, employees and consultants. Pursuant to the SOP, TMAC may not have more than 10% of the issued and outstanding Common Shares reserved for incentive Share Plans at any time. The significant terms of the SOP are as follows:

- The exercise price per Common Share shall be determined by the Board at the time the Option is granted, but, in any event, if the Common Shares are listed on a stock exchange at the time of grant, the exercise price shall not be less than the closing price of the Common Shares on the stock exchange on the trading day immediately preceding the day of the grant of the Option:
- The Board may at any time authorize the granting of Options subject to the provisions of the SOP. The date of each grant of Options shall be determined by the Board when the grant is authorized: and,
- The Board may grant Options with a specified vesting period; however, all Options must be exercisable during a period not extending beyond five years from the date of the Option grant. Notwithstanding the foregoing, in the event that an Option will expire within, or within two days of, a trading blackout period imposed by the Company, the expiry date of the Option will be automatically extended to the 10th business day following the end of the blackout period.

As at December 31, 2013, no Options had been granted by the Board. Subsequently, 4,367,000 options were granted on April 28, 2014 (note 21(d)).

(ii) Restricted share plan

On January 22, 2013, the shareholders of TMAC adopted the RSP under which the Board (or a committee designated by the Board) is authorized to grant restricted shares rights (the "**Restricted Share Rights**") to directors, officers, employees and consultants. The RSP provides for the acquisition of Common Shares by participants for the purpose of advancing the interests of the Company through the motivation, attraction and retention of employees, officers, directors and consultants of the Company. Pursuant to the RSP, TMAC may not have more than 10% of the issued and outstanding Common Shares reserved for incentive Share Plans at any time. The significant terms of the RSP are as follows:

- The Board may grant Restricted Share Rights to acquire from the Company any number of fully paid and non-assessable Common Shares as a discretionary payment for past services to the Corporation or as an incentive for future services, subject to the provisions of the RSP;
- Each Restricted Share Right entitles the holder to receive one Common Share, without payment of additional consideration, at the end of the restricted period or, if applicable, at a later deferred payment date. The Board will determine the restricted period applicable to each Restricted Share Right grant;
- Restricted Share Rights may be subject to performance conditions to be achieved by the Company or by the holder within a restricted period for the holder thereof to receive the underlying Common Shares; and,
- A Restricted Share Rights holder may elect to defer the receipt of all or any part of the underlying Common Shares until a selected deferred payment date.

As at December 31, 2013, no Restricted Share Rights had been granted by the Board.

(d) Earnings (loss) per share

The impact of outstanding potentially dilutive instruments are excluded from the diluted share calculation for loss per share amounts as they are anti-dilutive.

(e) Nature and purpose of reserves

The reserve for the equity component of the Newmont Loan is comprised of the amount allocated to equity for the Newmont Loan that is convertible into Common Shares at the option of Newmont (note 10).

15. Finance income and expense

	Period ended December 31, 2013 $000s
Finance income	
Interest income	(170)
Finance expense	
Accretion of environmental rehabilitation costs (note 11)	301
Newmont Loan	48
Letters of credit (note 18(iv))	32
	381
Net finance costs	**211**

Interest is earned from short-term demand deposit accounts from a major Canadian bank.

16. Management of Capital

TMAC's objectives with respect to managing its capital are to safeguard its ability to continue as a going concern by raising sufficient funds to finance ongoing mineral property exploration and evaluation investments so that it can provide returns for shareholders and benefits for other stakeholders.

The Company defines capital as total equity plus long-term debt. Total equity is comprised of share capital, reserves and accumulated deficit. As at December 31, 2013, TMAC did not have any outstanding long-term debt or borrowings, other than the short-term Newmont Loan, accounts payable and accrued liabilities with terms of less than 90 days to maturity. The Company manages its capital structure and makes adjustments to it in light of changes in economic conditions and the risk characteristics of the underlying assets. As TMAC does not currently have cash flow from operating activities, to maintain or adjust the capital structure, the Company may issue new shares, raise debt or sell assets to raise capital.

In order to maximize ongoing exploration and evaluation activities, the Company does not pay dividends. TMAC's cash management policy permits investment of its surplus cash resources in demand deposit accounts with large Canadian chartered banks, in highly-liquid short-term guaranteed investment certificates with large Canadian Chartered banks or in highly-liquid short-term Government of Canada issued treasury bills with maturities of 90 days or less from the original date of investment.

17. Financial instruments and risk management

(a) Financial instruments hierarchy and fair values

The three levels of the fair value hierarchy with respect to required disclosures about the inputs to fair value measurements are:

- Level 1 – Unadjusted quoted prices in active markets for identical assets or liabilities;
- Level 2 – Inputs other than quoted prices that are observable for the asset or liability either directly or indirectly; and,
- Level 3 – Inputs that are not based on observable market data.

At December 31, 2013, TMAC's financial assets and liabilities are recorded and measured as follows:

Asset or Liability	Category	Subsequent Measurement
Cash and cash equivalents	Fair value through profit or loss	Fair value
Amounts receivable	Loans and receivables	Amortized cost
Accounts payables and accrued liabilities	Other liabilities	Amortized cost
Newmont Loan	Other liabilities	Amortized cost

The carrying values of cash and cash equivalents, amounts receivable and accounts payable and accrued liabilities reflected in the Statement of Financial Position approximate fair value because of the short-term maturity of these financial instruments and are classified as Level 1 in accordance with the fair value hierarchy. The fair value of the Newmont Loan is $15,027,000 at December 31, 2013 and is classified as Level 2 in accordance with the fair value hierarchy.

(b) Commodity price risk

TMAC's ability to develop its properties and its future profitability are directly related to the market price of gold. The price of gold is affected by numerous factors including global consumption and demand for gold, international economic and political trends, fluctuations in the value of the US dollar and other currencies, interest rates and inflation. The current and forecast price of gold is a key factor in determining if the property, plant and equipment are impaired at the period end date.

(c) Liquidity Risk

Liquidity risk is the risk that TMAC will not be able to meet its financial obligations as they come due and that TMAC will be forced to sell financial assets at a value that is less than what they are worth or the Company may be unable to settle or recover a financial asset at all.

The ultimate responsibility for liquidity risk rests with the Board, which has approved an appropriate liquidity risk management framework for management of the Company's short, medium and long-term funding and liquidity requirements. The Company's cash requirements and balances are projected based on estimated future requirements. TMAC plans to meet these requirements through a mix of available funds, equity financing, sale of mining assets and project debt financing. Continuing operations are dependent on the Company's ability in the near term to access sufficient capital to complete TMAC's exploration and evaluation activities, identify commercial gold reserves and to ultimately have profitable operations. All accounts payable and accrued liabilities at December 31, 2013 have contractual maturities of less than 90 days and are subject to normal trade terms. At period end, TMAC had sufficient funds to settle these liabilities.

(d) Credit Risk

Credit risk arises when a failure by counterparties to discharge their obligations could reduce the amount of future cash inflows from financial assets on hand at the period end date. TMAC's financial assets are cash and amounts receivables. Management considers the credit risk on cash to be limited because the counterparty is an established well-known major Canadian chartered bank. During the period ended December 31, 2013, there were minimal amounts receivable, no allowance for bad debts were required on the amounts receivable and no amounts were past due as the receivable was primarily comprised of recoverable value added sales taxes. The Company did not have any customers or trade receivables at December 31, 2013. The maximum exposure to credit risk at December 31, 2013 is represented by the carrying amount of the cash and cash equivalents and amounts receivable on the Statement of Financial Position.

(e) Foreign Currency Risk

Foreign currency risk is the risk that a variation in the exchange rates between the Canadian dollar and foreign currencies could affect TMAC's operating and financial results. TMAC is exposed to foreign currency risk as the Company holds small amounts of cash in US dollars and has other financial liabilities that are denominated in either US dollars or other foreign currencies. TMAC's management monitors the exchange rate fluctuations on a regular basis and does not use currency derivative instruments to manage its exposure to foreign currency fluctuations.

At December 31, 2013, the carrying amounts of TMAC's foreign currency-denominated net financial assets are approximately as follows:

	Net financial Assets/ (liabilities) $000s	Effect of a 10% change in exchange rates on loss $000s
Australian dollar	(30)	(3)
South African Rand	298	30
US dollar	(144)	(14)

(f) Interest rate risk

TMAC's accounts payable and accrued liabilities are non-interest bearing and have contractual maturities of less than 90 days.

As at December 31, 2013, TMAC's interest bearing assets are cash and cash equivalents and are invested in demand deposit accounts with a large Canadian chartered bank.

18. Related party transactions

(a) Transactions with Newmont

Newmont is a related party as a result of its ownership interest in TMAC's Common Shares. The transactions with Newmont are as follows;

	Transitional services (i) $000s	Payments on behalf of TMAC $000s	Total $000s
Balance at October 30, 2012	**-**	**-**	**-**
Transactions	1,201	505	1,706
Payments	(1,201)	(505)	(1,706)
Balance at December 31, 2013	**-**	**-**	**-**

(i) Transition services

Newmont and TMAC entered into a Transition Services Agreement whereby TMAC can request assistance from Newmont at TMAC's expense for certain services for a specified period of time ending on September 30, 2013. Newmont made available certain Newmont employees for secondment to TMAC until September 30, 2013, after which date they were either hired by TMAC or returned to Newmont. These employees had specific skill sets that TMAC did not have at the time and were important for running the Hope Bay site. The seconded employees were under the direction of TMAC. The secondees were charged out by Newmont to TMAC at full cost reimbursement plus an administrative charge.

(ii) The Investor Rights Agreement

The Investor Rights Agreement provides Newmont and TMAC certain rights with respect to the Board and the Common Shares as follows:

- From the date of Closing until the earlier of (i) 18 months from the closing of the IPO Financing; and (ii) the date on which the Newmont ownership percentage becomes less than 20%, Newmont shall not, without the prior written consent of TMAC or except in certain limited circumstances, acquire or agree to acquire or make any proposal to acquire any securities or any material assets of TMAC;
- Newmont will not sell any of its Common Shares of TMAC for a period of 18 months following the IPO Financing. Sales after that date may only be made in certain specified manners;
- Provided that Newmont owns greater than or equal to 20% of TMAC's fully diluted Common Shares, Newmont has the right to participate in any equity financing offering that TMAC engages in that will allow Newmont to maintain its then current percentage ownership interest. This participation right does not apply to the IPO Financing, among other things;
- For a period of 18 months after the IPO Financing, if Newmont wishes to sell or otherwise dispose of a number of Common Shares held by Newmont which represents greater than or equal to 5% of the then outstanding Common Shares in any 6 month period;
- Subject to certain restrictions, Newmont will also have the right to piggy-back on any Common Share issuance that TMAC wishes to do by way of a prospectus and, provided that Newmont owns more than 20% of the fully diluted Common Shares, to require TMAC to file a prospectus;
- The Board shall have no more than 10 members;
- The Board shall initially have two nominees of Newmont. Provided that Newmont has an ownership percentage greater than or equal to 20% Newmont may nominate two directors: Should Newmont's ownership percentage be greater than or equal to 10% but less than 20%, Newmont may nominate one Board member; and,

- For a period of two years after the closing of the IPO Financing, Newmont will not vote their respective Common Shares at meetings of TMAC shareholders against management's recommendations, except in the case of fundamental changes, acquisitions, financings and change of control transactions, in which case Newmont will be entitled to vote their respective Common Shares at their discretion (note 21).

(iii) Newmont Loan

The Newmont Loan of $15,000,000 was fully drawn down on December 19, 2013 (notes 10 and 21).

(iv) Letters of Credit

As described in note 3, TMAC agreed to indemnify Newmont for any funds expended in connection with draws made on the Letters of Credit associated with TMAC's environmental rehabilitation obligations under the permits that are held by Aboriginal Affairs and Northern Development Canada, the Department of Fisheries and Oceans and the KIA. TMAC also agreed to permit Newmont to enter on and access Hope Bay and to possess and use any of the Hope Bay assets for the purpose of conducting any work required to ensure compliance with the environmental rehabilitation obligations under the permits to the extent that TMAC does not conduct such work in a manner acceptable to Newmont, acting reasonably, as in the opinion of Newmont is necessary or desirable to satisfy the obligations that are secured by the Letters of Credit. TMAC will reimburse Newmont for its direct costs incurred in performing this work. TMAC shall arrange for replacement bonds and/or letters of credit on or before the earlier of 30 days following the closing of the IPO Financing and June 30, 2014. Until such time as TMAC has arranged for the replacement bonds or letters of credit, Newmont shall use commercially reasonable efforts to maintain (and shall cause any applicable affiliate of Newmont to maintain) the applicable financial assurance and other financial sureties by continuing to meet its obligations under the Letters of Credit and obtaining any renewals or additions that may be necessary. The Letters of Credit are secured by a second general security agreement in favor of Newmont.

As at December 31, 2013, the amount of the Letters of Credit issued by Newmont with respect to the Hope Bay Gold Project environmental rehabilitation obligations totaled approximately $18 million.

In addition to the approximately $18 million of Letters of Credit that Newmont has issued on behalf of Hope Bay for environmental rehabilitation liabilities, Newmont had provided a corporate guarantee to the KIA of up to $8.0 million of additional environmental rehabilitation assurance to, essentially, provide twice the amount of assurance as required by the Federal regulators on certain aspects of the Hope Bay site environmental rehabilitation (the "**Overbonding Amount**"). On September 13, 2013, TMAC and the KIA renewed the Commercial Lease on Hope Bay for a period of five years. In conjunction with the renewal of the Commercial Lease, TMAC provided the KIA with a corporate guarantee in the amount of $8.0 million with respect to the Overbonding Amount secured by a general security agreement (the "**KIA GSA**"). The KIA GSA is in second position to the Newmont general security agreements.

(v) Newmont NSR

As part of the Transaction Agreement, on March 12, 2013, TMAC assumed the Newmont NSR which provides for a 1% net smelter royalty on all saleable metals produced by TMAC from Hope Bay and an area of interest surrounding the Hope Bay property.

(b) Transactions with a director

The initial shareholder, director and president of the Company advanced $150,000 to TMAC in the period prior to the Initial Equity Financing to fund TMAC's activities to that date. The advance did not bear interest and was repaid shortly after completion of the Initial Equity Financing.

(c) Compensation of key management personnel

The compensation of directors and other key members of management personnel during the year was as follows:

	Period ended December 31, 2013 $000s
Management compensation	1,388
Directors fees	-
	1,388

19. Segmented information

TMAC owns one mineral property, Hope Bay, operates in one geographic location, Nunavut, Canada and in one industry, mining. Accordingly, the chief decision maker considers TMAC to currently have one segment and, therefore, segmented information is not presented.

20. Commitments and contingencies

TMAC subleases office space in Toronto on a month to month basis at an approximate cost of $7,000 per month.

TMAC has estimated the required annual landholding payments and environmental compliance work for Hope Bay to be approximately $1.7 million and $3.0 million, respectively. All of these payments are not contractual commitments but are required to maintain the Company's permits and land tenure agreements in good standing. Certain parts of Doris are permitted as an operating mine site and environmental and monitoring costs are required to maintain these permits. The landholding agreements with the KIA and NTI are being renegotiated and the estimate for these costs could change as negotiations progress. Some of the payments in the current agreements are dependent upon certain future milestones of which the timing is uncertain.

The Company has equipment stored in various locations including the partially completed processing plant stored in South Africa. The equipment is stored on a month to month basis for an approximate cost of $50,000 per month.

As part of the purchase of Hope Bay on March 12, 2013, TMAC acquired a partially completed processing plant with most of the components thereof located in storage areas in Durban, South Africa. Pursuant to the rules of the South African Revenue Service ("**SARS**"), TMAC does not qualify as an "enterprise" in South Africa and, therefore, does not qualify as a "registrant" for purposes of South Africa's 14% value added tax ("**VAT**"). Exports out of South Africa, however, are normally VAT exempt provided that the goods are exported within two months of a purchase and sale. As TMAC was not in a position to export the processing plant from South Africa within the two month period following March 12, 2013 permitted by SARS, TMAC applied for a ruling from SARS, to extend the period of time to export the processing plant. SARS provided a favorable ruling extending the date that TMAC can export the processing plant on a VAT exempt basis to May 31, 2014. Should the processing plant not be exported within the specified time period, the goods would lose their VAT exempt status and would,

therefore, become subject to VAT at an estimated amount of $600,000. As TMAC does not expect to be able to export the processing plant by May 31, 2014, and that TMAC may use South African manufacturers to complete many of the processing plant components, TMAC intends to request SARS to extend their ruling to mid-2015. As the likelihood of obtaining a favorable ruling is currently unknown no amounts have been recorded in the financial statements for this contingent liability.

21. Subsequent events

(a) CEE Renunciation

In January 2014, TMAC filed with the Canada Revenue Agency, the forms renouncing, with an effective date of December 31, 2013, the $4,339,000 of CEE to the FT Share investors (note 11).

(b) Second Equity Financing

On April 28, 2014, the Company completed a Second Equity Financing of 43,943,700 Common Shares (the "**Second Non-FT Shares**") at $1.75/share, for gross proceeds of $76,901,000, and 434,000 of flow-through Common Shares (the "**Second FT Shares**") at $2.00/share, for gross proceeds of $868,000, for an aggregate amount of $77,769,000. Costs associated with the completion of the Second Non-FT Shares issuance will be charged to share capital on the Statement of Changes in Shareholders' Equity.

Resource Capital Fund VI L.P. ("**RCF**"), a private equity investment firm, acquired 37,200,000 of the Second Non-FT Shares for a total of $65,100,000 which, after closing of this financing results in RCF owning approximately 29.3%, and Newmont owning 45.2% of the issued and outstanding Common Shares, respectively. In accordance with the RCF subscription agreement, RCF was granted certain investor rights, including:

- Provided that RCF owns greater than or equal to 10% of TMAC's issued and outstanding Common Shares, RCF has the right to participate in any equity financing offering that TMAC engages in up to such number of Common Shares that will allow RCF to maintain a percentage ownership interest in the outstanding Common Shares that is the same as the RCF ownership percentage immediately prior to completion of the offering;
- The Board shall have no more than 10 members;
- Provided that RCF owns greater than or equal to 10% of TMAC's issued and outstanding Common Shares, RCF has the right to nominate one Board member. Should RCF own greater than or equal to 30% of TMAC's issued and outstanding Common Shares, RCF has the right to nominate one additional independent Board member, and;
- Voting its Common Shares in favour of the SOP and RSP at TMAC's 2014 and 2015 annual general meetings of shareholders.

In addition, the Investor Rights Agreement with Newmont was amended to permit Newmont to vote their Common Shares at their discretion under all circumstances other than for share-based payment compensation at TMAC's 2014 and 2015 respective annual general meetings of shareholders (note 18).

The subscription agreement for the Second FT Shares requires TMAC to incur $868,000 of qualifying CEE and renounce the CEE to the Second FT Shares shareholders with an effective date of December 31, 2014. The $0.25/share premium of the Second FT Shares over the Second Non-FT Shares results in an other liability in the amount of $109,000 which amount will be charged to share capital.

(c) Prepayment of Newmont Loan

In conjunction with the Second Equity Financing, TMAC issued Newmont a notice of prepayment of the Newmont Loan advising that TMAC will repay the entire outstanding amount of the Newmont Loan plus interest on April 28, 2014. Newmont declined to convert the Newmont Loan to Common Shares and TMAC paid Newmont $15,265,000, whereupon the Newmont Loan was cancelled and the Company will take measures to discharge the Newmont general security agreement with respect to the Newmont Loan.

(d) Share based payments

On April 28, 2014, TMAC granted 4,467,000 Options with a grant price of $1.75 per option to the directors, executives and employees of the Company. The options vest in 3 equal tranches, the first vesting immediately and the remaining two vesting on each the following two anniversaries of the grant. The options expire on April 27, 2019.

Appendix 4

(for Chapter 4, Project Description)

4-A SRK, November 2014 Memo – Hope Bay Project: Madrid North Bulk Sample: Surface Infrastructure

4-B SRK, November 2014 Memo – Hope Bay Project: Madrid South Bulk Sample: Surface Infrastructure

4-C SRK, November 2014 Memo – Hope Bay Project: Madrid South Bulk Sample: Madrid South All-Weather Road

Appendix 4-A

SRK, November 2014 Memo – Hope Bay Project: Madrid North Bulk Sample: Surface Infrastructure

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Memo

To:	Joh Roberts, TMAC	**Client:**	TMAC Resources Inc.
From:	Lowell Wade Maritz Rykaart	**Project No:**	1CT022.001.410
Cc:		**Date:**	November 27, 2014
Subject:	Hope Bay Project: Madrid North Bulk Sample: Surface Infrastructure		

1 Introduction

TMAC Resources Inc. is currently in the process of constructing their Doris North Project (Project) in the Kitikmeot region of Nunavut, Canada. Concurrent with this, TMAC is carrying out regional exploration and have identified the Madrid North area as a potential high quality exploration target. However, advanced exploration and extraction of a bulk sample is needed to verify economic feasibility and milling process methods.

The Madrid North area is located about 9 km south of the Project, along the Doris-Windy All-Weather Road. An access road will turn off the Doris-Windy All-Weather Road at kilometre 8+600 and head west up to the portal and infrastructure pad, as well as waste the rock pile and ore stockpile. At kilometre 9+000 a second turn off, on the west side of the Doris-Windy All-Weather Road, will lead to the vent raise pad.

This memo provides complete details of the Madrid North surface infrastructure pads and access roads. This should be read in conjunction with the attached set of conceptual level engineering drawings (Attachment 1). Water management at Madrid South has been discussed in SRK (2014a) and closure activities have been discussed in SRK (2014b).

2 Design Concept

All of the infrastructure pads and all-weather access roads associated with the Hope Bay Project are located on Inuit Owned Land (IOL), administered by the Kitikmeot Inuit Association (KIA).

The design concept of the Madrid North pads are based on the same principles as adopted for elsewhere on the Project which is to construct all facilities either on bedrock or on rock fill pads at least 1 m thick to preserve permafrost. Site layouts are designed to minimize the overall footprint and all attempts are made to minimize the volume of contact water. Contact water is captured and contained in secure ponds for appropriate disposal.

Site access roads are considered private roads, administered and controlled entirely by TMAC. Although none of these access roads are used as, or classified as mine haul roads in accordance with the Nunavut Mine Safety Act pertaining to haul roads, TMAC has opted to ensure that all site roads are designed in accordance with the minimum requirements as set out for mine haul roads in the Nunavut Mine Safety Act.

All site roads use the same primary design criteria as the 10 km long Doris-Windy All-Weather Road, which includes allowing for dual lane traffic for frequently travelled vehicles such as trucks and crew busses, while allowing single lane traffic for occasional oversize vehicles. Strategically placed road turnouts are provided to facilitate single lane use.

3 Site Layout Alternatives

TMAC considered three surface infrastructure alternatives for the waste rock pile at the Madrid North portal location:

- South Waste Rock Pile. The waste rock pile would be placed in the gully located to the southwest of the portal. The pollution control pond berm, required to capture the contact water, would be located on disturbed ground that has experienced permafrost degradation and would tie into the Doris-Windy All-Weather Road. To provide containment capacity the berm would need to be up to 7 m in height. This option was not selected because of the berm height.

- East Waste Rock Pile. The waste rock pile would be placed in the gully located to the south east of the portal. The pollution control pond berm required to capture the contact water would be located in proximity to the vent raise pad with access from the Doris-Windy All-Weather Road. To provide containment capacity the berm would need to be up to 6 m in height. This option was not selected because of the berm height and the proximity to the vent raise pad.

- North Waste Rock Pile. The waste rock pile as well as the ore stockpile would be placed in the large open area north of the portal. The pollution control pond berm required to capture the contact water would only need to be 3 m in height. This option also provides suitable grades for access road construction to the pollution control pond. This option was the preferred option.

4 System Design

4.1 Design Criteria

The infrastructure associated with the underground activities at Madrid North consists of roads, a waste rock pad, an ore stockpile pad, a portal and portal upper pad, a fuel transfer station pad and a vent raise pad.

The infrastructure components associated with operations, the underground portal and the vent raise are summarized in Table 1.

Table 1: Surface Infrastructure Facilities Associated With the Portal and Vent Raise

Infrastructure Component	Surface Area	Limitations	Comments
Waste Rock Pad	21,530 m^2	Within 500 m haul distance from portal; haul road cannot exceed 7% grade	Storage for 285,000 tonnes minimum of waste rock
Ore Stockpile Pad	5,560 m^2	Within 500 m haul distance from portal; haul road cannot exceed 7% grade	Storage for 50,000 tonnes minimum of ore
Shop	450 m^2 (15x30 m)	Horizontal pad of rectangular shape	
Laydown Area	1,000 m^2 (20x50 m) minimum		
Diesel Power Generator	19 m^2 (2.5x7.5 m)		Seacan container at the portal entrance
Site Office Trailer	30 m^2 (3x10m)		ATCO Trailer
Emergency Shelter	30 m^2 (3x10m)		Trailer
Brine Mixing Facility (BMF)	19 m^2 (2.5x7.5 m)	Required at portal	Seacan container. Also includes area for CaCl laydown
Water Storage Tank with Containment	144 m^2 (12x12m)	Required at portal	50,000L water tank assumed (tank radius ~4.4m)
Air Heating Facility	19 m^2 (2.5x7.5 m)	Required immediately adjacent to vent raise	
Fuel Tanks	Requires lined containment	(Fuel Transfer Station) (Fuel Containment Area)	75,000 L Fuel Tank 60,000 L Fuel Tank
Fuel Transfer Station Fuel Containment Area	1,258 m^2 (34x37 m) 441 m2 (21x21 m)	Drive-through facility (lined containment)	Each holds one Fuel Tank

4.2 Survey Data

The design of the Madrid North infrastructure pads and access roads are based on topographic contour maps produced from 2008 aerial photography supplied by Hope Bay Mining Limited (HBML). No detailed ground surveys have been completed.

4.3 Foundation Conditions

Comprehensive geotechnical investigations have been carried out at the Hope Bay Site (SRK 2009). This information confirms that the area lies within the zone of continuous permafrost, with the permafrost being up to 550 m deep. Permafrost temperature at the surface is about -8ºC and the active layer is generally less than 1 m thick. Laboratory and in-situ tests on disturbed and undisturbed samples indicate that the overburden soils are predominantly comprised of marine silts and clays, and the pore-water in these soils has high salinity, depressing the freezing point to -2ºC. The ice-rich overburden soils are typically between 5 and 20 m deep, before encountering competent bedrock, predominantly basalt. Bedrock is frequently exposed, rising columnar 5 to 100 m above the surrounding landscape.

Thermal modelling has determined that a 1 m minimum of rock fill cover would be required over the tundra to preserve the permafrost under the infrastructure pads (SRK 2006). Since all pads are designed to have a flat surface with minor grading for drainage, the run of quarry (ROQ) fill thickness reaches up to 7 m at places due to underlying topography.

The geotechnical design parameters for Hope Bay have been summarized in SRK (2011a).

4.4 Waste Rock Pile and Ore Stockpile

4.4.1 Design Criteria

The waste rock pad is designed to accommodate a minimum of 285,000 tonnes of waste rock while the ore stockpile pad is designed to accommodate a minimum of 50,000 tonnes of ore. Both the waste rock pad and ore stockpile pad will be a minimum of 1 m thick ROQ material placed over the original ground. The waste rock pile and ore stockpile have a haul distance of less than 500 m; avoids archaeological sites; and are more than 31 m from neighbouring water bodies.

4.4.2 Design

The overall waste rock pile design, at this location, has not been finalized; however, the waste rock pile will be constructed with an overall slope angle of 2H:1V. The waste rock pile has a base area of 21,530 m^2.

The overall ore stockpile design, at this location, has not been finalized but will be constructed with an overall slope angle of 2H:1V. The ore stockpile has a base area of 5,560 m^2.

4.5 Pollution Control Pond

4.5.1 Design Criteria

The pollution control pond has the capacity to contain contact water from the overall drainage area and 25% of annual snow coverage combined with a 100-year, 24-hour storm event which is 14,940 m^3 of water.

4.5.2 Design

There is a single pollution control pond at Madrid North. This fully lined pond is located downstream of the portal, waste rock and ore stockpile pads. The pond will be contained by a 6 m wide berm. This berm has been designed to allow for light vehicle access around the pond for regular inspection; to assist in accommodating any required maintenance; and to allow for a vacuum truck to remove any retained water. The containment berm will be constructed using ROQ material. The surface area of the pollution control pond is 13,900 m^2.

4.6 Madrid North Pads

4.6.1 Design Criteria

The design criteria for the Madrid North pads are as follows:

- Minimum 1 m fill thickness must be maintained;
- 1.5H:1.0V slopes are utilized with fill thickness less than 2 m;
- 2.0H:1.0V slopes are utilized with fill thickness greater than 2 m;
- The maximum particle size for ROQ is 500 mm for fill thickness of 850 mm, and 900 mm for fill thickness exceeding 850 mm. All material shall be free from organic matter, soil, snow and ice;
- No cut is allowed, except in designated rock quarries; and
- Safety barricades (oversize ROQ boulders, Jersey Barriers, or Berms) are to be placed along the crest where fill thicknesses are greater than 3 m.

4.6.2 Design

Pads are to be constructed using a minimum 1 m thick fill material. Typically the fill is expected to consist of minimum 0.85 m of ROQ overlain by a minimum 0.15 m thick surfacing material layer. The waste rock pad and ore stockpile pad do not require surfacing material; however, the 1 m minimum fill thickness must be maintained for permafrost protection and to allow for adequate seep drainage. All pads will be graded at 0.5% towards the pollution control pond or to assist in promoting sediment control measures.

4.7 Access and Haul Roads

4.7.1 Design Criteria

There are three road alignments within Madrid North. The first road alignment, portal pad haul road, is a 243 m long by 9.5 m wide haul road to the portal which extends from kilometre 8+600 along the Doris-Windy All-Weather Road west to the portal and infrastructure pad. The second road alignment, pond access road, is a 448 m long by 6 m wide access road which extends from the portal and infrastructure pad to the pollution control pond berm. The third road alignment, access road, is the 70 m long by 6 m wide vent raise access road which extends from kilometre 9+000 along the Doris-Windy All-Weather Road to the vent raise and infrastructure pad.

The design criteria for the access and haul roads are the same as for the Doris-Windy All-Weather Road (SRK 2012). The key design criteria are:

- Access and haul roads have a maximum grade of 7%;
- A minimum thickness of 1 m over tundra must be maintained and 0.3 m over bedrock;
- The roadway will be crowned to promote drainage by means of 0.5% surface grading in both directions from the centreline of the roadway;

- Road shoulders will be graded to 2H:1V in areas where fill thickness is at least 1.5 m and 1.5H:1V in zones where fill thickness is less than 1.5 m; and
- No cut is allowed, except in designated rock quarries, and then only to a grade at least 0.5 m above the surrounding tundra elevation.

4.7.2 Design

The all-weather roads will be constructed from ROQ material obtained from local approved and permitted rock quarries. This material will be placed in lift thicknesses that do not exceed 0.85 m and compacted using a vibratory drum compactor using a site specific compaction specification. The surfacing layer of the road consists of a 150 mm thick layer of 1¼ inch crush.

The portal pad haul road is 9.5 m wide to allow for two-way traffic, of larger vehicles, to and from the waste rock pile and ore stockpile. The pond access road and the access road to the vent raise pad have been designed with a final road crest width of 6 m to allow for one-way traffic.

4.8 Fuel Storage

4.8.1 Design Criteria

There will be two locations where fuel will be stored at Madrid North. A 75,000 L fuel transfer station, with a 75,000 L fuel tank, will be located on the fuel storage facility pad and a fuel containment area, with a 60,000 L fuel tank, will be located at the vent raise pad.

The fuel transfer station and fuel containment area are designed to contain 110% of the entire volume of the fuel tank plus 10% of the fuel transport truck as well as 25% of annual snow cover combined with a 1-in-100 year 24-hour storm event.

Each facility will consist of a fuel tank containment area and a fuel transfer apron which will contain fuel lines as well as the fuel transport truck. The entire footprint of each facility will be lined with a HDPE membrane sandwiched between two layers of 12 oz. non-woven geotextile. The floor of the containment area will be sunk into the ROQ fill of the pad, such that the crest of the liner is flush with the pad surface, and a slightly raised berm (0.3 m high above the pad surface elevation) will enclose the perimeter of the containment area and the fuel transfer apron, to prevent spills outside of the lined area. A bedding layer 0.2 m thick consisting of ¾ inch crushed rock will be placed and compacted prior to liner deployment. The liner will be covered by a lift of ¾ inch crushed rock over its entire surface, including the floor and the slopes of the containment. A second lift, 0.3 m thick, of 1 ¼ inch crushed rock will be placed on the floor of the containment, while a third lift of 1 ¼ inch crush will be placed over the footprint of the fuel transfer apron.

A sump will be installed in one corner of the containment area, and the surface of the containment area will be graded to drain toward the sump.

In addition, the fuel storage facilities will be designed to the following codes and guidelines:

- NFPA 30 – Flammable and Combustible Liquids Code 2008 Edition;
- Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products - Canadian Council of Ministers of the Environment; and
- Canada Gazette Part 1, Vol. 141, No. 14 April 7, 2007.

5 Construction Methodology

The pads and roads will be constructed with ROQ material excavated from permitted and approved quarries along the Doris-Windy All-Weather Road (Quarry A, B, and D). SRK (2008) discusses the complete details pertaining to geochemical characterization of these rock quarries confirming their suitability for use in construction. The management and monitoring of quarry development for the construction of the infrastructure pads and access roads is discussed in SRK (2010).

Surface grade material for both the surface infrastructure pads as well as access and haul roads will be from Quarry #2 and the crusher located in Quarry #2. Complete material quantities are included in Attachment 1.

All roads and pads will be constructed in accordance to SRK's Technical Specifications (SRK 2011b.

Disclaimer—SRK Consulting (Canada) Inc. has prepared this document for TMAC Resources Inc.. Any use or decisions by which a third party makes of this document are the responsibility of such third parties. In no circumstance does SRK accept any consequential liability arising from commercial decisions or actions resulting from the use of this report by a third party.

The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

6 References

SRK Consulting (Canada) Inc., 2006. Doris North Project – Thermal modeling to support design thickness for granular pads. Technical Memorandum, Prepared for Miramar Hope Bay Limited, Project Number: 1CM014.008, August 20, 2006.

SRK Consulting (Canada) Inc., 2008. Geochemical Characterization of Quarry Materials for the Doris-Windy All-Weather Road. Hope Bay Project. Report Prepared for Hope Bay Mining Limited, Project Number 1CH008.000.300. August 2008.

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SRK Consulting (Canada) Inc., 2012. Engineering Drawings for the Doris-Windy All-Weather Road, Doris Infrastructure Project, Nunavut, Canada. Revision 1 - As-Built. Drawing Package Prepared for Hope Bay Mining Ltd. Project Number 1CH008.033/.058. May 11, 2012.

SRK Consulting (Canada) Inc., 2014a. Madrid North Water Management Plan. Technical Memorandum Prepared for TMAC Resources Inc., Project Number: 1CT022.001.410. November 14, 2014.

SRK Consulting (Canada) Inc., 2014b. Hope Bay Project: Madrid Advanced Exploration Program: Conceptual Closure and Reclamation Plan. Technical Memorandum Prepared for TMAC Resources Inc., Project Number: 1CT022.001.410. October 31, 2014.

Attachment 1
Engineering Drawings for the Madrid North Surface Infrastructure

Engineering Drawings for the Madrid North Surface Infrastructure, Hope Bay Project, Nunavut, Canada

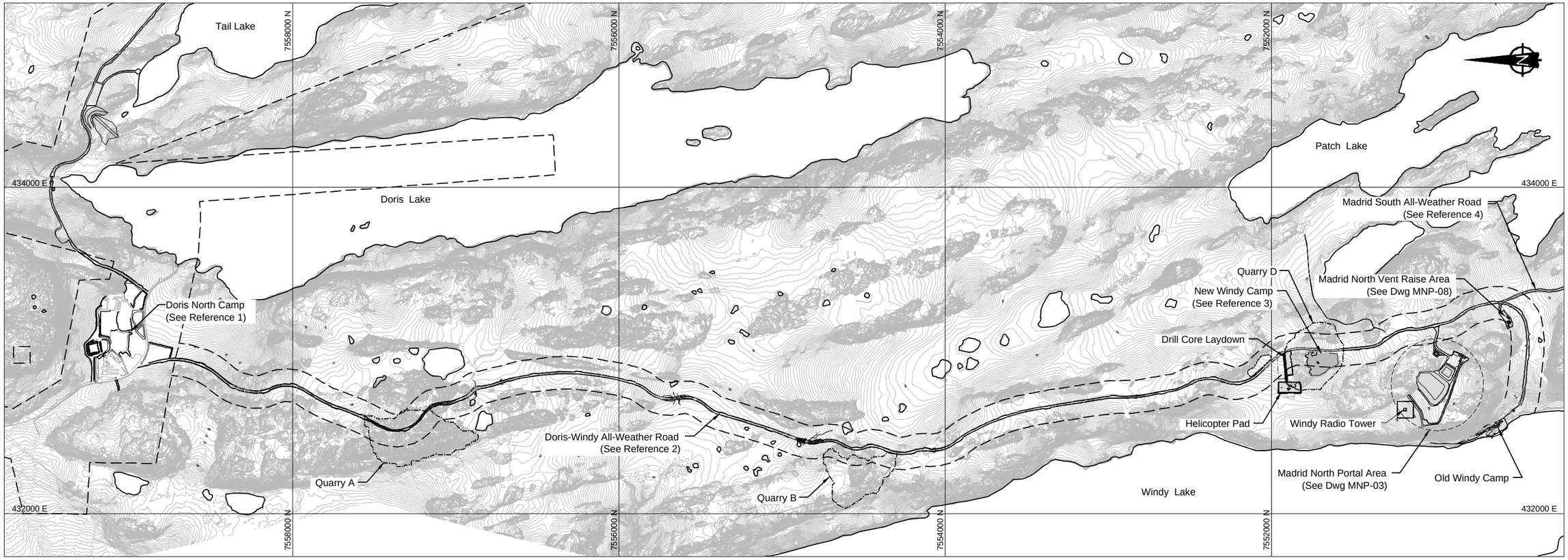
ACTIVE DRAWING STATUS

DWG NUMBER	DRAWING TITLE	REVISION	DATE	STATUS
MNP-01	Engineering Drawings for the Madrid North Surface Infrastructure, Hope Bay Project, Nunavut, Canada	E	Oct. 31, 2014	Minor Edits
MNP-02	General Arrangement Doris North Camp to Madrid North Portal	C	Oct. 31, 2014	Minor Edits
MNP-03	Site Layout Portal	D	Oct. 31, 2014	Minor Edits
MNP-04	Portal Access Road and Pond Access Road Profiles	B	Oct. 31, 2014	Minor Edits
MNP-05	Sections A and B	D	Oct. 31, 2014	Minor Edits
MNP-06	Typical Fuel Transfer Station	D	Oct. 31, 2014	Minor Edits
MNP-07	Typical Fuel Transfer Station Sections	D	Oct. 31, 2014	Minor Edits
MNP-08	Site Layout Vent Raise	D	Oct. 31, 2014	Minor Edits
MNP-09	Vent Raise Section and Profile	C	Oct. 31, 2014	Minor Edits
MNP-10	Berm and Barrier Details	C	Oct. 31, 2014	Minor Edits
MNP-11	Animal Crossing Plan and Section and Culvert Section	C	Oct. 31, 2014	Minor Edits
MNP-12	Material List and Quantity Estimates	D	Oct. 31, 2014	Minor Edits

TMAC RESOURCES

srk consulting

PROJECT NO: 1CT022.001
Revision E
October 31, 2014
Drawing MNP-01



NOTES

1. Topographic contour data for the terrain model were provided by Hope Bay Mining, and is based on 2007 Aerial Photography. Contour intervals are 0.5m.
2. The co-ordinate system is UTM NAD 83, Zone 13.
3. All dimensions are in metric units, unless specifically mentioned.
4. Notes in this drawing apply to all other active drawings.

REFERENCES

1) Engineering Drawings for the Doris North Camp Area, Doris North Project, Nunavut, Canada. Revision AB1. As-Built Drawings Prepared for Hope Bay Mining Limited. Project Number 1CH008.033. May 18, 2012
2) Engineering Drawings for the Doris-Windy All-Weather Road, Doris Infrastructure Project, Nunavut, Canada. Revision AB1. As-Built Drawings Prepared for Hope Bay Mining Ltd. Project Number: 1CH008.033/.058. May 11, 2012
3) Engineering Drawings for the New Windy Camp, Doris North Project, Nunavut, Canada. Revision 3. Issued for Construction Drawings Prepared for Hope Bay Mining Ltd. Project Number 1CH008.033. October 17, 2011
4) Engineering Drawings for the Madrid South All-Weather Road, Hope Bay Project, Nunavut, Canada. Revision D. Issued for Discussion Drawings Prepared for TMAC Resources Inc. Project Number 1CT022.001.410. October 31, 2014

0 200 400 600 800 1000
Scale in Metres

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
C	Minor Edits	LW	EMR	31Oct14
B	Minor Edits	LW	EMR	12June14
A	Issued for Discussion	LW	EMR	14Mar14

REVISIONS

PROFESSIONAL ENGINEERS STAMP

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DESIGN: LW | DRAWN: NV | REVIEWED: EMR
CHECKED: LW/EMR | APPROVED: EMR | DATE: Oct. 2014
FILE NAME: 1CT022.001_Madrid_North_Portal Overview.dwg

TMAC RESOURCES

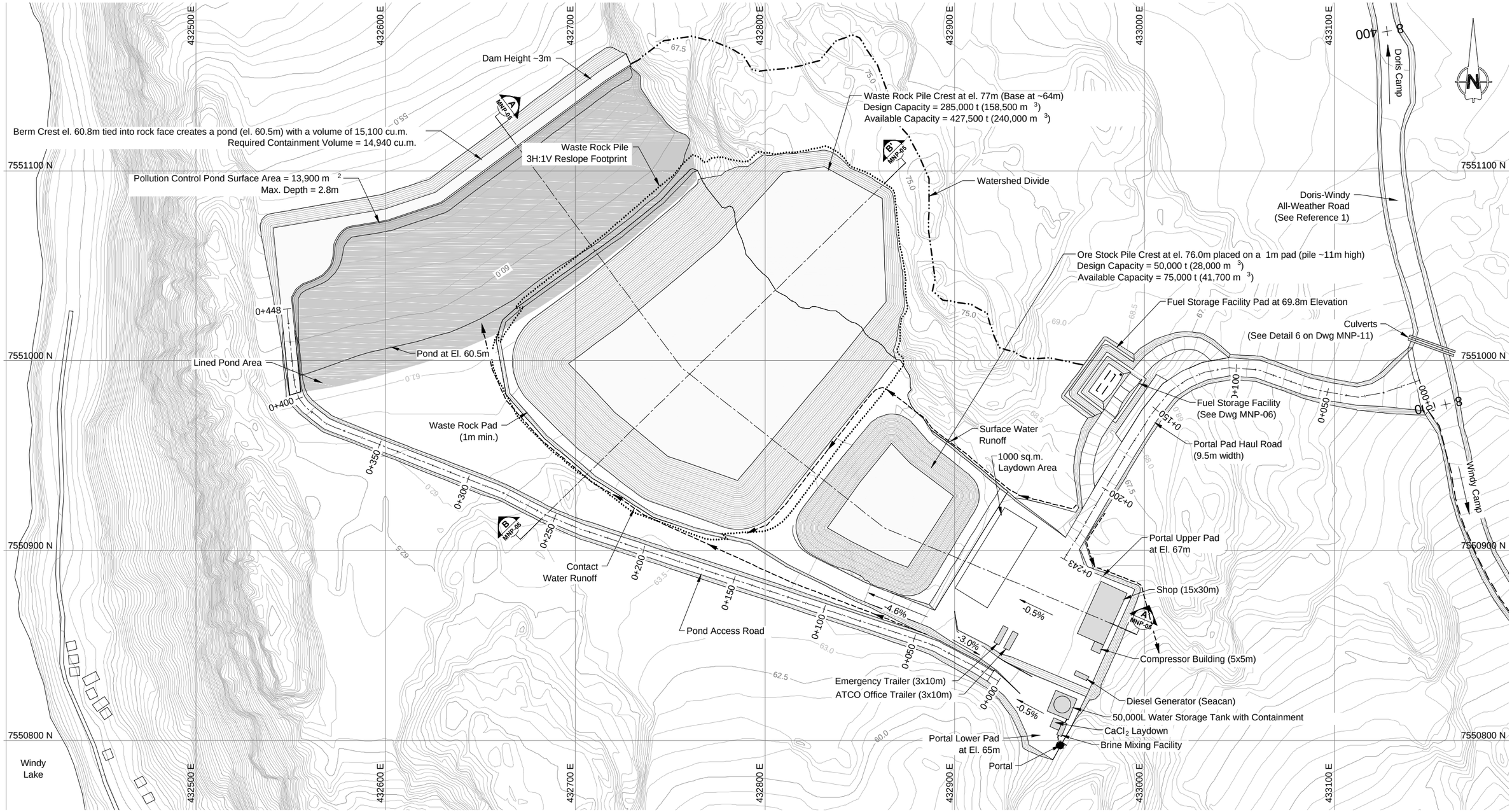
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SRK JOB NO.: 1CT022.001

Madrid North Surface Infrastructure

DRAWING TITLE:
General Arrangement
Doris North Camp to Madrid North Portal

DRAWING NO. MNP-02 | SHEET 2 OF 11 | REVISION NO. C

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NOTES

1. All dimensions in metres unless noted otherwise.
2. Notes in this drawing apply to all other active drawings.

REFERENCE

1) Engineering Drawings for the Doris-Windy All-Weather Road, Doris Infrastructure Project, Nunavut, Canada. Revision AB1. As-Built Drawings Prepared for Hope Bay Mining Ltd. Project Number: 1CH008.033/.058. May 11, 2012

0 10 20 30 40 50
Scale in Metres

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REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
D	Minor Edits	LW	EMR	31Oct14
C	Minor Edits	LW	EMR	17Sep14
B	Minor Edits	LW	EMR	25Apr14
A	Issued for Discussion	LW	EMR	14Mar14

REVISIONS

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DESIGN:	DRAWN:	REVIEWED:
LW	NV	EMR
CHECKED:	APPROVED:	DATE:
LW/EMR	EMR	Oct. 2014

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TMAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.001

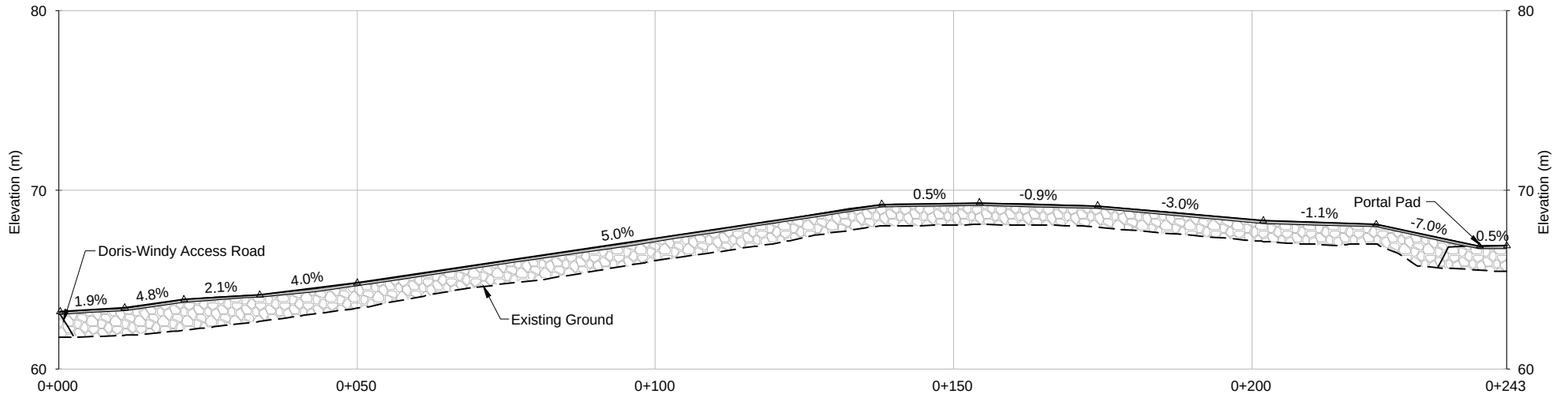
Madrid North Surface Infrastructure

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Site Layout Portal

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MNP-03	3 OF 11	D

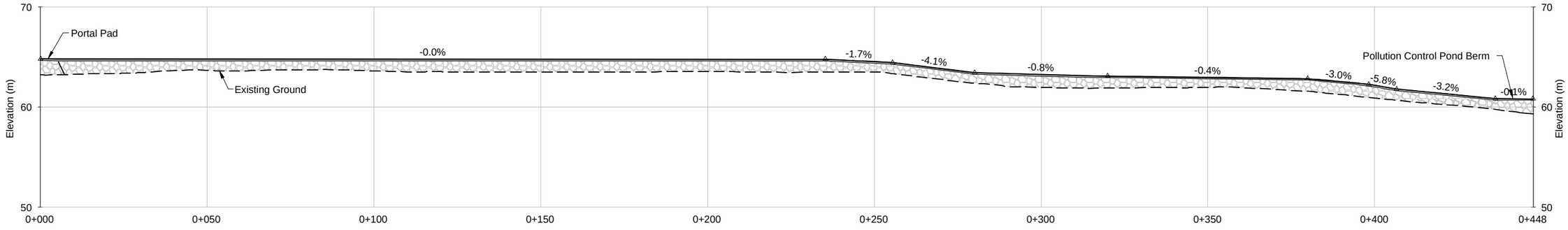
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PORTAL HAUL ROAD PROFILE

0 5 10 15 20 25

Horizontal Scale in Metres
Vertical Exaggeration 3X



POND ACCESS ROAD PROFILE

0 5 10 15 20 25

Horizontal Scale in Metres
Vertical Exaggeration 3X

LEGEND

- Existing ground surface
- Surfacing Material
- Run of Quarry Material
- Point of Intersection
- 6.1% Grade

NOTES

1. All dimensions in metres unless noted otherwise.
2. Notes in this drawing apply to all other active drawings.

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REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
B	Minor Edits	LW	EMR	31Oct14
A	Issued for Discussion	LW	EMR	14Mar14

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DESIGN:	DRAWN:	REVIEWED:
LW	NV	EMR
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LW/EMR	EMR	Oct. 2014

FILE NAME: 1CT022.001_Madrid_North_Portal.dwg

TMAC RESOURCES

HOPE BAY PROJECT

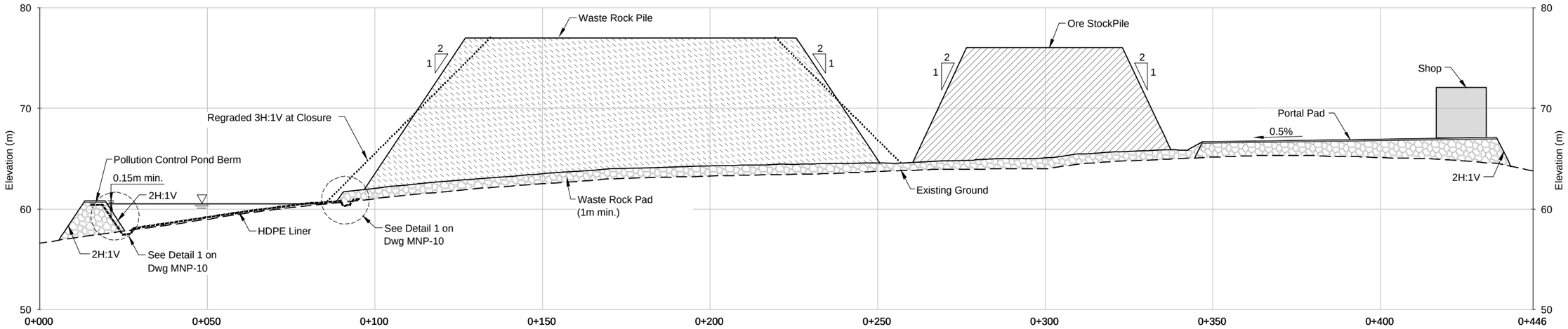
SRK JOB NO.: 1CT022.001

Madrid North Surface Infrastructure

DRAWING TITLE:

Portal Access Road and
Pond Access Road Profiles

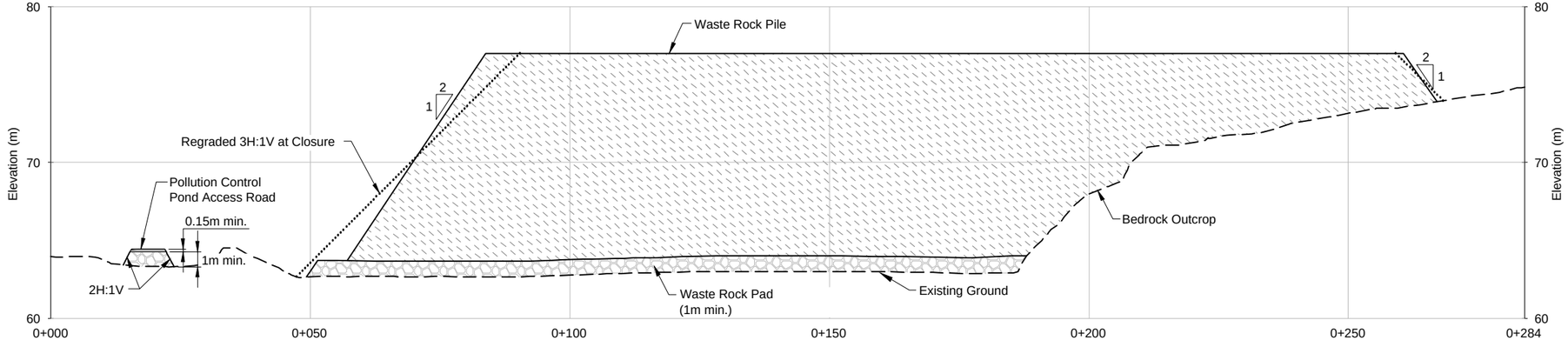
DRAWING NO.	SHEET	REVISION NO.
MNP-04	4 OF 11	B



A MNP-03 **SECTION A**

0 5 10 15 20 25

Horizontal Scale in Metres
Vertical Exaggeration 3X



B MNP-03 **SECTION B**

0 5 10 15 20 25

Horizontal Scale in Metres
Vertical Exaggeration 3X

LEGEND

- Existing ground surface
- Surfacing Material
- Run of Quarry Material
- Waste Rock
- Ore Stockpile

NOTES

1. All dimensions in metres unless noted otherwise.
2. Where the thickness of the pads is greater than 3.0m allow for the placement of barriers.
3. The barriers are to consist of boulders larger than 1m in diameter, jersey-barriers (1.82 long X 1.37m high X 0.61m wide) or a rock fill berm 0.5m high. Maximum spacing between barriers is 3.3m.
4. Notes in this drawing apply to all other active drawings.

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
D	Minor Edits	LW	EMR	31Oct14
C	Minor Edits	LW	EMR	17Sep14
B	Minor Edits	LW	EMR	25Apr14
A	Issued for Discussion	LW	EMR	14Mar14

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TMAC RESOURCES

HOPE BAY PROJECT

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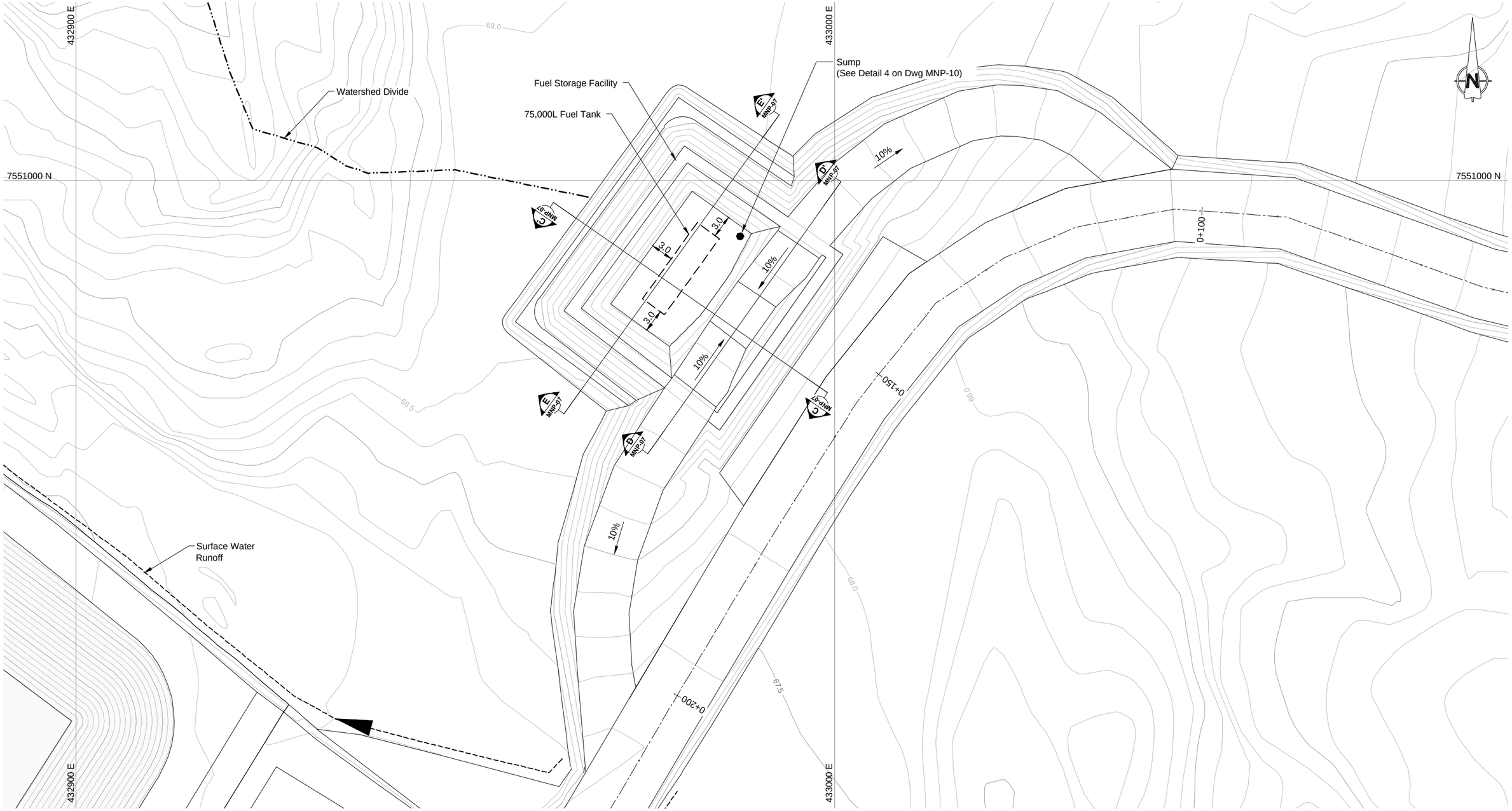
Madrid North Surface Infrastructure

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Sections A and B

DRAWING NO.	SHEET	REVISION NO.
MNP-05	5 OF 11	D

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NOTES

1. All dimensions in metres unless noted otherwise.
2. Notes in this drawing apply to all other active drawings.

0 2 4 6 8 10
Scale in Metres

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
D	Minor Edits	LW	EMR	31Oct14
C	Minor Edits	LW	EMR	12June14
B	Minor Edits	LW	EMR	25Apr14
A	Issued for Discussion	LW	EMR	14Mar14

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TMAC RESOURCES

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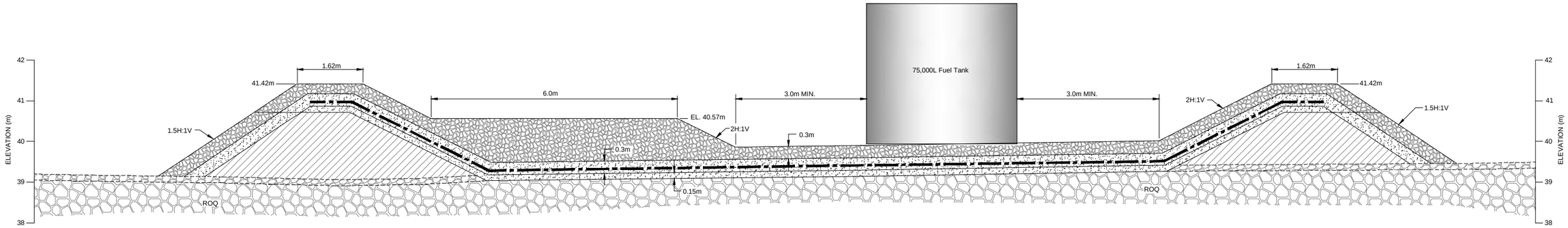
Madrid North Surface Infrastructure

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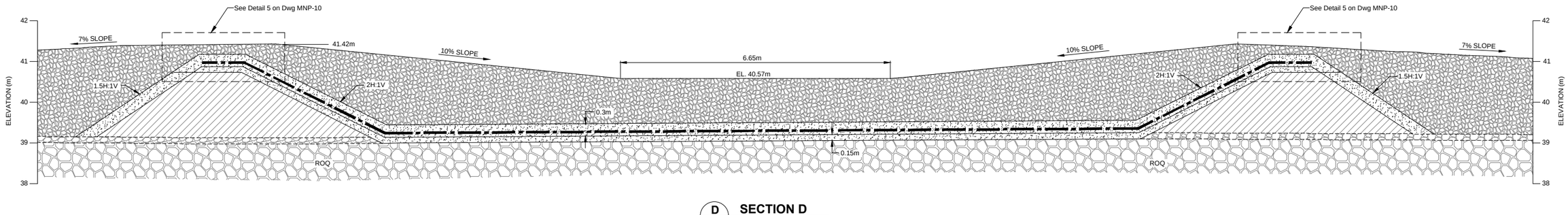
Typical Fuel Transfer Station

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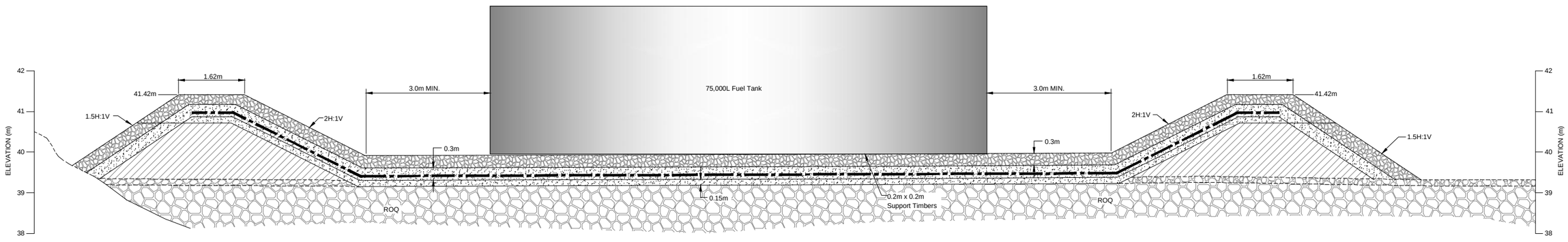
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C MNP-06 **SECTION C**



D MNP-06 **SECTION D**



E MNP-06 **SECTION E**

LEGEND

- ¾" Crush Finishing Material
- 1 ½" Crushed Material
- 6" Compacted Jaw-Run Material
- Run of Quarry Material
- Liner System

0 0.5 1 1.5 2 2.5
Scale in Metres

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REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
D	Minor Edits	LW	EMR	31Oct14
C	Minor Edits	LW	EMR	17Sep14
B	Minor Edits	LW	EMR	12June14
A	Issued for Discussion	LW	EMR	14Mar14

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LW/EMR	EMR	Oct. 2014

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TMAC RESOURCES

HOPE BAY PROJECT

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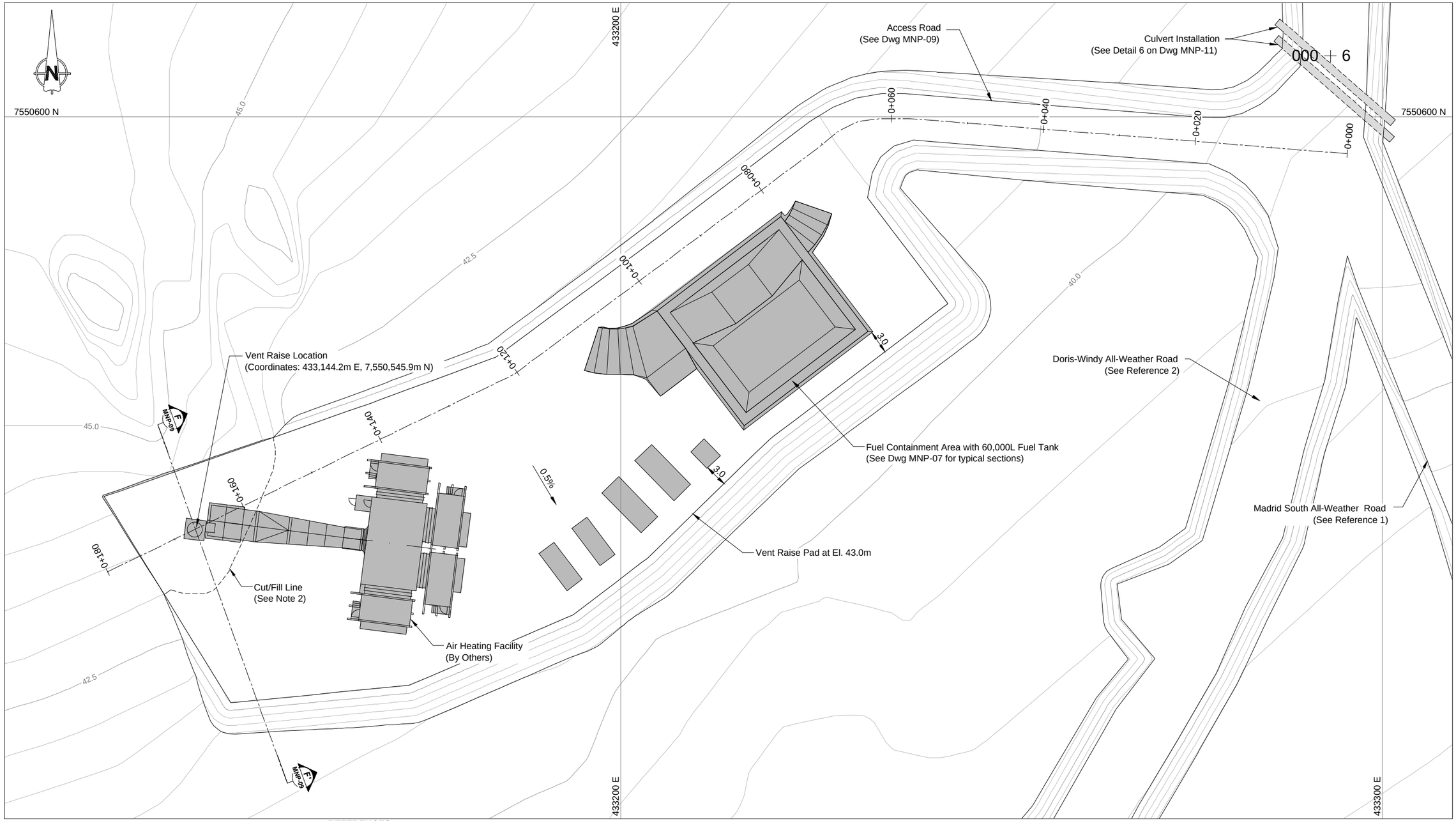
Madrid North Surface Infrastructure

DRAWING TITLE:

Typical Fuel Transfer Station Sections

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MNP-07	7 OF 12	D

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NOTES

1. All dimensions in metres unless noted otherwise.
2. Cut into bedrock outcrop required for construction of vent raise collar.
3. Notes in this drawing apply to all other active drawings.

REFERENCES

1) Engineering Drawings for the Madrid South All-Weather Road, Hope Bay Project, Nunavut, Canada. Revision D. Issued for Discussion Drawings Prepared for TMAC Resources Inc. Project Number 1CT022.001.410. October 31, 2014

2) Engineering Drawings for the Doris-Windy All-Weather Road, Doris Infrastructure Project, Nunavut, Canada. Revision AB1. As-Built Drawings Prepared for Hope Bay Mining Ltd. Project Number: 1CH008.033/.058. May 11, 2012

0 2 4 6 8 10
Scale in Metres

REFERENCE DRAWINGS				REVISIONS				
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				A	Issued for Discussion	LW	EMR	14Mar14

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TMAC RESOURCES

HOPE BAY PROJECT

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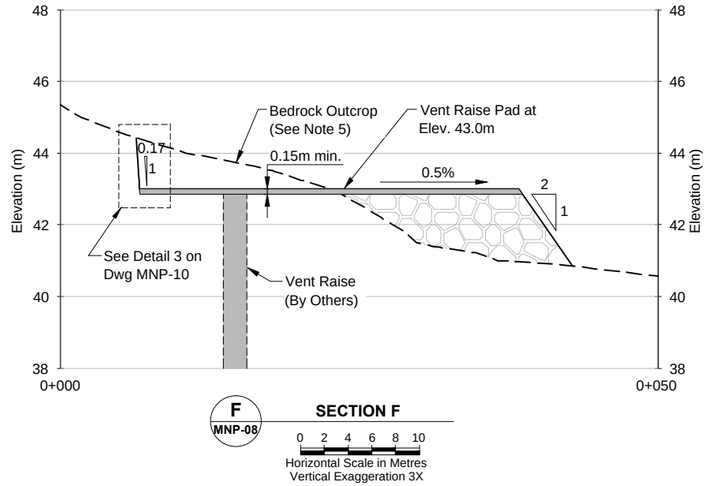
Madrid North Surface Infrastructure

DRAWING TITLE:

Site Layout Vent Raise

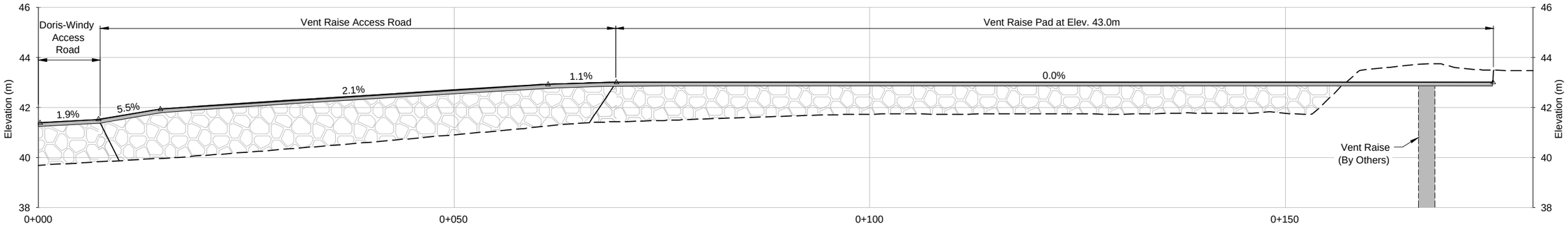
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MNP-08	8 OF 11	D

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F MNP-08 **SECTION F**

0 2 4 6 8 10
Horizontal Scale in Metres
Vertical Exaggeration 3X



VENT RAISE PAD AND ACCESS ROAD PROFILE

0 2 4 6 8 10
Horizontal Scale in Metres
Vertical Exaggeration 3X

LEGEND

- Existing ground surface
- Surfacing Material
- Run of Quarry Material

NOTES

1. All dimensions in metres unless noted otherwise.
2. Where the thickness of the pads is greater than 3.0m allow for the placement of barriers.
3. The barriers are to consist of boulders larger than 1m in diameter, jersey-barriers (1.82 long X 1.37m high X 0.61m wide) or a rock fill berm 0.5m high. Maximum spacing between barriers is 3.3m.
4. Extents of bedrock outcrop are based on 2007 aerial orthophoto and ground inspection. To ensure layouts match site conditions exact extents of bedrock outcrops are to be surveyed prior to any construction activities.
5. Cut into bedrock outcrop required for construction of vent raise collar.
6. Notes in this drawing apply to all other active drawings.

REFERENCE DRAWINGS				REVISIONS				
DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE	NO.	DESCRIPTION	CHK'D	APP'D	DATE
				C	Minor Edits	LW	EMR	31Oct14
				B	Minor Edits	LW	EMR	17Sep14
				A	Issued for Discussion	LW	EMR	14Mar14

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FILE NAME: 1CT022.001_Madrid_North_Portal.dwg

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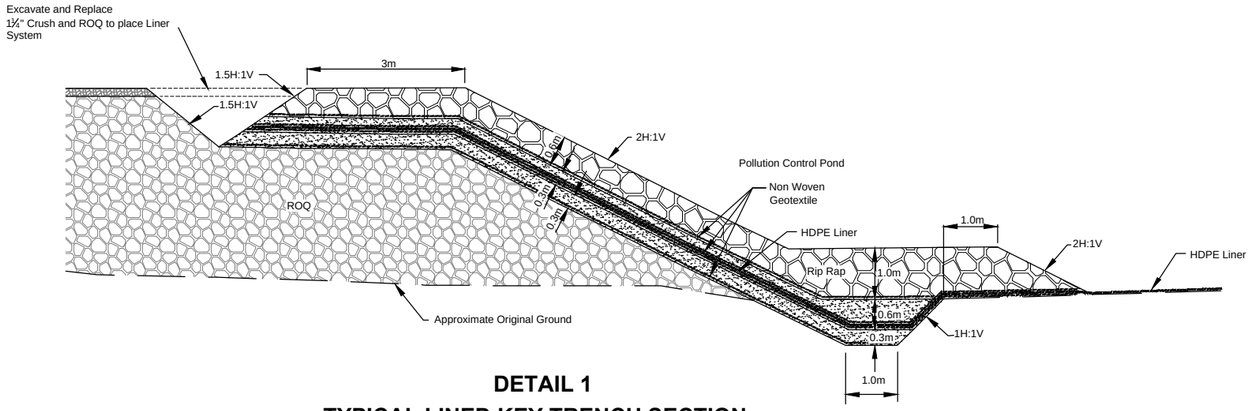
HOPE BAY PROJECT
SRK JOB NO.: 1CT022.001

Madrid North Surface Infrastructure

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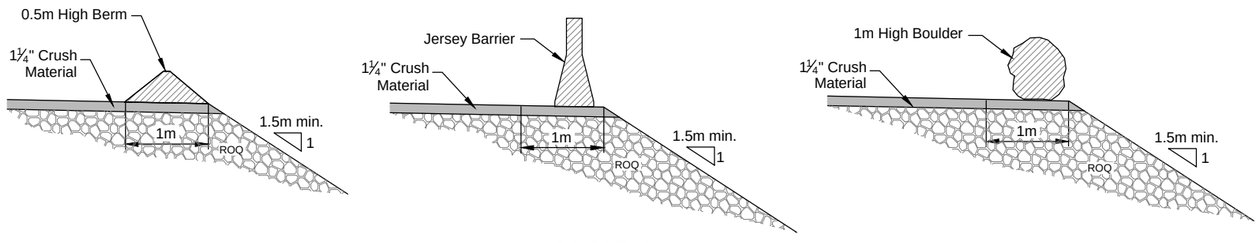
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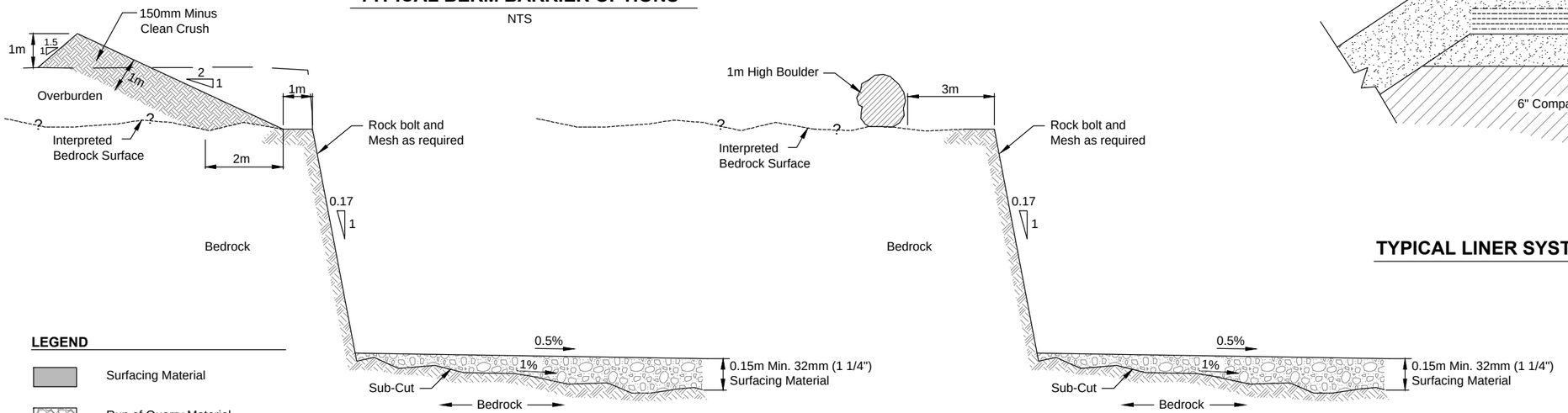
DETAIL 1
TYPICAL LINED KEY TRENCH SECTION

NTS



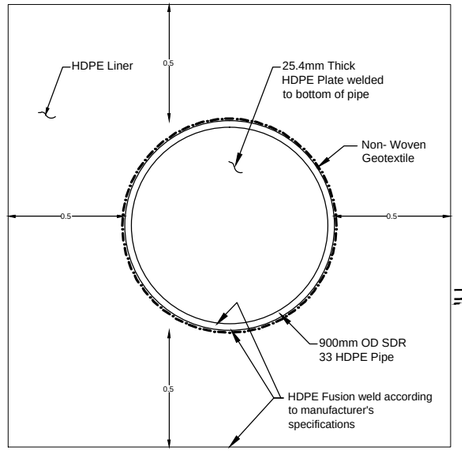
DETAIL 2
TYPICAL BERM BARRIER OPTIONS

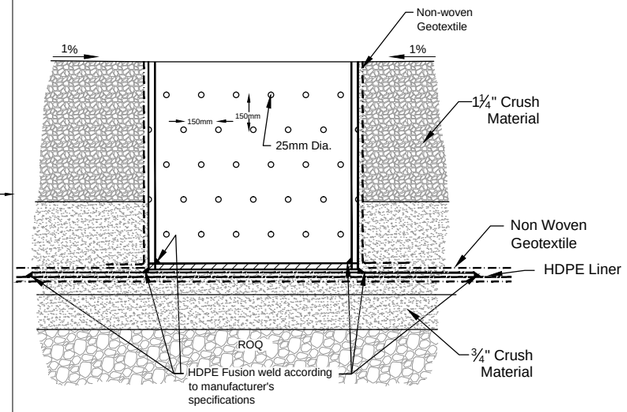
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DETAIL 3
TYPICAL SECTIONS OF HIGHWALL SAFETY BERM/BARRIER

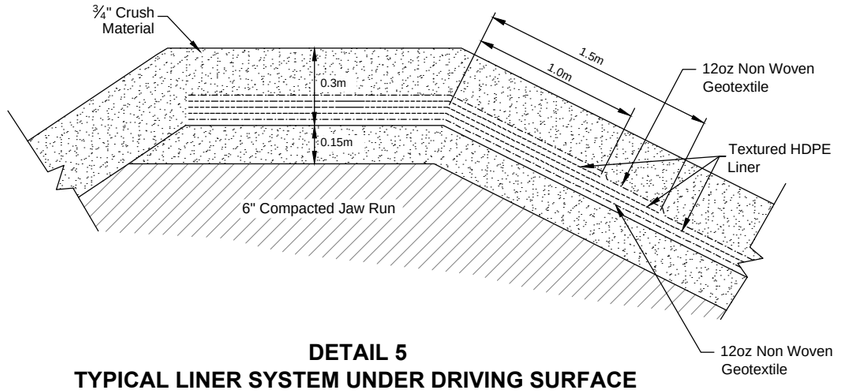
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DETAIL 4 - SUMP

NTS



DETAIL 5
TYPICAL LINER SYSTEM UNDER DRIVING SURFACE

NTS

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NO.	DESCRIPTION	CHK'D	APP'D	DATE
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FILE NAME: 1CT022.001_Madrid_North_Pad-Berm Details.dwg

TMAC RESOURCES

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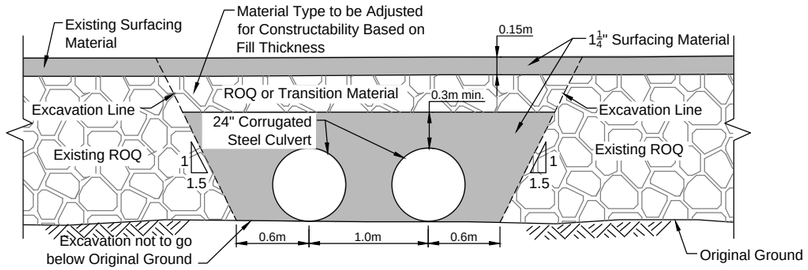
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Madrid North Surface Infrastructure

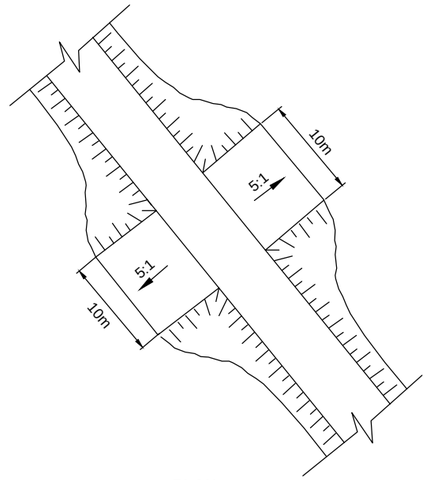
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MNP-10	10 OF 12	C

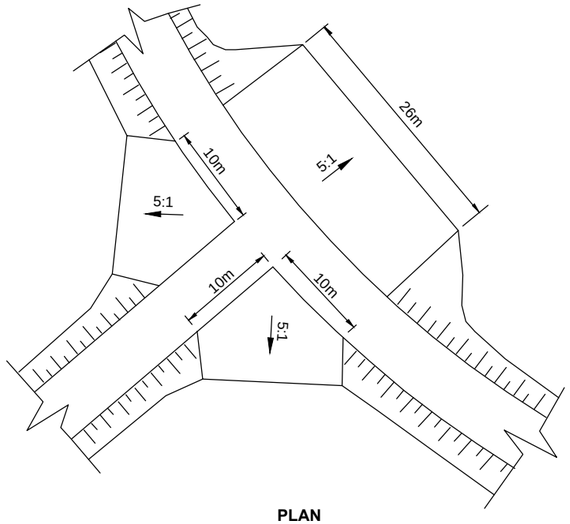
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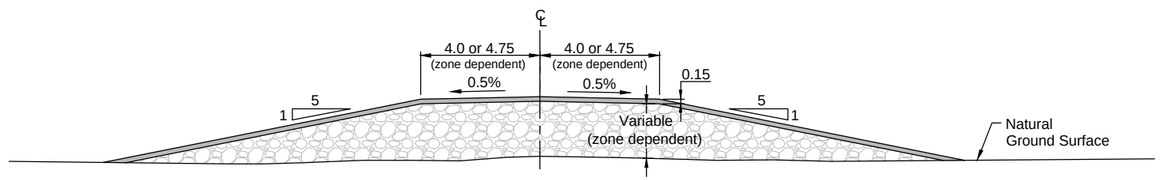
DETAIL 6
6 TYPICAL CROSS SECTION OF CULVERT CROSSING
NOT TO SCALE



PLAN
7 TYPICAL ANIMAL CROSSING
NTS



PLAN
7 TYPICAL ANIMAL CROSSING AT ROAD JUNCTION
NTS



DETAIL 7
7 TYPICAL ANIMAL CROSSING SECTION

LEGEND

- Surfacing Material
- Run of Quarry Material

NOTES

1. All dimensions in metres unless noted otherwise.
2. Locations for animal crossings will be identified by Land Owner and Elders once road construction is completed.

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
C	Minor Edits	LW	EMR	31Oct14
B	Minor Edits	LW	EMR	17Sep14
A	Issued for Discussion	LW	EMR	14Mar14

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TMAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.001

Madrid North Surface Infrastructure

DRAWING TITLE:
Animal Crossing Plan and Section and Culvert Section

DRAWING NO.	SHEET	REVISION NO.
MNP-11	11 OF 12	C

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Materials List and Quantity Estimates

Item	Quantity / Area / Volume	ROQ (cu.m.)	Cut (cu.m.)	Description
1. Run of Quarry Material	Upper/Lower Portal Pads	12,210		Approximate In-Place Neat-line Volume (3D volume based on Civil 3D surfaces - no allowance has been made for losses and/or tundra embedment)
	Fuel Storage Facility Pad	2,020		
	Waste Rock Pad	31,000		
	Doris-Windy Rd to Upper Portal Pad Road	3,590		
	Lower Portal to Pollution Control Berm Road	3,660		
	Ramp from Upper Portal Pad to Waste Rock Pile	140		
	Pollution Control Berm	11,380		
	Vent Raise Pad	6,400	170	
	Doris-Windy Rd to Vent Raise Pad Road	1,280		
	Total	71,570		
2. Surface Grade Material	Pads:			Approximate In-Place Neat-line Volume
	Upper Portal Pad	900		
	Lower Portal Pad	190		
	Vent Raise Pad	530		
	Roads:			
	Doris-Windy Rd to Upper Portal Pad	390		
	Lower Portal to Pollution Control Berm	390		
	Pollution Control Berm	330		
	Ramp from Upper Portal Pad to Waste Rock Pad	150		
	Doris-Windy Rd to Vent Raise Pad	60		
	Total	2,940		

Materials List and Quantities for Pollution Control Berm Pond

Item	Quantity / Area / Volume		Description
Rip Rap	Rip Rap on Berm Face and Over Downstream Key Trench	2640 m³	Volumes approximated by typical section and key trench lengths
Finishing Material (¾" Crush)	OverLiner at Downstream Key Trench	1480 m³	
	OverLiner at Upstream Key Trench	880 m³	
	UnderLiner at Downstream Key Trench	940 m³	
	UnderLiner at Upstream Key Trench	320 m³	
Geotextile (2 Layers)	Geotextile OverLiner	8800 m²	12oz. Non Woven
	Geotextile UnderLiner	8800 m²	
Liner	Geomembrane Liner on Berm Face and in Downstream Key Trench	4400 m²	Textured HDPE 60 or Equivalent
	Geomembrane Liner in Pond Area and in Upstream Key Trench	16530 m²	

Materials List and Quantities (Fuel Facilities at Portal and Vent Raise)

Item	Quantity / Area / Volume		Description
6" Compacted Jaw Run Material	Berm Walls (FSF at Portal)	575 m³	Volumes derived by Eagle Point 7.2. - Side slopes 2H:1V Unless otherwise noted
	Berm Walls (FCA at Vent Raise)	575 m³	
Finishing Material (¾" Crush)	OverLiner (FSF at Portal)	350 m³	
	OverLiner (FCA at Vent Raise)	350 m³	
	UnderLiner (FSF at Portal)	120 m³	
	UnderLiner (FCA at Vent Raise)	120 m³	
Surfacing Material (1¼" Crush)	Final Surface (FSF at Portal)	1260 m³	
	Final Surface (FCA at Vent Raise)	1260 m³	
Geotextile (2 Layers)	Geotextile OverLiner (FSF at Portal)	750 m²	12oz. Non Woven
	Geotextile OverLiner (FCA at Vent Raise)	750 m²	
	Geotextile UnderLiner (FSF at Portal)	750 m²	
	Geotextile UnderLiner (FCA at Vent Raise)	750 m²	
	Sump (FSF at Portal)	5 m²	
	Sump (FCA at Vent Raise)	5 m²	
Liner	Geomembrane Liner 1 Base (FSF at Portal)	750 m²	Textured HDPE 60 or Equivalent
	Geomembrane Liner 1 Base (FCA at Vent Raise)	750 m²	
	Geomembrane Liner 2 Under Driving Surface (FSF at Portal)	25 m²	
	Geomembrane Liner 2 Under Driving Surface (FCA at Vent Raise)	25 m²	
	Geomembrane Liner 3 Under Driving Surface (FSF at Portal)	17 m²	
	Geomembrane Liner 3 Under Driving Surface (FCA at Vent Raise)	17 m²	
	Sump (FSF at Portal)	5 m²	
	Sump (FCA at Vent Raise)	5 m²	

Tolerances Road Material Placement:

Location	Fill (mm)	Excavation (mm)
Vertical Tolerance on Roads	0 to +75	n/a
Horizontal Tolerance on Roads	-150 to +150	

Note: Grade shall not be uniformly high or low.

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REFERENCE DRAWINGS			

NO.	DESCRIPTION	CHK'D	APP'D	DATE
D	Minor Edits	LW	EMR	31Oct14
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TMAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.001

Madrid North Surface Infrastructure

DRAWING TITLE:

Material List and Quantity Estimates

DRAWING NO.	SHEET	REVISION NO.
MNP-12	12 OF 12	D

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Appendix 4-B

SRK, November 2014 Memo – Hope Bay Project: Madrid South Bulk Sample: Surface Infrastructure

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Vancouver, BC V6E 3X2

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F: +1.604.687.5532

vancouver@srk.com
www.srk.com

Memo

To:	John Roberts, TMAC	**Client:**	TMAC Resources Inc.
From:	Lowell Wade Maritz Rykaart	**Project No:**	1CT022.001.410
Cc:		**Date:**	November 27, 2014
Subject:	Hope Bay Project: Madrid South Bulk Sample: Surface Infrastructure		

1 Introduction

TMAC Resources Inc. is currently in the process of constructing their Doris North Project (Project) in the Kitikmeot region of Nunavut, Canada. Concurrent with this, TMAC is carrying out regional exploration and have identified the Madrid South area as a potential high quality exploration target. However, advanced exploration and extraction of a bulk sample is needed to verify economic feasibility and milling process methods.

The Madrid South area is located about 15 km south of the Doris North Camp. Currently there is no permanent access to this area; therefore, TMAC proposes to construct a 4.7 km long all-weather road which will branch off from the southernmost end of the existing Doris-Windy All-Weather Road.

This memo provides complete details of the Madrid South surface infrastructure pads and access roads. This should be read in conjunction with the attached set of conceptual level engineering drawings (Attachment 1). Water management, at Madrid South, has been discussed in SRK (2014a) and closure activities have been discussed in SRK (2014b).

2 Design Concept

All of the infrastructure pads and all-weather access roads associated with the Hope Bay Project are located on Inuit Owned Land (IOL), administered by the Kitikmeot Inuit Association (KIA).

The design concept of the Madrid South pads are based on the same principles as adopted for elsewhere on the Doris North Project which is to construct all facilities either on bedrock or on rock fill pads at least 1 m thick to preserve permafrost. Site layouts are designed to minimize the overall footprint and all attempts are made to minimize the volume of contact water. Contact water is captured and contained in secure ponds for appropriate disposal.

Site access roads are considered private roads, administered and controlled entirely by TMAC. Although none of these access roads are used as, or classified as mine haul roads in accordance with the Nunavut Mine Safety Act pertaining to haul roads, TMAC has opted to ensure that all site roads are designed in accordance with the minimum requirements as set out for mine haul roads in the Nunavut Mine Safety Act.

All site roads use the same primary design criteria as the 10 km long Doris-Windy All-Weather Road, which includes allowing for dual lane traffic for frequently travelled vehicles such as trucks and crew busses, while allowing single lane traffic for occasional oversize vehicles. Strategically placed road turnouts are provided to facilitate single lane use.

3 Site Layout Alternatives

TMAC considered three surface infrastructure alternatives at the Madrid South surface infrastructure locations:

- Access from Doris North Portal. Access to Madrid South would be underground via the Doris North, Connector, and Central underground workings. No surface infrastructure would be required. This option was not selected as hauling waste rock and ore from Madrid South to Doris North using underground vehicles is not practical.

- Minimal Development. Only the Madrid South portal and vent raise pads would be constructed. All waste rock and the ore would be hauled to Doris North via a winter road to the Doris-Windy All-Weather Road. This option was not selected as hauling waste rock, for disposal, and ore, to be stockpiled, at Doris North is not practical.

- Full Development. The entire surface infrastructure required to support the underground bulk sample would be constructed. As well, all the waste rock and ore would be stored at Madrid South. The ore would then be transported to Doris North at a later time when the mill is in operation. This was selected as the preferred option.

4 System Design

4.1 Design Criteria

The infrastructure associated with the underground activities at Madrid South consists of all-weather roads, a waste rock pad, an ore stockpile pad, a portal pad, a vent raise pad as well as an infrastructure pad and a laydown pad.

The infrastructure components associated with operations, the underground portal, and the vent raise are summarized in Table 1.

Table 1: Surface Infrastructure Facilities Associated With the Portal and Vent Raise

Infrastructure Component	Surface Area	Limitations	Comments
Waste Rock Pad	31,230 m^2	Within 500 m haul distance from portal; haul road cannot exceed 7% grade	Storage for 225,000 tonnes minimum of waste rock
Ore Stockpile Pad	12,200 m^2	Within 500 m haul distance from portal; haul road cannot exceed 7% grade	Storage for 55,000 tonnes minimum of ore
Shop	450 m^2 (15x30 m)	Horizontal pad of rectangular shape	
Laydown Area	1,000 m^2 (20x50 m) minimum		
Laydown Pad	5,040 m^2 (74.5x67.5 m)		
Diesel Power Generator x 2	19 m^2 (2.5x7.5 m)		Seacan container; one at the vent raise and a second unit at the portal entrance
Site Office Trailer	30 m^2 (3x10m)		ATCO Trailer
Emergency Shelter	30 m^2 (3x10m)		Trailer
Brine Mixing Facility (BMF)	19 m^2 (2.5x7.5 m)	Required at portal	Seacan container. Also includes area for CaCl laydown.
Water Storage Tank with Containment	144 m^2 (12x12m)	Required at portal	50,000L water tank assumed (tank radius ~4.4m)
Air Heating Facility	19 m^2 (2.5x7.5 m)	Required immediately adjacent to vent raise	
Fuel Tanks	Requires lined containment	(Fuel Transfer Station) (Fuel Containment Area)	75,000 L Fuel Tank 60,000 L Fuel Tank
Fuel Transfer Station Fuel Tank Containment	1,258 m^2 (34x37 m) 441 m2 (21x21 m)	Drive-through facility (lined containment)	Each holds one Fuel Tank

4.2 Survey Data

The design of the Madrid South infrastructure pads and access roads are based on topographic contour maps produced from 2008 aerial photography supplied by Hope Bay Mining Limited (HBML). No detailed ground surveys have been completed.

4.3 Foundation Conditions

Comprehensive geotechnical investigations have been carried out at the Hope Bay Site (SRK 2009). This information confirms that the area lies within the zone of continuous permafrost, with the permafrost being up to 550 m deep. Permafrost temperature at the surface is about -8ºC and the active layer is generally less than 1 m thick. Laboratory and in-situ tests on disturbed and undisturbed samples indicate that the overburden soils are predominantly comprised of marine silts and clays, and the pore-water in these soils has high salinity,

depressing the freezing point to -2ºC. The ice-rich overburden soils are typically between 5 and 20 m deep, before encountering competent bedrock, predominantly basalt. Bedrock is frequently exposed, rising columnar 5 to 100 m above the surrounding landscape.

Thermal modelling has determined that a 1 m minimum of rock fill cover would be required over the tundra to preserve the permafrost under the infrastructure pads (SRK 2006). Since all pads are designed to have a flat surface with minor grading for drainage, the run-of-quarry (ROQ) fill thickness reaches up to 7 m at places due to underlying topography.

The geotechnical design parameters for Hope Bay have been summarized in SRK (2011a).

4.4 Waste Rock Pile and Ore Stockpile

4.4.1 Design Criteria

The waste rock pad is designed to accommodate a minimum of 225,000 tonnes of waste rock while the ore stockpile pad is designed to accommodate a minimum of 55,000 tonnes of ore. Both the waste rock pad and ore stockpile pad will be a minimum of 1 m thick ROQ material be placed over the original ground. The waste rock pile and ore stockpile have a haul distance of less than 500 m; avoids archaeological sites; and are more than 31 m from neighbouring water bodies.

4.4.2 Design

The overall waste rock pile design, at this location, has not been finalized; however, the waste rock pile will be constructed with an overall slope angle of 2.5H:1V. The waste rock pile has a base area of 31,230 m^2.

The overall ore stockpile design, at this location, has not been finalized, but will be constructed with an overall slope angle of 2.5H:1V. The ore stockpile has a base area of 12,200 m^2.

4.5 Pollution Control Ponds

4.5.1 Design Criteria

The primary pollution control pond has the capacity to contain contact water from the overall drainage area and 25% of annual snow coverage combined with a 100-year, 24-hour storm event which is 15,000 m^3 of water The secondary pollution control pond has the capacity to contain contact water from the overall drainage area and 25% of annual snow coverage, which is 900 m^3 of water; however, it is expected that this pond will always be operated in a manner as to allow for pumping to commence as soon as the containment volume is large enough for one (1) continuous hour of pumping.

4.5.2 Design

There are two pollution control ponds at Madrid South. Both pollution control ponds will be fully lined. The primary pollution control pond will be constructed downstream of the waste rock pile and ore stockpile and will be contained by an 8-m wide berm which will double as a roadway to

allow access around the primary pollution control pond. This berm will be constructed using ROQ material. The surface area of the primary pollution control pond is 12,300 m^2.

The secondary pollution control pond is located next to the Madrid South portal. This pond will be contained by a 6-m wide berm constructed with ROQ material. This berm has been designed to allow for light vehicle access around the pond for regular inspection and to assist in accommodating any required maintenance. The surface area of the secondary pollution control pond is 940 m^2.

4.6 Madrid South Pads

4.6.1 Design Criteria

The design criteria for the Madrid South pads are as follows:

- Minimum 1 m fill thickness must be maintained;
- 1.5H:1.0V slopes are utilized with fill thickness less than 2 m;
- 2.0H:1.0V slopes are utilized with fill thickness greater than 2 m;
- The maximum particle size for ROQ is 500 mm for fill thickness of 850 mm, and 900 mm for fill thickness exceeding 850 mm. All material shall be free from organic matter, soil, snow and ice;
- No cut is allowed, except in designated rock quarries; and
- Safety barricades (oversize boulders, Jersey Barriers, Berms) are to be placed along the crest where fill thicknesses are greater than 3 m.

4.6.2 Design

Pads are to be constructed using a minimum 1 m thick fill material. Typically the fill is expected to consist of minimum 0.85 m of ROQ overlain by a minimum 0.15 m thick surfacing material layer. The waste rock pad and ore stockpile pad do not require surfacing material; however, the 1 m minimum fill thickness must be maintained for permafrost protection and to allow for adequate seepage drainage. All pads will be graded at 0.5% towards the two pollution control ponds.

4.7 Access and Haul Roads

4.7.1 Design Criteria

There are two road alignments within the Madrid South area. The first road alignment is the 506 m long haul road and vent raise access road which extends from the waste rock pile and ore stockpile; accesses the infrastructure pad containing the shop, fuel transfer station, laydown area, and office trailers; the portal pad; to the vent raise pad. The second road alignment is the 243 m long infrastructure access road which extends from the infrastructure pad past the laydown pad to the vent raise pad.

The design criteria for the access and haul roads are the same as for the Madrid South All-Weather Road (SRK 2014c). The key design criteria are:

- Access and haul roads have a maximum grade of 7%;
- A minimum thickness of 1 m over tundra must be maintained and 0.3 m over bedrock;
- The roadway will be crowned to promote drainage by means of 0.5% surface grading in both directions from the centreline of the roadway;
- Road shoulders will be graded to 2H:1V in areas where fill thickness is at least 1.5 m and 1.5H:1V in zones where fill thickness is less than 1.5 m; and
- No cut is allowed, except in designated rock quarries, and then only to a grade at least 0.5 m above the surrounding tundra elevation.

4.7.2 Design

The all-weather road will be constructed from ROQ material obtained from local approved and permitted rock quarries. This material will be placed in lift thicknesses that do not exceed 0.85 m and compacted using a vibratory drum compactor using a site specific compaction specification. The surfacing layer of the road consists of a 150 mm thick layer of 1¼ inch crush.

The haul road connecting the infrastructure pad to Madrid South portal is 16 m wide to allow for two-way traffic, of larger vehicles, to and from the waste rock pile and ore stockpile. The vent raise access road and the infrastructure access road have been designed with a final road crest width of 8 m to allow for one-way traffic, of larger vehicles.

4.8 Fuel Storage

4.8.1 Design Criteria

There will be two locations where fuel will be stored at Madrid South. A fuel transfer station, with a 75,000 L fuel tank, will be located on the infrastructure pad and a fuel containment area, with a 60,000 L fuel tank, will be located on the vent raise pad.

The fuel transfer station and fuel containment area are designed to contain 110% of the entire volume of the fuel tank plus 10% of the fuel transport truck as well as 25% of annual snow cover combined with a 1-in-100 year 24-hour storm event.

Each facility will consist of a fuel tank containment area and a fuel transfer apron which will contain fuel lines as well as the fuel transport truck. The entire footprint of each facility will be lined with a HDPE membrane sandwiched between two layers of 12 oz. non-woven geotextile. The floor of the containment area will be sunk into the ROQ fill of the pad, such that the crest of the liner is flush with the pad surface, and a slightly raised berm (0.3 m high above the pad surface elevation) will enclose the perimeter of the containment area and the fuel transfer apron, to prevent spills outside of the lined area. A bedding layer 0.2 m thick consisting of ¾ inch crushed rock will be placed and compacted prior to liner deployment. The liner will be covered by a lift of ¾ inch crushed rock over its entire surface, including the floor and the slopes of the containment. A second lift, 0.3 m thick, of 1 ¼ inch crushed rock will be placed on the floor of the

containment, while a third lift of 1 ¼ inch crush will be placed over the footprint of the fuel transfer apron.

A sump will be installed in one corner of the containment area, and the surface of the containment area will be graded to drain toward the sump.

In addition, the fuel storage facilities will be designed to the following codes and guidelines:

- NFPA 30 – Flammable and Combustible Liquids Code 2008 Edition;
- Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products - Canadian Council of Ministers of the Environment; and
- Canada Gazette Part 1, Vol 141, No. 14 April 7, 2007.

5 Construction Methodology

The pads and roads will be constructed from ROQ material excavated from permitted and approved quarries along the Doris-Windy All-Weather Road (Quarry A, B, and D) as well as the new Quarry G, along the Madrid South All-Weather Road, and Quarry H, which is the location of the Madrid South bulk sample. SRK (2008) contains complete details pertaining to geochemical characterization of the Doris-Windy All-Weather Road Quarries while SRK (2014d) provides the geochemical characterization of the new rock quarries confirming the suitability of these quarries for use in construction. The management and monitoring of the existing quarries along the Doris-Windy All-Weather Road will be according to SRK (2010b), while the management and monitoring of the new quarries (Quarry G and H) that will be used for the construction of the surface infrastructure pads and access roads is discussed in SRK (2014e).

Surface grade material for both the surface infrastructure components as well as access and haul roads will be from Quarry #2 and the crusher located in Quarry #2. Complete material quantities are included in Attachment 1.

All pads and roads will be constructed in accordance to SRK's Technical Specifications (SRK 2011b).

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The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

6 References

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SRK Consulting (Canada) Inc., 2014b. Hope Bay Project: Madrid Advanced Exploration Program: Conceptual Closure and Reclamation Plan. Technical Memorandum Prepared for TMAC Resources Inc., Project Number: 1CT022.001.410. October 31, 2014.

SRK Consulting (Canada) Inc., 2014c. Hope Bay Project: Madrid South Bulk Sample: Madrid North to Madrid South All-Weather Road. Technical Memorandum Prepared for TMAC Resources Inc., Project Number: 1CT022.001.410. October 31, 2014.

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SRK Consulting (Canada) Inc. 2014e. Hope Bay Project. Quarry Management and Monitoring Plan – Revision 02 DRAFT. Report Prepared for TMAC Resources Inc. Project Number: 1CT022.001.840. July 2014.

Attachment 1
Engineering Drawings for the Madrid South Surface Infrastructure

Engineering Drawings for the Madrid South Surface Infrastructure, Hope Bay Project, Nunavut, Canada

ACTIVE DRAWING STATUS

DWG NUMBER	DRAWING TITLE	REVISION	DATE	STATUS
MSP-00	Engineering Drawings for the Madrid South Surface Infrastructure, Hope Bay Project, Nunavut, Canada	F	Oct. 31, 2014	Minor Edits
MSP-01	Madrid South General Arrangement	E	Oct. 31, 2014	Minor Edits
MSP-02	Madrid South Site Layout	G	Oct. 31, 2014	Minor Edits
MSP-03	Madrid South Arrangement and Access Road Profiles	D	Oct. 31, 2014	Minor Edits
MSP-04	Madrid South Pad Sections (1 of 2)	D	Oct. 31, 2014	Minor Edits
MSP-05	Madrid South Pad Sections (2 of 2)	C	Oct. 31, 2014	Minor Edits
MSP-06	Typical Fuel Transfer Station	C	Oct. 31, 2014	Minor Edits
MSP-07	Typical Fuel Transfer Station Sections	D	Oct. 31, 2014	Minor Edits
MSP-08	Berm and Barrier Details	C	Oct. 31, 2014	Minor Edits
MSP-09	Material Specifications	E	Oct. 31, 2014	Minor Edits

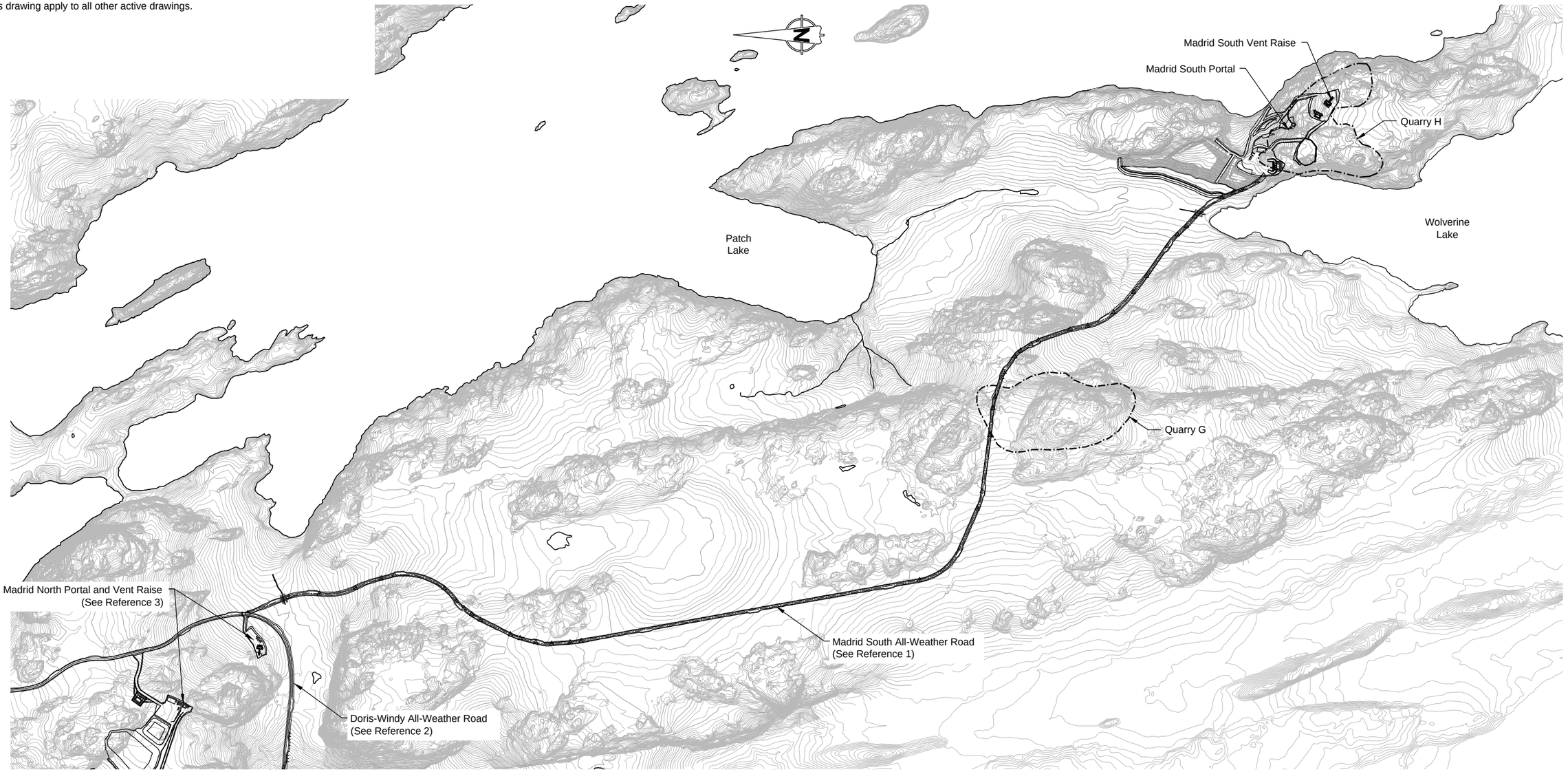
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PROJECT NO: 1CT022.001
Revision F
October 31, 2014
Drawing MSP-00

NOTES

1. Topographic contour data for the terrain model were provided by Hope Bay Mining, and is based on 2007 Aerial Photography. Contour intervals are 0.5m.
2. The co-ordinate system is UTM NAD 83, Zone 13.
3. All dimensions are in metric units, unless specifically mentioned.
4. Notes in this drawing apply to all other active drawings.



LEGEND

- Existing Approved and Permitted Quarry
- Proposed Development Quarry
- Road Alignment

REFERENCES

1. Engineering drawings for the Madrid South All-Weather Road, Hope Bay Project, Nunavut, Canada. Issued for Discussion. Revision D. Project No. 1CT022.001. October 31, 2014.
2. Engineering Drawings for the Doris-Windy All-Weather Road, Doris Infrastructure Project, Nunavut, Canada. Revision AB1. As-Built Drawings Prepared for Hope Bay Mining Ltd. Project Number: 1CH008.033/.058. May 11, 2012
3. Engineering drawings for the Madrid North Surface Infrastructure, Hope Bay Project, Nunavut, Canada. Issued for Discussion. Revision E. Project No. 1CT022.001. October 31, 2014.

0 100 200 300 400 500
Scale in Metres

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
E	Minor Edits	LW	EMR	31Oct14
D	New Portal Location	LW	EMR	24June14
C	Minor Edits	LW	EMR	12June14
B	Minor Edits	JK	EMR	25Apr14
A	Issued for Review	JK	EMR	14Mar14

REVISIONS

Original Drawings Stamped and Signed by Engineer

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DESIGN:	DRAWN:	REVIEWED:
JK	NV	LW
CHECKED:	APPROVED:	DATE:
LW	EMR	Oct. 31, 2014

FILE NAME: 1CT022_001_Madrid South_GA RevE.dwg

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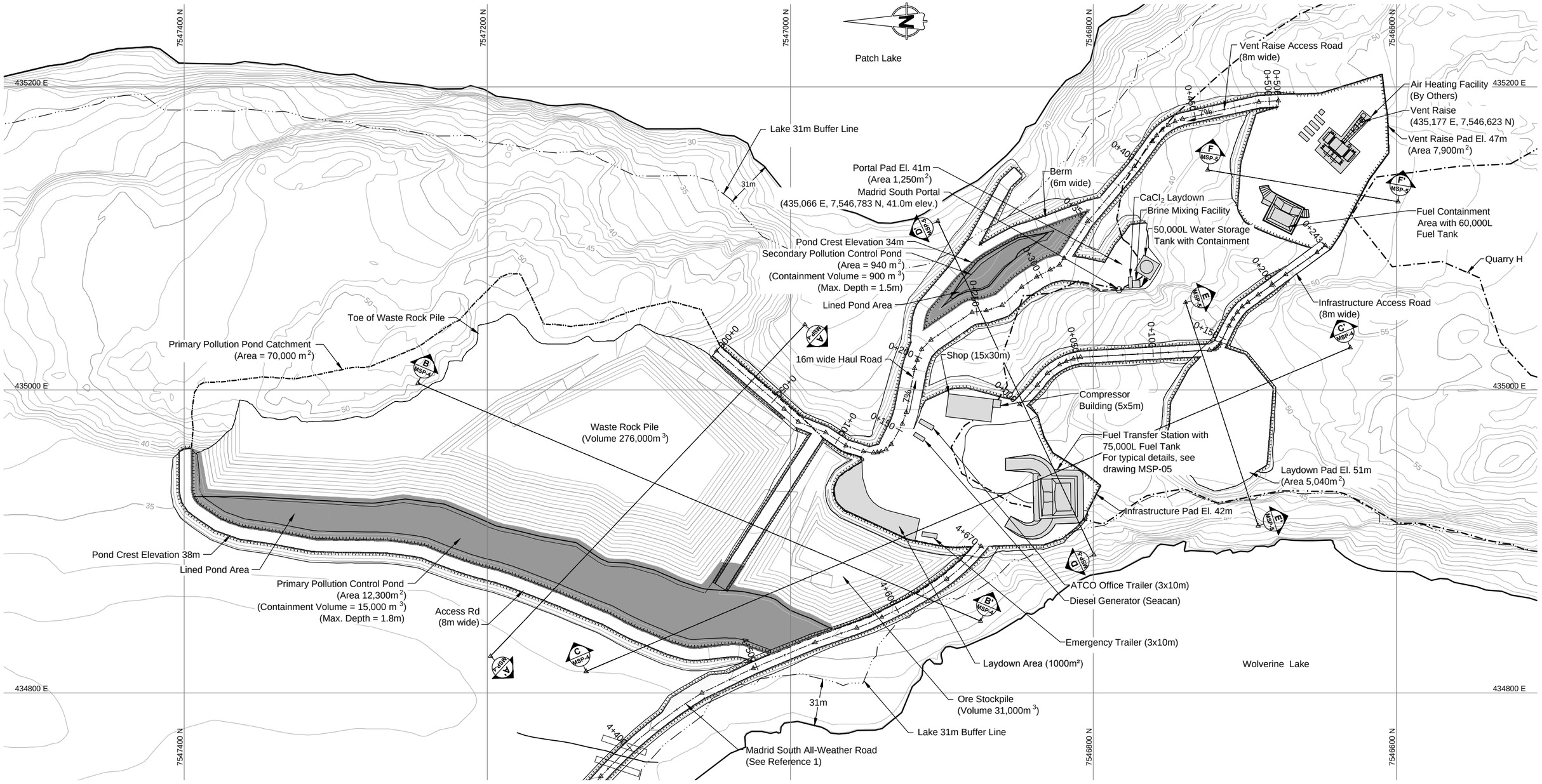
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Madrid South Surface Infrastructure

DRAWING TITLE: Madrid South General Arrangement

DRAWING NO.	SHEET	REVISION NO.
MSP-01	2 OF 10	E

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LEGEND

- Proposed Quarry Boundary
- Water Line
- Pollution Pond Catchment

NOTES

1. The design of the Madrid South Portal and Vent Raise is based on topographic contour information provided by HBML and is derived by 2007 aerial photography.
2. Contours are shown in 1m intervals.
3. The co-ordinate system is UTM NAD 83, Zone 13.
4. All dimensions are in metric units, unless specifically mentioned.
5. Notes in this drawing apply to all other active drawings.

REFERENCE

1. Engineering drawings for the Madrid South All-Weather Road, Hope Bay Project, Nunavut, Canada. Issued for Discussion. Revision D. Project No. 1CT022.001. October 31, 2014.

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Scale in Metres

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REFERENCE DRAWINGS			

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F	Minor Edits	LW	EMR	17Sep14
E	Liner Added to Ponds	LW	EMR	7Aug14
D	New Portal Location	LW	EMR	27June14
C	Minor Edits	LW	EMR	12June14
B	Minor Edits	JK	EMR	25Apr14
A	Issued for Review	JK	EMR	14Mar14
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LW	EMR	Oct. 31, 2014

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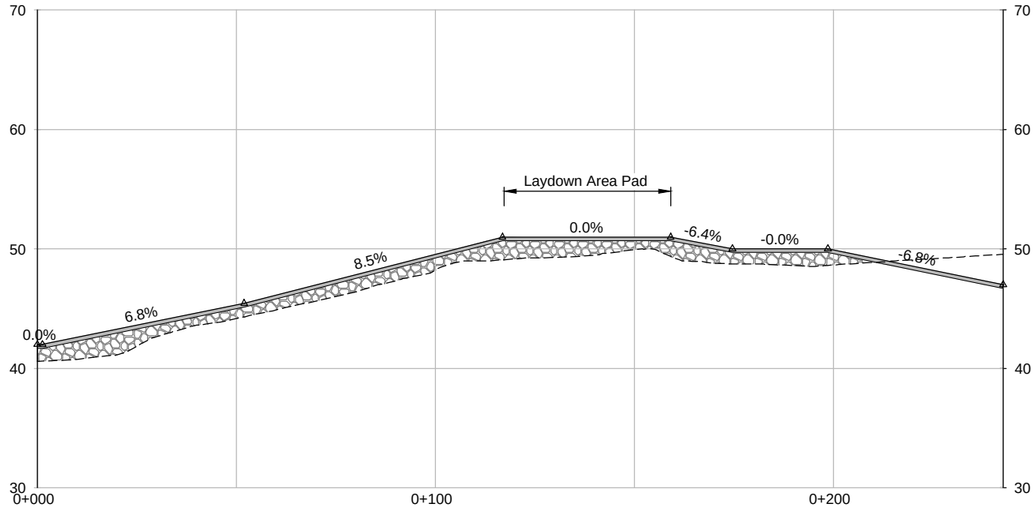
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DRAWING TITLE:

Madrid South Site Layout

DRAWING NO.	SHEET	REVISION NO.
MSP-02	3 OF 10	G

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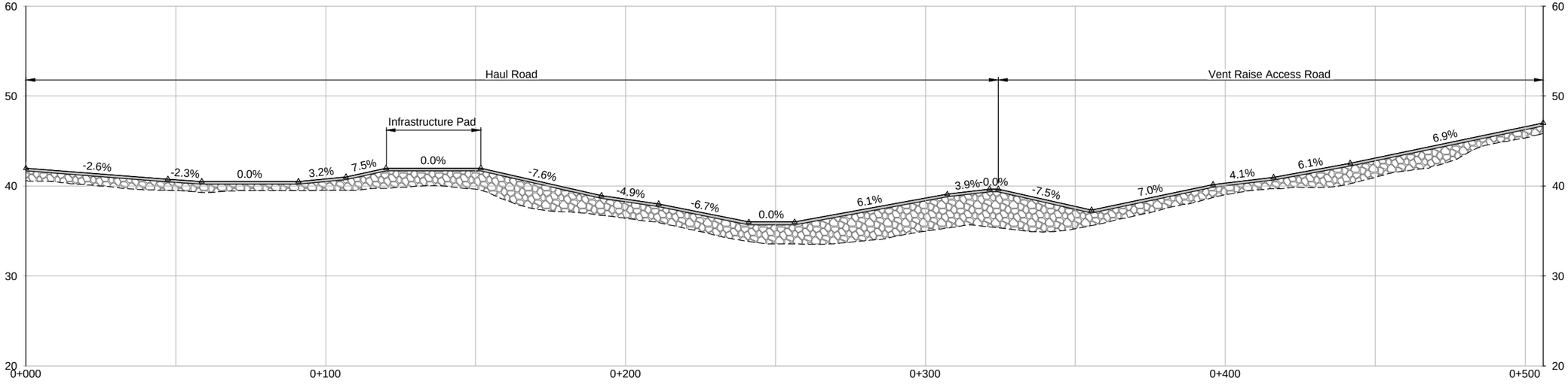
LAYDOWN AREA ACCESS ROAD

LEGEND

- Existing ground surface
- Surfacing Material
- Run of Quarry Material
- Point of Intersection
- 6.1% Grade

NOTES

1. All dimensions in metres unless noted otherwise.
2. Notes in this drawing apply to all other active drawings.



HAUL ROAD TO PORTAL

0 5 10 15 20 25 Horizontal Scale in Metres

0 2 4 6 8 10 Vertical Scale in Metres

Vertical Exaggeration 3X

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS			

NO.	DESCRIPTION	CHK'D	APP'D	DATE
D	Minor Edits	LW	EMR	31Oct14
C	New Portal Location	LW	EMR	27June14
B	Minor Edits	LW	EMR	12June14
A	Issued for Review	JK	EMR	14Mar14

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LW	EMR	Oct. 31, 2014

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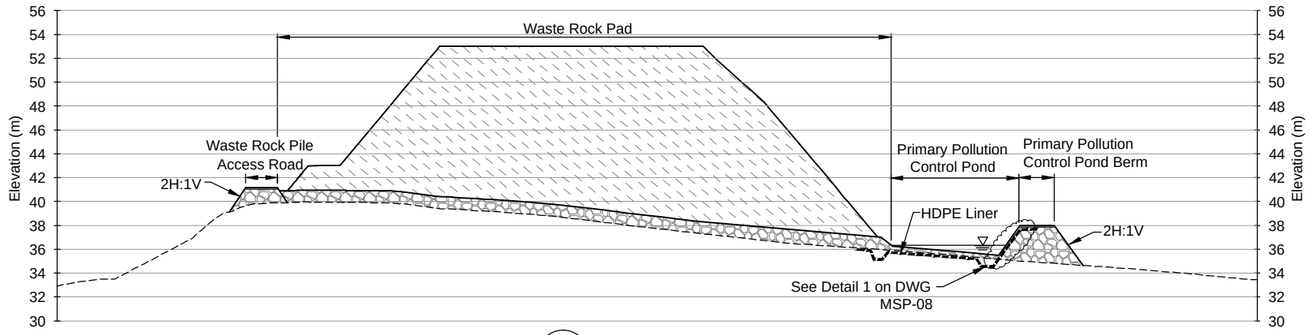
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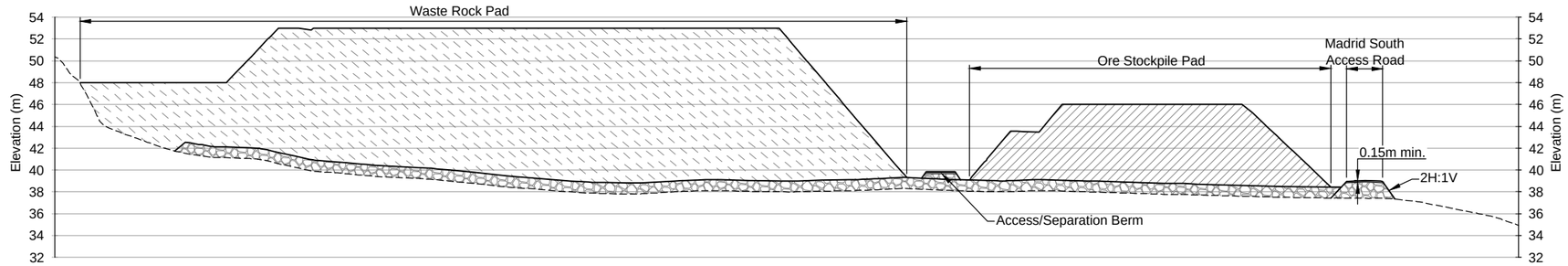
Madrid South Arrangement and Access Road Profiles

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MSP-03	4 OF 10	D

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A MSP-02 **SECTION A**



B MSP-02 **SECTION B**

C MSP-02 **SECTION C**

LEGEND

- Existing ground surface
- Surfacing Material
- Run of Quarry Material
- Waste Rock
- Ore Stockpile

NOTES

1. All dimensions in metres unless noted otherwise.
2. Where the thickness of the pads is greater than 3.0m allow for the placement of barriers.
3. The barriers are to consist of boulders larger than 1m in diameter, jersey-barriers (1.82 long X 1.37m high X 0.61m wide) or a rock fill berm 0.5m high. Maximum spacing between barriers is 3.3m.
4. Extents of bedrock outcrop are based on 2007 aerial orthophoto and ground inspection. To ensure layouts match site conditions exact extents of bedrock outcrops are to be surveyed prior to any construction activities.
5. Notes in this drawing apply to all other active drawings.

0 5 10 15 20 25
Horizontal Scale in Metres

0 2 4 6 8 10
Vertical Scale in Metres

Vertical Exaggeration 3X

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
D	Minor Edits	LW	EMR	31Oct14
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REVISIONS

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CHECKED:	APPROVED:	DATE:
JK	EMR	Oct. 31, 2014

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SRK JOB NO.: 1CT022.001

MAC RESOURCES

HOPE BAY PROJECT

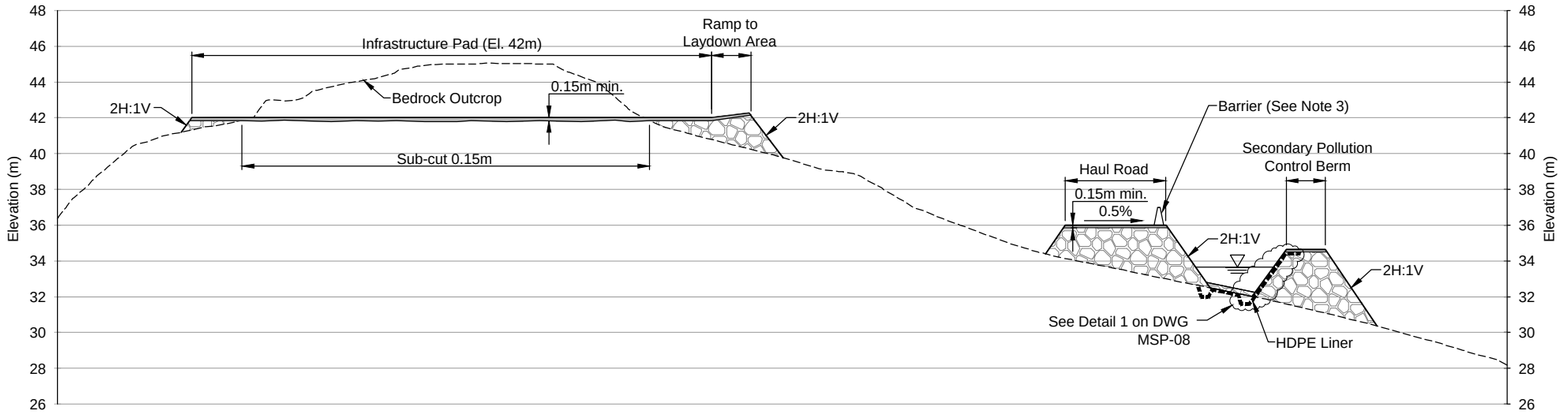
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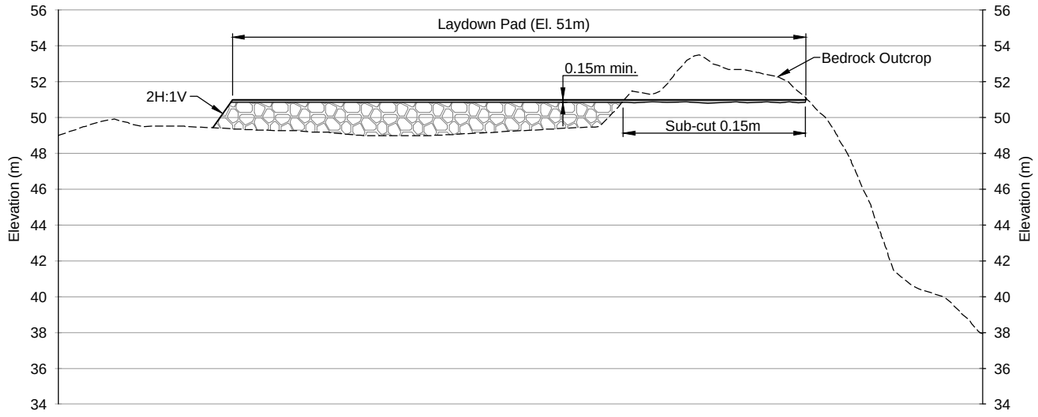
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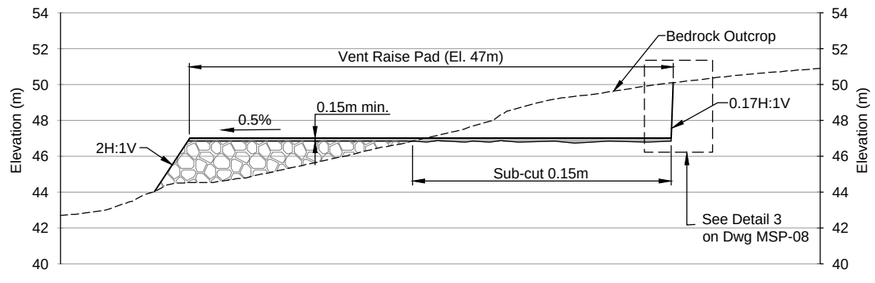
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D MSP-02 **SECTION D**



E MSP-02 **SECTION E**



F MSP-02 **SECTION F**

LEGEND

- Existing ground surface
- Surfacing Material
- Run of Quarry Material

NOTES

1. All dimensions in metres unless noted otherwise.
2. Where the thickness of the pads is greater than 3.0m allow for the placement of barriers.
3. The barriers are to consist of boulders larger than 1m in diameter, jersey-barriers (1.82 long X 1.37m high X 0.61m wide) or a rock fill berm 0.5m high. Maximum spacing between barriers is 3.3m.
4. Extents of bedrock outcrop are based on 2007 aerial orthophoto and ground inspection. To ensure layouts match site conditions exact extents of bedrock outcrops are to be surveyed prior to any construction activities.
5. Notes in this drawing apply to all other active drawings.

0 5 10 15 20 25 Horizontal Scale in Metres

0 1 2 3 4 5 Vertical Scale in Metres

Vertical Exaggeration 3X

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

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REVISIONS

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CHECKED:	APPROVED:	DATE:
JK	EMR	Oct. 31, 2014

FILE NAME: 1CT022.001_Madrid_South_Pad-Sections RevD.dwg

TMAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.001

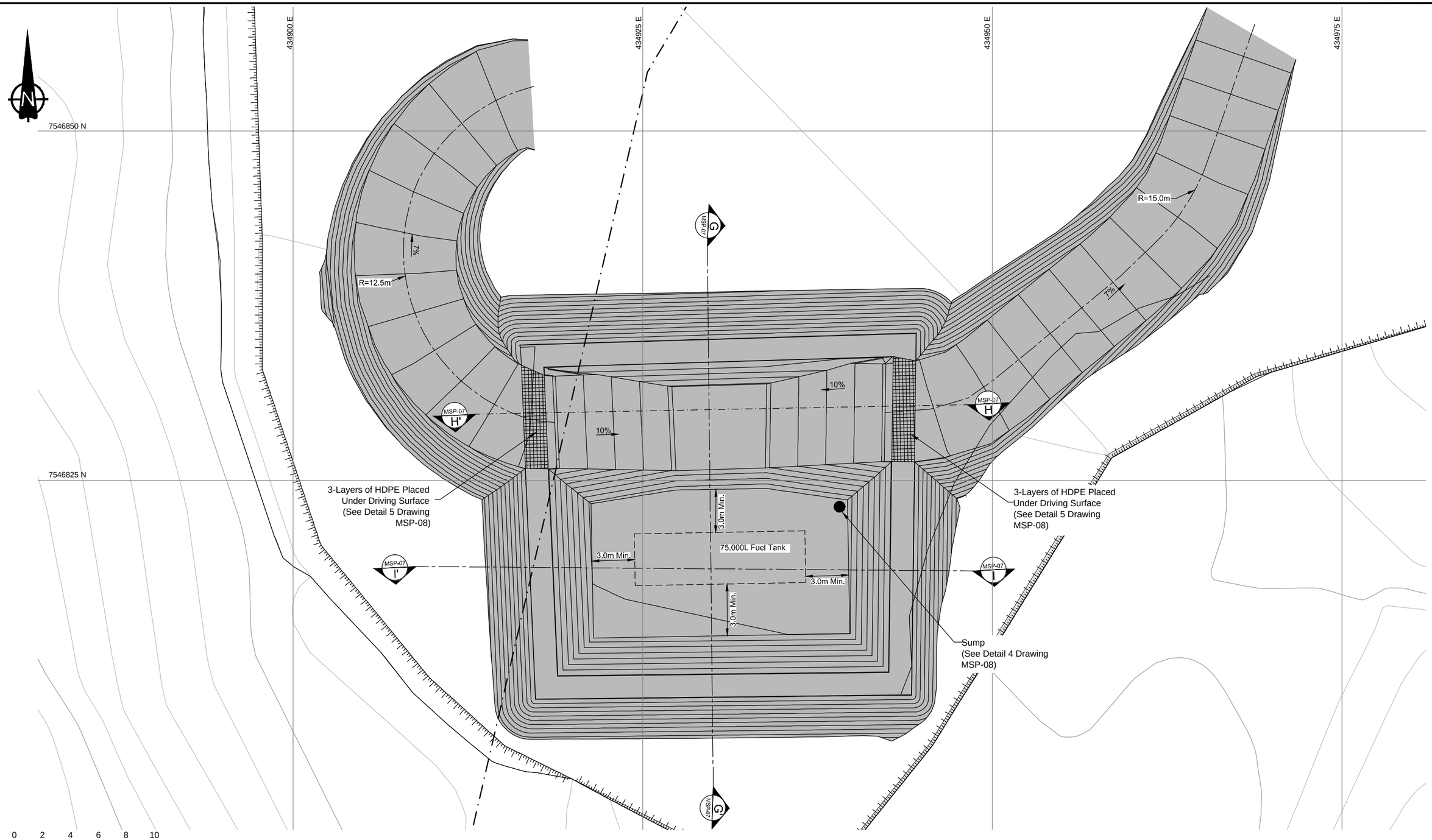
Madrid South Surface Infrastructure

DRAWING TITLE:

Madrid South Pad Sections (2 of 2)

DRAWING NO.	SHEET	REVISION NO.
MSP-05	6 OF 10	D

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DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
C	Minor Edits	LW	EMR	31Oct14
B	Minor Edits	LW	EMR	12June14
A	Issued for Review	JK	EMR	14Mar14

REVISIONS

Original Drawings
Stamped and
Signed by Engineer

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DESIGN:	DRAWN:	REVIEWED:
MK	MDDS	EMR
CHECKED:	APPROVED:	DATE:
LW	EMR	Oct. 31, 2014

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TMAC RESOURCES

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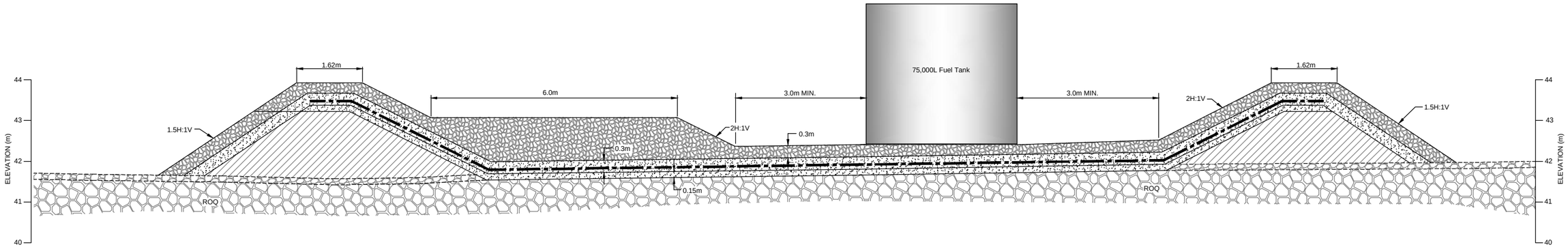
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Madrid South Surface Infrastructure

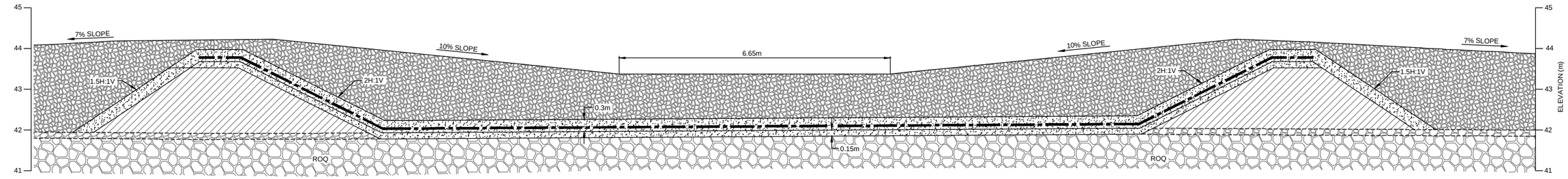
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Typical Fuel Transfer Station

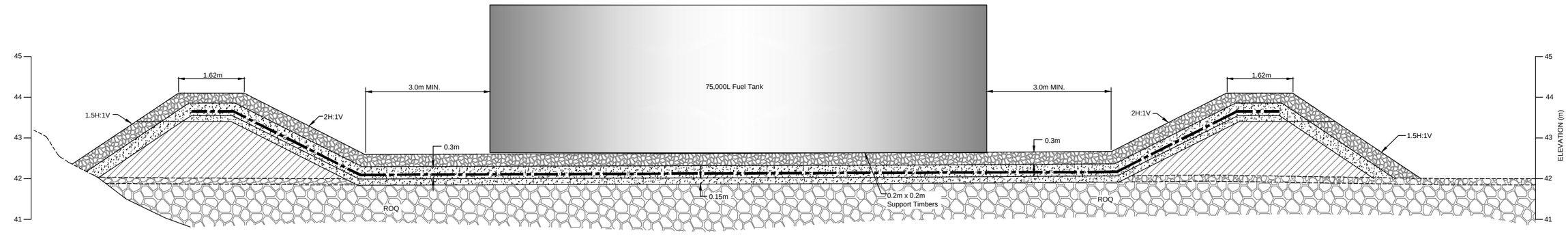
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MSP-06	7 OF 10	C



G MSP-06 **SECTION G-G'**



H MSP-06 **SECTION H-H'**



I MSP-06 **SECTION I-I'**

LEGEND

- ¾" Crush Finishing Material
- 1 ½" Crushed Material
- 6" Compacted Jaw-Run Material
- Run of Quarry Material
- Liner System

0 0.5 1 1.5 2 2.5
Scale in Metres

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS			

NO.	DESCRIPTION	CHK'D	APP'D	DATE
D	Minor Edits	LW	EMR	31Oct14
C	Minor Edits	LW	EMR	17Sep14
B	Minor Edits	LW	EMR	12June14
A	Issued for Review	JK	EMR	14Mar14
REVISIONS				

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MK	MDDS	EMR
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LW	EMR	Oct. 31, 2014

FILE NAME: 1CT022.001_Madrid_South_Fuel_Transfer.dwg

MAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.001

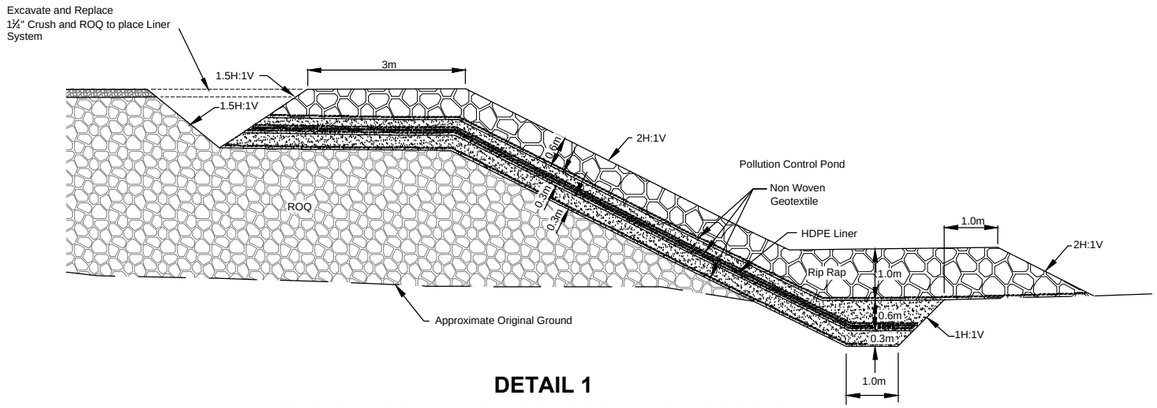
Madrid South Surface Infrastructure

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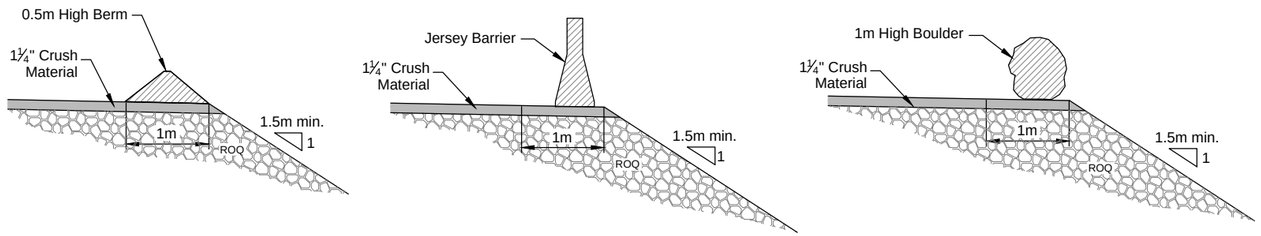
Typical Fuel Transfer Station Sections

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MSP-07	8 OF 10	D

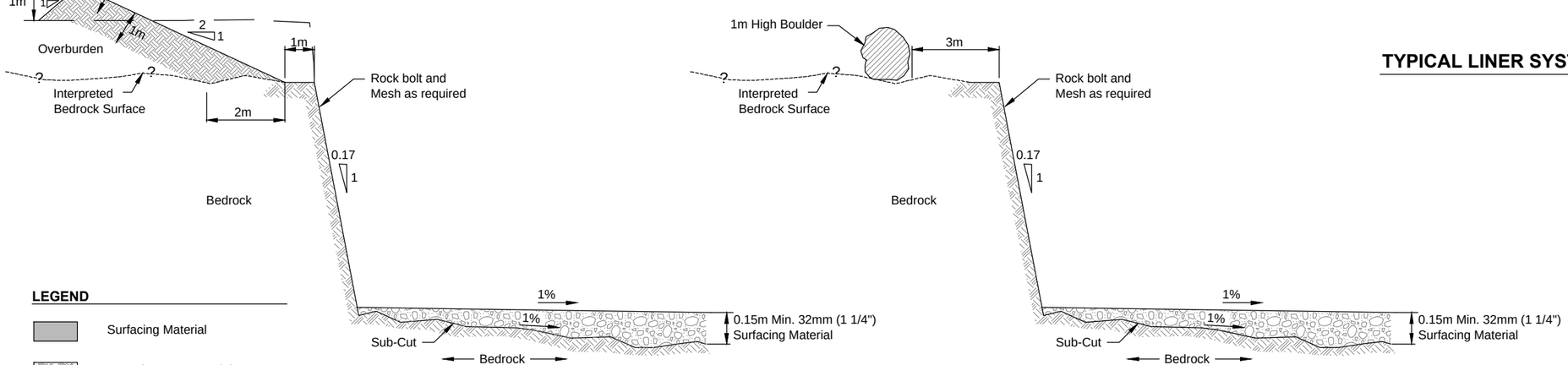
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DETAIL 1
TYPICAL POLLUTION CONTROL BERM SECTION
NTS



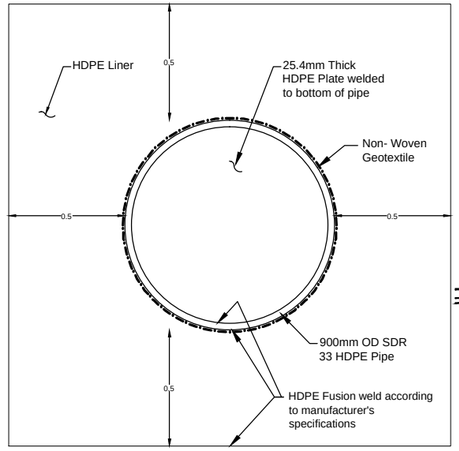
DETAIL 2
TYPICAL BERM BARRIER OPTIONS
NTS

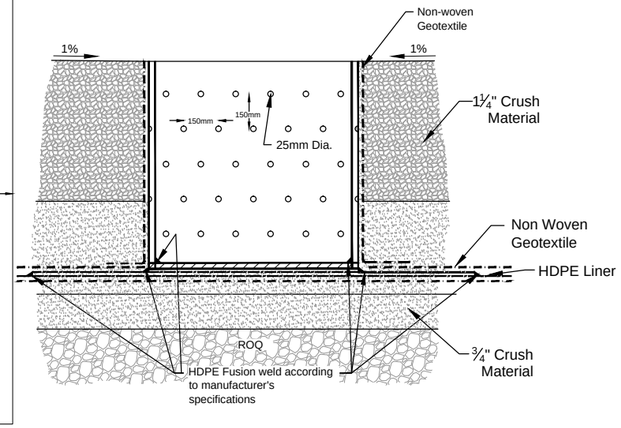


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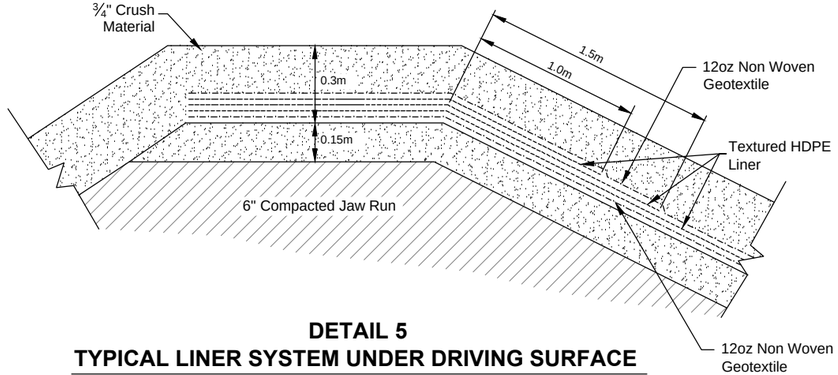
- Surfacing Material
- Run of Quarry Material

DETAIL 3
TYPICAL SECTIONS OF HIGHWALL SAFETY BERM/BARRIER
NTS





DETAIL 4 - SUMP
NTS



DETAIL 5
TYPICAL LINER SYSTEM UNDER DRIVING SURFACE
NTS

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS			

NO.	DESCRIPTION	CHK'D	APP'D	DATE
C	Minor Edits	LW	EMR	31Oct14
B	Minor Edits	LW	EMR	17Sep14
A	Issued for Review	JK	EMR	14Mar14

REVISIONS

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DESIGN:	DRAWN:	REVIEWED:
JK	NV	LW
CHECKED:	APPROVED:	DATE:
JK	EMR	Oct. 31, 2014

FILE NAME: 1CT022.001_Madrid_South_Pad-Sections RevD.dwg

TMAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.001

Madrid South Surface Infrastructure

DRAWING TITLE: Berm and Barrier Details

DRAWING NO.	SHEET	REVISION NO.
MSP-08	9 OF 10	C

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Materials List and Quantity Estimates

Item	Quantity / Area / Volume	ROQ (cu.m.)	Cut (cu.m.)	Description
1. Run of Quarry Material	Laydown Area Pad	7,330	1,375	Approximate In-Place Neat-line Volume (3D volume based on Civil 3D surfaces - no allowance has been made for losses and/or tundra embedment)
	Infrastructure Pad	17,770	6,881	
	Portal Pad	2,560		
	Vent Raise Access Pad	3,915	11,066	
	Waste Rock Pad	31,230		
	Ore Stockpile Pad	12,200		
	Access Roads	23,810	297	
	Primary Pollution Control Berm	7,040		
	Secondary Pollution Control Berm	5,270		
	Total	111,125	19,619	
2. Surface Grade Material	Laydown Area Pad	928		Approximate In-Place Neat-line Volume
	Infrastructure Pad	1,847		
	Portal Pad	190		
	Vent Raise Access Pad	1,366		
	Waste Rock Pad	-		
	Ore Stockpile Pad	-		
	Access Roads	1,015		
	Primary Pollution Control Berm	516		
	Secondary Pollution Control Berm	180		
	Total	6,042		

Materials List and Quantities for Pollution Control Berm Ponds

Item	Quantity / Area / Volume		Description
Rip Rap	Rip Rap on Berm Face and Over Downstream Key Trench	4280 m³	Volumes approximated by typical section and key trench lengths
Finishing Material (¾" Crush)	OverLiner	1840 m³	
	UnderLiner	1690 m³	
Geotextile (2 Layers)	Geotextile OverLiner	11240 m²	12oz. Non Woven
	Geotextile UnderLiner	11240 m²	
Liner	Geomembrane Liner on Berm Face and in Downstream Key Trench	5620 m²	Textured HDPE 60 or Equivalent
	Geomembrane Liner in Pond Area and in Upstream Key Trench	12590 m²	

Materials List and Quantities (Fuel Transfer Station for both at Portal and Pad)

Item	Quantity / Area / Volume		Description
6" Compacted Jaw Run Material	Berm Walls (FSF at Portal)	575 m³	Volumes derived by Eagle Point 7.2. - Side slopes 2H:1V Unless otherwise noted
	Berm Walls (FCA at Pad)	575 m³	
Finishing Material (¾" Crush)	OverLiner (FSF at Portal)	350 m³	
	OverLiner (FCA at Pad)	350 m³	
	UnderLiner (FSF at Portal)	120 m³	
	UnderLiner (FCA at Portal)	120 m³	
Surfacing Material (1¼" Crush)	Final Surface (FSF at Portal)	1260 m³	
	Final Surface (FCA at Pad)	1260 m³	
Geotextile (2 Layers)	Geotextile OverLiner (FSF at Portal)	750 m²	12oz. Non Woven
	Geotextile OverLiner (FCA at Pad)	750 m²	
	Geotextile UnderLiner (FSF at Portal)	750 m²	
	Geotextile UnderLiner (FCA at Pad)	750 m²	
	Sump (FSF at Portal)	5 m²	
	Sump (FCA at Pad)	5 m²	
Liner	Geomembrane Liner 1 Base (FSF at Portal)	750 m²	Textured HDPE 60 or Equivalent
	Geomembrane Liner 1 Base (FCA at Pad)	750 m²	
	Geomembrane Liner 2 Under Driving Surface (FSF at Portal)	25 m²	
	Geomembrane Liner 2 Under Driving Surface (FCA at Pad)	25 m²	
	Geomembrane Liner 3 Under Driving Surface (FSF at Portal)	17 m²	
	Geomembrane Liner 3 Under Driving Surface (FCA at Pad)	17 m²	
	Sump (FSF at Portal)	5 m²	
	Sump (FCA at Pad)	5 m²	

Tolerances Road Material Placement:

Location	Fill (mm)	Excavation (mm)
Vertical Tolerance on Roads	0 to +75	n/a
Horizontal Tolerance on Roads	-150 to +150	

Note: Grade shall not be uniformly high or low.

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DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
E	Minor Edits	LW	EMR	31Oct14
D	Minor Edits	LW	EMR	17Sep14
C	Liner Added to Ponds	LW	EMR	7Aug14
B	New Portal Location	LW	EMR	27June14
A	Issued for Review	JK	EMR	14Mar14

REVISIONS

Original Drawings Stamped and Signed by Engineer

PROFESSIONAL ENGINEERS STAMP

srk consulting

DESIGN:	DRAWN:	REVIEWED:
JK	NV	EMR
CHECKED:	APPROVED:	DATE:
JK	EMR	Oct. 31, 2014

FILE NAME: 1CT022.001_Madrid_South_Mat_Specs RevE.dwg

TMAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.001

Madrid South Surface Infrastructure

DRAWING TITLE:

Material Specifications

DRAWING NO.	SHEET	REVISION NO.
MSP-09	10 OF 10	E

Appendix 4-C

SRK, November 2014 Memo – Hope Bay Project: Madrid South Bulk Sample: Madrid South All-Weather Road

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Memo

To:	John Roberts	**Client:**	TMAC Resources Inc.
From:	Lowell Wade Maritz Rykaart	**Project No:**	1CT022.001.410
Cc:		**Date:**	November 27, 2014
Subject:	Hope Bay Project: Madrid South Bulk Sample: Madrid South All-Weather Road		

1 Introduction

TMAC Resources Inc. is currently in the process of constructing their Doris North Project (Project) in the Kitikmeot region of Nunavut, Canada. Concurrent with this, TMAC is carrying out regional exploration and have identified the Madrid South area as a potential high quality exploration target. However, advanced exploration and extraction of a bulk sample is needed to verify economic feasibility and milling process methods.

The Madrid South area is located about 15 km south of the Doris North Camp. Currently there is no permanent access to the area and therefore TMAC proposes to construct a 4.7 km long all-weather road which will branch off from the southernmost end of the existing Doris-Windy All-Weather Road.

This memo provides complete details of the Madrid South All-Weather Road design. This should be read in conjunction with the attached set of conceptual level engineering drawings (Attachment 1).

2 Design Concept

All the all-weather roads associated with the Hope Bay Project are located on Inuit Owned Land (IOL), administered by the Kitikmeot Inuit Association (KIA).

Site roads are considered private roads, administered and controlled entirely by TMAC. To date, none of the site roads are used as, or classified as mine haul roads in accordance with the Nunavut Mine Safety Act pertaining to haul roads. The proposed all-weather road to the Madrid South area will also not be classified as a haul road. Notwithstanding this, TMAC has opted to ensure that all site roads are designed in accordance with the minimum requirements as set out for mine haul roads in the Nunavut Mine Safety Act.

The proposed all weather access road to the Madrid South area, is an extension of the existing 10 km long Doris-Windy All-Weather Road, and uses the same primary design criteria. The road

will allow duel lane traffic for frequently travelled vehicles such as trucks and crew busses, while allowing single lane traffic for occasional oversize vehicles. Strategically placed road turnouts are provided to facilitate single lane use.

3 Access Alternatives

TMAC considered a number of alternative methods to access the Madrid South area, taking into consideration that the closest all-weather access road to the site is about 5 km to the north along the Doris-Windy All-Weather Road. The alternatives considered can be summarized as follows:

- Winter road access. Consideration was given to access the area using only seasonal winter roads. The easiest (least amount of portages) winter road route (about 4.5 km total length including 2 portages totalling 0.5 km) would extend west from the southernmost end of the Doris-Windy All-Weather road to Patch Lake and follow the eastern shore of the lake to the Madrid South area. The gradient from the Patch Lake shoreline to the project site is however too much, and therefore this route would not be practical. The next likely route is about 4.2 km long (including 2 portages totalling 2 km). This starts at the same point as the first route, but halfway down Patch Lake it turns into a bay on Patch Lake linking to the low ground between the Patch and Wolverine Lakes.

  Seasonal access will significantly limit functionality of the bulk sample program, requiring complex annual shut-downs, excessive seasonal manpower loads, and severely limit schedule flexibility. For these reasons this alternative was not pursued further although a winter road may be required to access Madrid South and the quarries until the Madrid South All-Weather Road has been constructed.

- Air access. Construction of an all-weather airstrip, linked with an all-weather road to the Madrid South area would facilitate year-round operation of the bulk sample program eliminating the seasonal access challenges. The closest viable airstrip is however more than 5 km from the Project site, requiring a longer all-weather access road than what would be required by bringing in a road from the existing Doris-Windy All-Weather Road. In addition, operating this way would require the Madrid South bulk sample to run completely as a satellite operation necessitating construction of a new camp and all associated infrastructure and facilities. This alternative was therefore not considered further although a winter ice airstrip may be required until the Madrid South All-Weather Road has been constructed.

- All-weather road access. The Madrid South area can be linked to the existing Doris North Project infrastructure by constructing a 4.7 km all-weather road from the southernmost end of the Doris-Windy road to the Project site. This would allow year-round access, provide maximum flexibility and allow seamless integration of the exploration workforce with the exploration base at Windy Camp. This option would also allow for the integration of the operations at Doris North with the Madrid Advanced Exploration Project. This was therefore selected as the preferred alternative.

Two alternative all-weather road alignments were considered:

- Eastern route on high ground. This route extends south from the Doris-Windy All-Weather Road crossing the topographic low (requiring a stream crossing) between Patch and Windy Lakes. The route turns slightly southeast after 0.3 km and continues on the lower ground closer to the Patch Lake shoreline for about 2.2 km. At this point the route turns east after two significant stream crossings and continues for about 0.5 km before turning due south along the topographic low between Patch Lake and Wolverine Lake. Another 1.0 km further along the route turns southeast again, crosses the stream channel leading to Wolverine Lake before continuing 0.3 km to the Madrid South area. This total route length is 4.3 km. The number of stream crossings and the difficult terrain (soft, poorly drained ground) over which this route travels outweighs the benefits offered by the shorter distance, and as a result this alternative was not selected.
- Western route on high ground. This route also extends south from the Doris-Windy All-Weather road crossing the topographic low (requiring a stream crossing) between Patch and Windy Lakes. After about 0.6 km, the route turns southwest and runs uphill for about 0.6 km onto high well-drained ground. The route continues due south for about 1.5 km before turning south-east heading downhill for about 1.7 km towards the topographic low (requiring a second stream crossing) between Patch Lake and Wolverine Lake. The Madrid South area is reached 0.3 km further on up the hill. The total route is 4.7 km long. This was selected as the preferred route.

4 System Design

4.1 Design Criteria

The access road to the Madrid South area is for private use and will support year round operations of the Project. Normal use will include routine crew change, equipment and consumable resupply and access to the Doris North Project airstrip for medical evacuation in an emergency.

The design vehicle for the all-weather road is a Super B-Train truck. To allow dual lane traffic of this vehicle, the minimum crest road width will need to be a minimum of 8 m. Where the road shoulder exceeds 3 m above ground, the road will be widened by 1 m and a safety barrier will be constructed at least 1 m high. Larger vehicles and equipment will occasionally travel this road and therefore turnouts (4 m wide and 30 m long) are strategically located along the road. Where the road fill is less than 2 m it will have side slopes of 1.5H:1V, and for fill thicknesses greater than 2 m the slopes will be 2H:1V.

Two drainage crossings have been identified along the all-weather road route where multiple 1 m diameter culverts will be installed through the road alignment.

4.2 Survey Data

The design of the all-weather road was based on topographic contour maps produced from 2008 aerial photography supplied by Hope Bay Mining Limited (HBML). Verification surveys of the stream locations were conducted by HBML but a detailed ground survey was not completed.

4.3 Foundation Conditions

Comprehensive geotechnical investigations have been carried out at the Hope Bay site (SRK 2009). This information confirms that the area lies within the zone of continuous permafrost, with the permafrost being up to 550 m deep. Permafrost temperature at the surface is about -8ºC and the active layer is generally less than 1 m thick. Laboratory and in-situ tests on disturbed and undisturbed samples indicate that the overburden soils are predominantly comprised of marine silts and clays, and the pore-water in these soils has high salinity, depressing the freezing point to -2ºC. The ice-rich overburden soils are typically between 5 and 20 m deep, before encountering competent bedrock, predominantly basalt. Bedrock is frequently exposed, rising columnar 5 to 100 m above the surrounding landscape.

Thermal modeling has determined that a 1 m minimum of rock fill cover would be required over the tundra to preserve the infrastructure pads (SRK 2006). Since all pads are designed to have a flat surface with minor grading for drainage, the Run-of-Quarry (ROQ) fill thickness reaches up to 7 m at places due to underlying topography.

The geotechnical design parameters for Hope Bay have been summarized in SRK (2011a).

4.4 Road Design

Thermal modeling was completed to determine how much fill would be required over the tundra to ensure the permafrost would be preserved for infrastructure construction such as the all-weather road (SRK 2006). Based on this assessment, the all-weather road will be constructed using four typical fill thicknesses (Bedrock Zone, Zone 1, Zone 2 and Zone 3) ranging from 0.3 to 2.0 m. Each of these zones is based on site specific ground conditions, identified through air photo interpretation followed by ground truthing. Details of the design are presented in Attachment 1.

The all-weather road will be constructed from ROQ material obtained from local approved and permitted rock quarries. This material will be placed in lift thicknesses that do not exceed 0.85 m (zone dependent) and compacted using a vibratory drum compactor using a site specific compaction specification. The surfacing layer of the road consists of a 150 mm thick layer of 1¼ inch crush.

Road turnouts matching the fill zone thickness of the road and measuring 4 m wide and 30 m long will be constructed based on principals of line of sight. Details pertaining to the location of these turnouts are provided in Attachment 1.

Animal crossings will be constructed along the All-Weather road alignment if required. The location of these crossings will be determined by Elders after construction of the road has been completed. Design details of these crossings are provided in Attachment 1.

4.5 Drainage Crossings

Two drainage crossings have been identified along the all-weather road route. To ensure unimpeded surface water flow to Patch Lake, multiple 1 m diameter culverts will be installed through the road alignment. The details for the installation of the twin culverts are shown in Attachment 1.

5 Construction Methodology

The all-weather road will be constructed with ROQ material excavated from permitted and approved quarries along the Doris-Windy All Weather Road (Quarry A, B, and D) as well as two new quarries (Quarry G and H) along the all-weather road route. SRK (2008) contains complete details pertaining to geochemical characterization of the Doris-Windy All-Weather Road Quarries A, B, and D while SRK (2014a) provides the geochemical characterization of the new Quarries G and H confirming the suitability of these quarries for use in construction. The management and monitoring of the existing Quarries along the Doris-Windy All-Weather Road and of the new Quarries (Quarry G and H) that will be used for the construction of the surface infrastructure pads and access roads is discussed in SRK (2014b).

The All-Weather road will be constructed in accordance to SRK's Technical Specifications (SRK 2011b).

Surface grade material for the All-Weather road will be from Quarry #2 and the crusher located in Quarry #2. Complete material quantities are included in Attachment 1.

Disclaimer—SRK Consulting (Canada) Inc. has prepared this document for TMAC Resources Inc.. Any use or decisions by which a third party makes of this document are the responsibility of such third parties. In no circumstance does SRK accept any consequential liability arising from commercial decisions or actions resulting from the use of this report by a third party.

The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

6 References

SRK Consulting (Canada) Inc., 2006. Doris North Project – Thermal modeling to support design thickness for granular pads. Technical Memorandum, Prepared for Miramar Hope Bay Limited, Project Number: 1CM014.008, August 20, 2006.

SRK Consulting (Canada) Inc., 2008. Geochemical Characterization of Quarry Materials for the Doris-Windy All-Weather Road. Hope Bay Project. Report Prepared for Hope Bay Mining Limited, Project Number 1CH008.000.300. August 2008.

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SRK Consulting (Canada) Inc., 2014a. Hope Bay Project. Geochemical Characterization Program for Quarry G, H and I. Report Prepared for TMAC Resources Inc. Project Number 1CT022.001.400.10. July, 2014.

SRK Consulting (Canada) Inc. 2014b. Hope Bay Project. Quarry Management and Monitoring Plan – Revision 02 DRAFT. Report Prepared for TMAC Resources Inc. Project Number: 1CT022.001.840. July 2014.

Attachment 1
Engineering Drawings for the Madrid South All-Weather Road

Engineering Drawings for the Madrid South All-Weather Road, Hope Bay Project, Nunavut, Canada

ACTIVE DRAWING STATUS

DWG NUMBER	DRAWING TITLE	REVISION	DATE	STATUS
MSR-00	Engineering Drawings for the Madrid South All-Weather Road, Hope Bay Project, Nunavut, Canada	D	Oct. 31, 2014	Minor Edits
MSR-01	General Arrangement (with Orthophoto)	C	Oct. 31, 2014	Minor Edits
MSR-02	General Arrangement	B	Oct. 31, 2014	Minor Edits
MSR-03	Road Alignment Plan and Profile (1 of 5)	D	Oct. 31, 2014	Minor Edits
MSR-04	Road Alignment Plan and Profile (2 of 5)	A	Mar. 14, 2014	Issued For Discussion
MSR-05	Road Alignment Plan and Profile (3 of 5)	A	Mar. 14, 2014	Issued For Discussion
MSR-06	Road Alignment Plan and Profile (4 of 5)	A	Mar. 14, 2014	Issued For Discussion
MSR-07	Road Alignment Plan and Profile (5 of 5)	D	Oct. 31, 2014	Minor Edits
MSR-08	Road Plan and Sections	B	Aug. 5, 2014	Issued For Discussion
MSR-09	Animal Crossings Plan and Sections	A	Mar. 14, 2014	Issued For Discussion
MSR-10	Crossing #1 - Bridge Option - Plan, Section and Detail (1 of 2)	A	Mar. 14, 2014	Discontinued (Removed)
MSR-11	Crossing #1 - Bridge Option - Plan, Section and Detail (2 of 2)	A	Mar. 14, 2014	Discontinued (Removed)
MSR-12	Crossing #1 - Arch Culvert Option	A	Mar. 14, 2014	Discontinued (Removed)
MSR-13	Crossing #2 - Arch Culvert	A	Mar. 14, 2014	Discontinued (Removed)
MSR-14	Typical Arch Culvert Plan and Profile (1 of 2)	A	Mar. 14, 2014	Discontinued (Removed)
MSR-15	Typical Arch Culvert Details (2 of 2)	A	Mar. 14, 2014	Discontinued (Removed)
MSR-16	Material List and Quantity Estimates	B	Aug. 5, 2014	Issued For Discussion

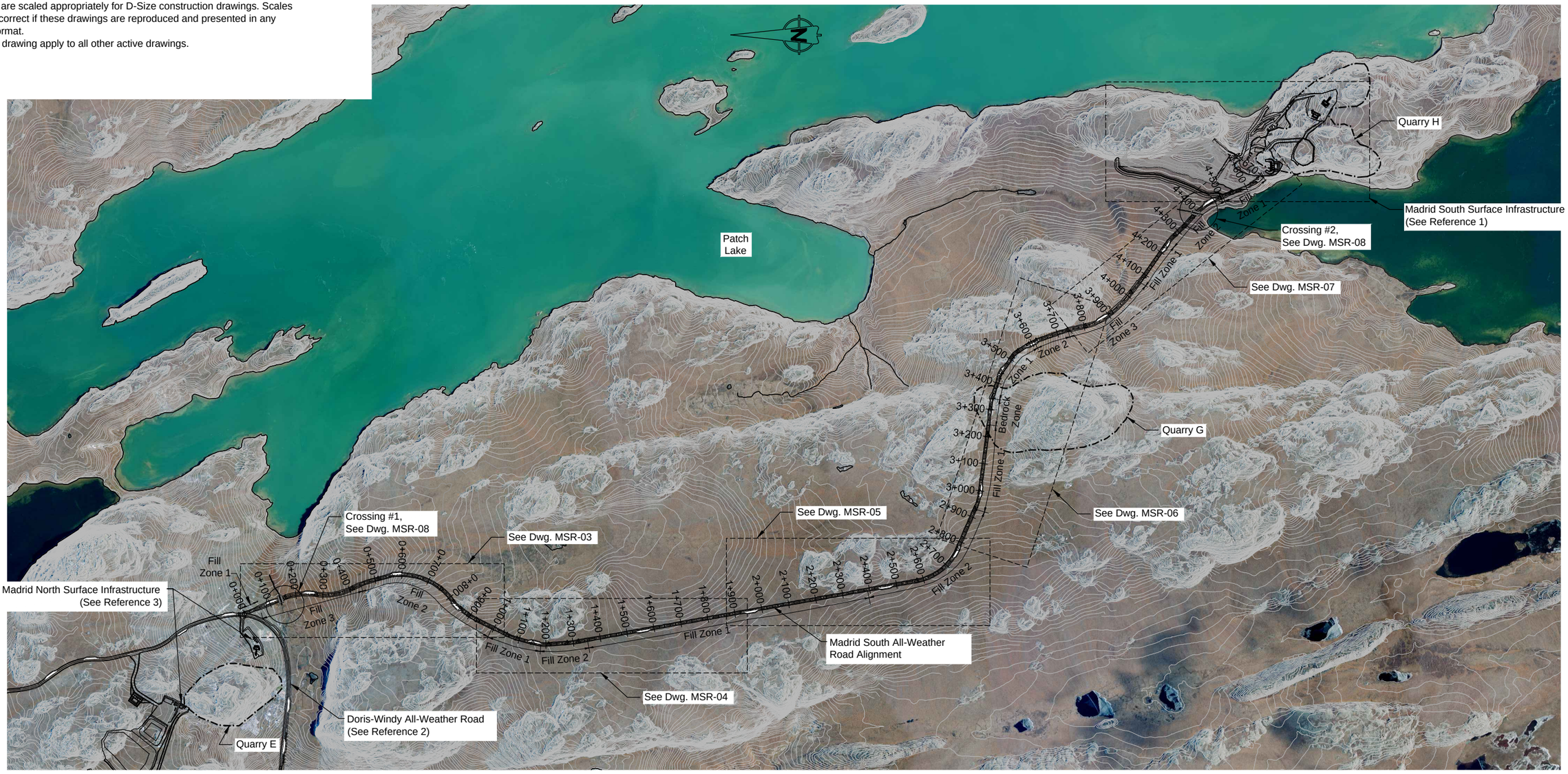
TMAC RESOURCES

srk consulting

PROJECT NO: 1CT022.001
Revision D
October 31, 2014
Drawing MSR-00

NOTES

1. Topographic contour data for the terrain model were provided by Hope Bay Mining, and is based on 2007 Aerial Photography. Contour intervals are 0.5m.
2. The co-ordinate system is UTM NAD 83, Zone 13.
3. All dimensions are in metric units, unless specifically mentioned.
4. All drawings are scaled appropriately for D-Size construction drawings. Scales may not be correct if these drawings are reproduced and presented in any other size format.
5. Notes in this drawing apply to all other active drawings.



LEGEND

- Existing Approved and Permitted Quarry
- Proposed Development Quarry
- Road Alignment
- Route Centerline (+000)

ROAD CONSTRUCTION ZONES TABLE:

Fill Zone 1	1.0m min. Overall Road Thickness with 1.5H:1V Side Slopes
Fill Zone 2	1.5m min. Overall Road Thickness with 1.5H:1V Side Slopes
Fill Zone 3	2.0m min. Overall Road Thickness with 2.0H:1V Side Slopes
Bedrock Zone	0.3m min Road Thickness (ROQ not required) with Side Slopes to be determined in the field

REFERENCES

1. Engineering drawings for the Madrid South Surface Infrastructure, Hope Bay Project, Nunavut, Canada. Issued for Discussion. Revision F. Project No. 1CT022.001. October 31, 2014.
2. Engineering Drawings for the Doris-Windy All-Weather Road, Doris Infrastructure Project, Nunavut, Canada. Revision AB1. As-Built Drawings Prepared for Hope Bay Mining Ltd. Project Number: 1CH008.033/.058. May 11, 2012
3. Engineering drawings for the Madrid North Surface Infrastructure, Hope Bay Project, Nunavut, Canada. Issued for Discussion. Revision E. Project No. 1CT022.001. October 31, 2014.

0 100 200 300 400 500
Scale in Metres

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
C	Minor Edits	LW	EMR	31Oct14
B	Issued for Discussion	LW	EMR	5Aug14
A	Issued for Discussion	JK	EMR	14Mar14

REVISIONS

Original Drawings Stamped and Signed by Engineer

PROFESSIONAL ENGINEERS STAMP

srk consulting

DESIGN:	DRAWN:	REVIEWED:
JK	NV	LW
CHECKED:	APPROVED:	DATE:
LW	EMR	October 31, 2014

FILE NAME: 1CT022_001_Madrid South_all weather road.dwg

TMAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.001

Madrid South All-Weather Road

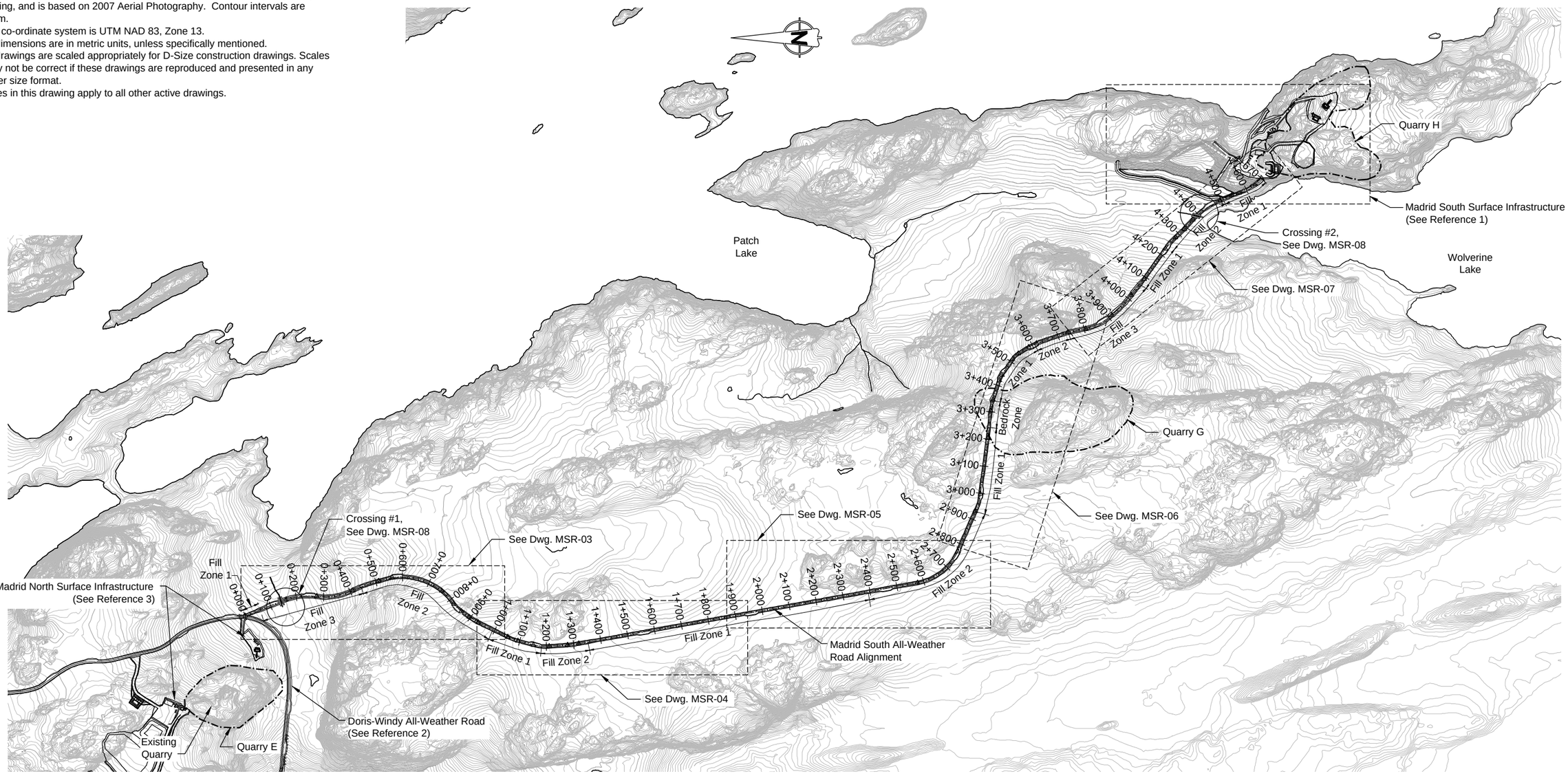
DRAWING TITLE: Madrid South All-Weather Access Road General Arrangement (with Orthophoto)

DRAWING NO.	SHEET	REVISION NO.
MSR-01	2 OF 17	C

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NOTES

1. Topographic contour data for the terrain model were provided by Hope Bay Mining, and is based on 2007 Aerial Photography. Contour intervals are 0.5m.
2. The co-ordinate system is UTM NAD 83, Zone 13.
3. All dimensions are in metric units, unless specifically mentioned.
4. All drawings are scaled appropriately for D-Size construction drawings. Scales may not be correct if these drawings are reproduced and presented in any other size format.
5. Notes in this drawing apply to all other active drawings.



LEGEND

- Existing Approved and Permitted Quarry
- Proposed Development Quarry
- Road Alignment
- Route Centerline (1+000)

ROAD CONSTRUCTION ZONES TABLE:

Fill Zone 1	1.0m min. Overall Road Thickness with 1.5H:1V Side Slopes
Fill Zone 2	1.5m min. Overall Road Thickness with 1.5H:1V Side Slopes
Fill Zone 3	2.0m min. Overall Road Thickness with 2.0H:1V Side Slopes
Bedrock Zone	0.3m min Road Thickness (ROQ not required) with Side Slopes to be determined in the field

REFERENCES

1. Engineering drawings for the Madrid South Surface Infrastructure, Hope Bay Project, Nunavut, Canada. Issued for Discussion. Revision F. Project No. 1CT022.001. October 31, 2014.
2. Engineering Drawings for the Doris-Windy All-Weather Road, Doris Infrastructure Project, Nunavut, Canada. Revision AB1. As-Built Drawings Prepared for Hope Bay Mining Ltd. Project Number: 1CH008.033/.058. May 11, 2012
3. Engineering drawings for the Madrid North Surface Infrastructure, Hope Bay Project, Nunavut, Canada. Issued for Discussion. Revision E. Project No. 1CT022.001. October 31, 2014.

0 100 200 300 400 500
Scale in Metres

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS			

NO.	DESCRIPTION	CHK'D	APP'D	DATE
B	Minor Edits	LW	EMR	31Oct14
A	Issued for Discussion	JK	EMR	14Mar14

REVISIONS

Original Drawings Stamped and Signed by Engineer

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DESIGN:	DRAWN:	REVIEWED:
JK	NV	LW
CHECKED:	APPROVED:	DATE:
JK	EMR	October 31, 2014

FILE NAME: 1CT022_001_Madrid South_all weather road.dwg

TMAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.001

Madrid South All-Weather Road

DRAWING TITLE:

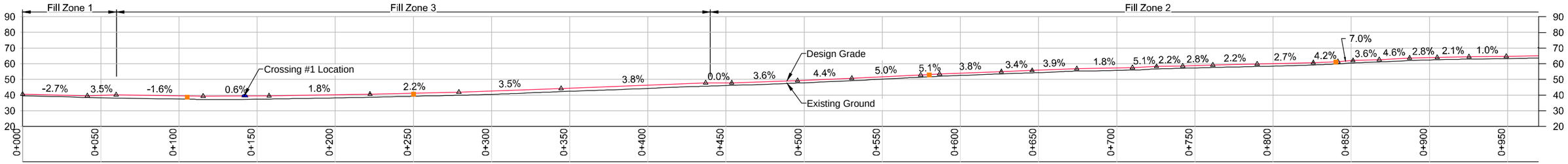
Madrid South All-Weather Access Road
General Arrangement

DRAWING NO.	SHEET	REVISION NO.
MSR-02	3 OF 17	B

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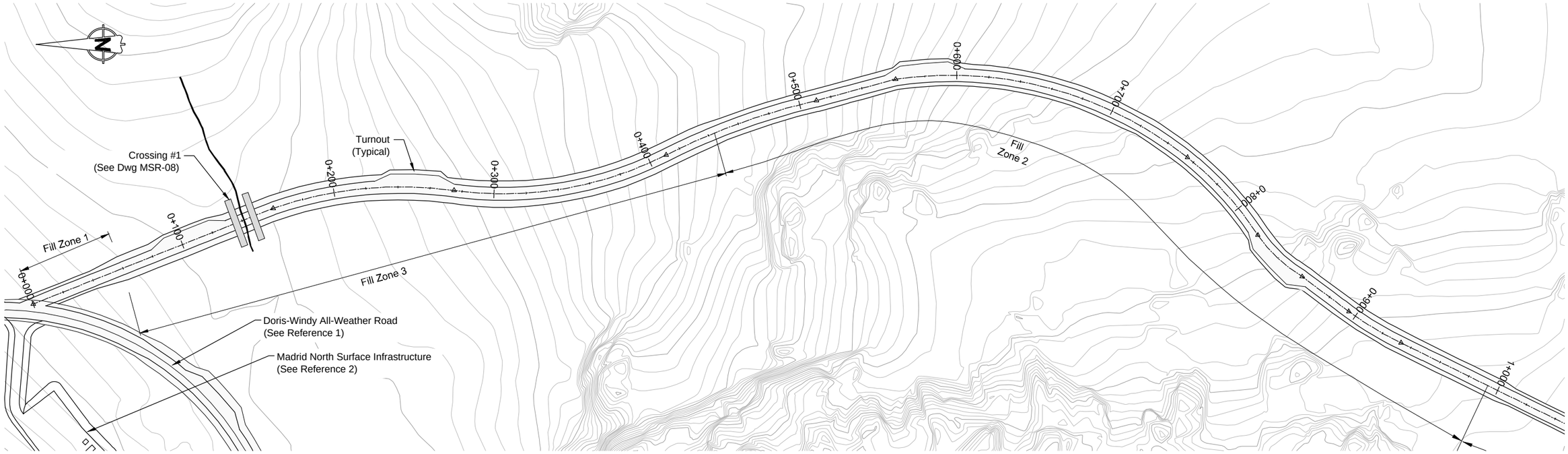
PROFILE LEGEND

- Point of Intersection
- 6.1% Grade
- Turnout Location; not to scale (See Drawing MSR-07 for Typical Layout)



PROFILE
MADRID NORTH TO MADRID SOUTH

0 10 20 30 40 50
Scale in Metres



PLAN VIEW
MADRID NORTH TO MADRID SOUTH

0 10 20 30 40 50
Scale in Metres

LEGEND

- Point of Intersection
- Route Centerline (1+000)
- Road Alignment
- Crossing Location

NOTES

1. All dimensions in metres unless noted otherwise.
2. Notes in this drawing apply to all other active drawings.

ROAD CONSTRUCTION ZONES TABLE:

Fill Zone 1	1.0m min. Overall Road Thickness with 1.5H:1V Side Slopes
Fill Zone 2	1.5m min. Overall Road Thickness with 1.5H:1V Side Slopes
Fill Zone 3	2.0m min. Overall Road Thickness with 2.0H:1V Side Slopes
Bedrock Zone	0.3m min Road Thickness (ROQ not required) with Side Slopes to be determined in the field

REFERENCES

1. Engineering Drawings for the Doris-Windy All-Weather Road, Doris Infrastructure Project, Nunavut, Canada. Revision AB1. As-Built Drawings Prepared for Hope Bay Mining Ltd. Project Number: 1CH008.033/.058. May 11, 2012
2. Engineering drawings for the Madrid North Surface Infrastructure, Hope Bay Project, Nunavut, Canada. Issued for Discussion. Revision E. Project No. 1CT022.001. October 31, 2014.

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
D	Minor Edits	LW	EMR	31Oct14
C	Minor Edits	LW	EMR	12Sep14
B	Issued for Discussion	LW	EMR	5Aug14
A	Issued for Discussion	JK	EMR	14Mar14

REVISIONS

Original Drawings Stamped and Signed by Engineer

PROFESSIONAL ENGINEER'S STAMP

srk consulting

DESIGN: JK | DRAWN: NV | REVIEWED: LW
CHECKED: LW | APPROVED: EMR | DATE: October 31, 2014
FILE NAME: 1CT022_001_Madrid South_all weather road.dwg

TMAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.001

Madrid South All-Weather Road

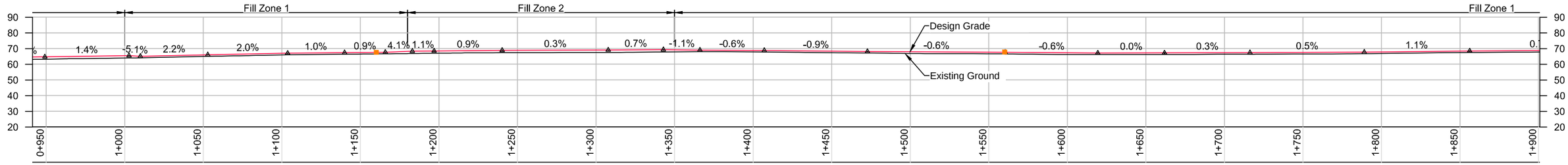
DRAWING TITLE: Road Alignment Plan and Profile (1 of 5)

DRAWING NO. MSR-03 | SHEET 4 OF 17 | REVISION NO. D

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PROFILE LEGEND

- Point of Intersection
- 6.1% Grade
- Turnout Location; not to scale
  (See Drawing MSR-07 for Typical Layout)



PROFILE
MADRID NORTH TO MADRID SOUTH

0 10 20 30 40 50
Scale in Metres



PLAN VIEW
MADRID NORTH TO MADRID SOUTH

0 10 20 30 40 50
Scale in Metres

LEGEND

- Point of Intersection
- 1+000 Route Centerline
- Road Alignment
- Crossing Location

ROAD CONSTRUCTION ZONES TABLE:

Fill Zone 1	1.0m min. Overall Road Thickness with 1.5H:1V Side Slopes
Fill Zone 2	1.5m min. Overall Road Thickness with 1.5H:1V Side Slopes
Fill Zone 3	2.0m min. Overall Road Thickness with 2.0H:1V Side Slopes
Bedrock Zone	0.3m min Road Thickness (ROQ not required) with Side Slopes to be determined in the field

NOTES

1. All dimensions in metres unless noted otherwise.
2. Notes in this drawing apply to all other active drawings.

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS			

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issued for Discussion	JK	EMR	14Mar14

REVISIONS

Original Drawings Stamped and Signed by Engineer

PROFESSIONAL ENGINEER'S STAMP

srk consulting

DESIGN: JK	DRAWN: NV	REVIEWED: LW
CHECKED: JK	APPROVED: EMR	DATE: Mar. 14, 2014

FILE NAME: 1CT022_001_Madrid South_all weather road.dwg

SRK JOB NO.: 1CT022.001

MAC RESOURCES

HOPE BAY PROJECT

Madrid South All-Weather Road

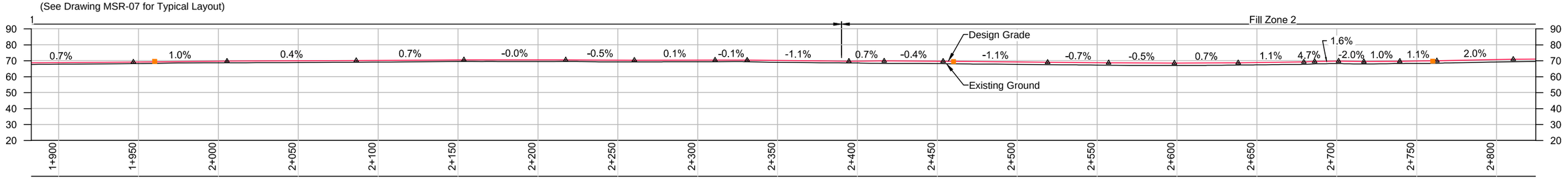
DRAWING TITLE:
Road Alignment
Plan and Profile
(2 of 5)

DRAWING NO.	SHEET	REVISION NO.
MSR-04	5 OF 17	A

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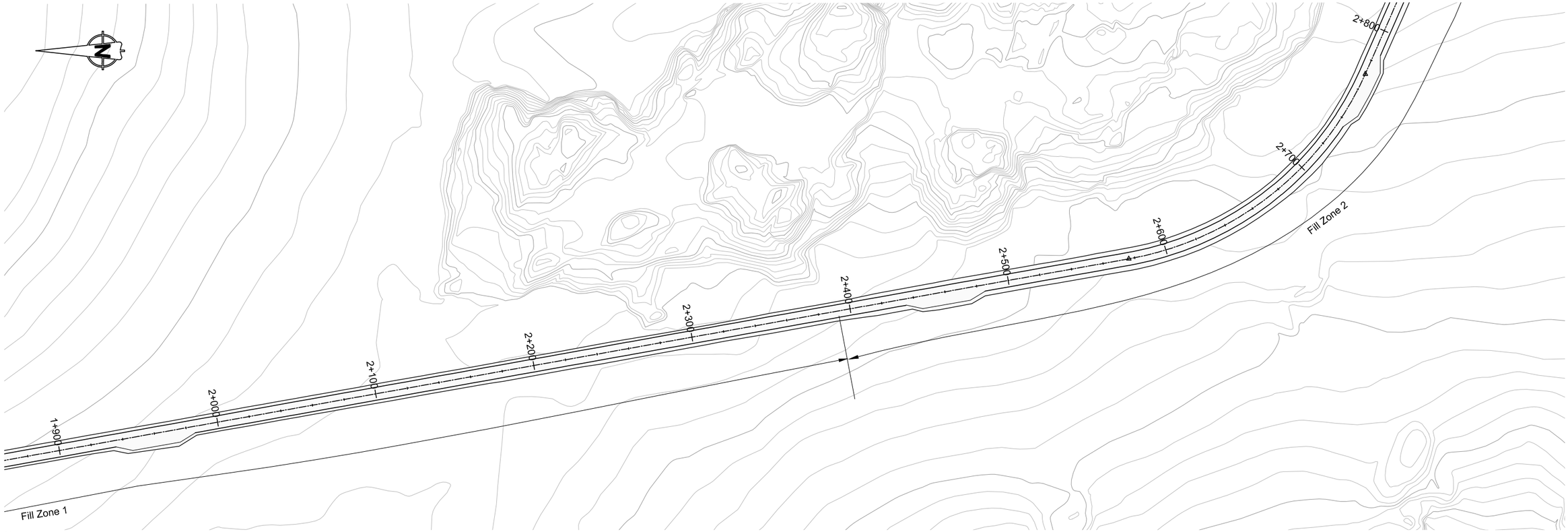
PROFILE LEGEND

- Point of Intersection
- 6.1% Grade
- Turnout Location; not to scale
  (See Drawing MSR-07 for Typical Layout)



PROFILE
MADRID NORTH TO MADRID SOUTH

0 10 20 30 40 50
Scale in Metres



LEGEND

- Point of Intersection
- Route Centerline (1+000)
- Road Alignment
- Crossing Location

ROAD CONSTRUCTION ZONES TABLE:

Fill Zone 1	1.0m min. Overall Road Thickness with 1.5H:1V Side Slopes
Fill Zone 2	1.5m min. Overall Road Thickness with 1.5H:1V Side Slopes
Fill Zone 3	2.0m min. Overall Road Thickness with 2.0H:1V Side Slopes
Bedrock Zone	0.3m min Road Thickness (ROQ not required) with Side Slopes to be determined in the field

PLAN VIEW
MADRID NORTH TO MADRID SOUTH

0 10 20 30 40 50
Scale in Metres

NOTES

1. All dimensions in metres unless noted otherwise.
2. Notes in this drawing apply to all other active drawings.

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issued for Discussion	JK	EMR	14Mar14

REVISIONS

Original Drawings Stamped and Signed by Engineer

PROFESSIONAL ENGINEER'S STAMP

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DESIGN:	DRAWN:	REVIEWED:
JK	NV	LW
CHECKED:	APPROVED:	DATE:
JK	EMR	Mar. 14, 2014

FILE NAME: 1CT022_001_Madrid South_all weather road.dwg

TMAC RESOURCES

HOPE BAY PROJECT

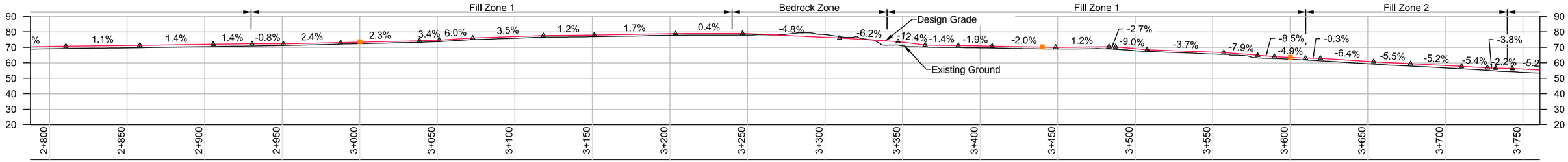
SRK JOB NO.: 1CT022.001

Madrid South All-Weather Road

DRAWING TITLE:
Road Alignment
Plan and Profile
(3 of 5)

DRAWING NO.	SHEET	REVISION NO.
MSR-05	6 OF 17	A

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PROFILE LEGEND

- Point of Intersection
- 6.1% Grade
- Turnout Location; not to scale (See Drawing MSR-07 for Typical Layout)

PROFILE
MADRID NORTH TO MADRID SOUTH

0 10 20 30 40 50
Scale in Metres



LEGEND

- Point of Intersection
- Route Centerline 1+000
- Road Alignment
- Crossing Location

ROAD CONSTRUCTION ZONES TABLE:

Fill Zone 1	1.0m min. Overall Road Thickness with 1.5H:1V Side Slopes
Fill Zone 2	1.5m min. Overall Road Thickness with 1.5H:1V Side Slopes
Fill Zone 3	2.0m min. Overall Road Thickness with 2.0H:1V Side Slopes
Bedrock Zone	0.3m min Road Thickness (ROQ not required) with Side Slopes to be determined in the field

PLAN VIEW
MADRID NORTH TO MADRID SOUTH

0 10 20 30 40 50
Scale in Metres

NOTES

1. All dimensions in metres unless noted otherwise.
2. Notes in this drawing apply to all other active drawings.

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issued for Discussion	JK	EMR	14Mar14

REVISIONS

Original Drawings Stamped and Signed by Engineer

PROFESSIONAL ENGINEER'S STAMP

srk consulting

DESIGN:	DRAWN:	REVIEWED:
JK	NV	LW
CHECKED:	APPROVED:	DATE:
JK	EMR	Mar. 14, 2014

FILE NAME: 1CT022_001_Madrid South_all weather road.dwg

MAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.001

Madrid South All-Weather Road

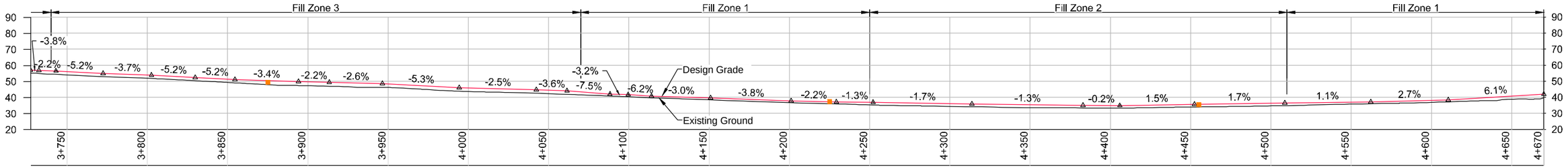
DRAWING TITLE:
Road Alignment
Plan and Profile
(4 of 5)

DRAWING NO.	SHEET	REVISION NO.
MSR-06	7 OF 17	A

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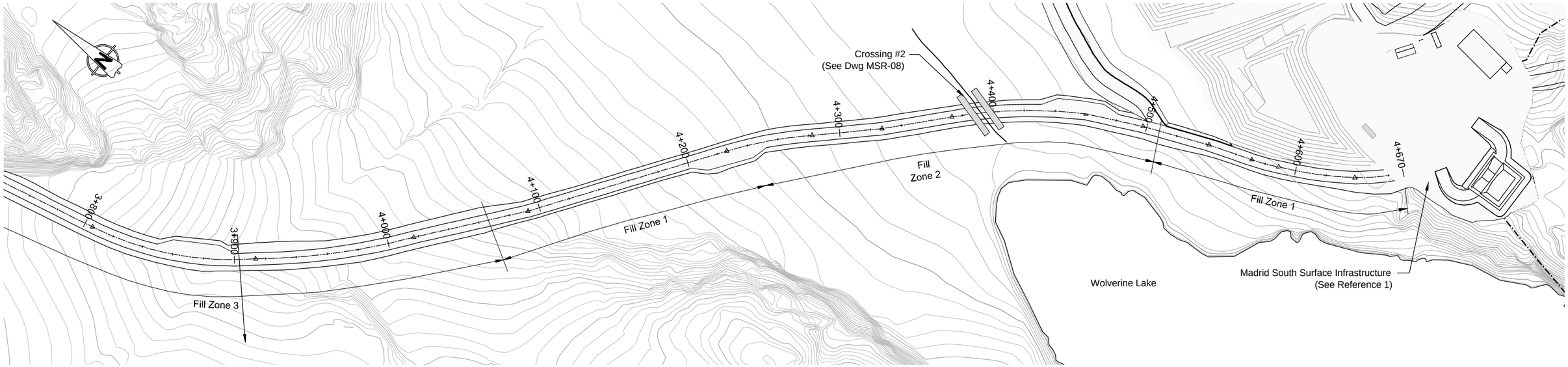
PROFILE LEGEND

- Point of Intersection
- 6.1% Grade
- Turnout Location; not to scale
  (See Drawing MSR-07 for Typical Layout)



PROFILE
MADRID NORTH TO MADRID SOUTH

0 10 20 30 40 50
Scale in Metres



PLAN VIEW
MADRID NORTH TO MADRID SOUTH

0 10 20 30 40 50
Scale in Metres

LEGEND

- Point of Intersection
- Route Centerline 1+000
- Road Alignment
- Crossing Location

ROAD CONSTRUCTION ZONES TABLE:

Fill Zone 1	1.0m min. Overall Road Thickness with 1.5H:1V Side Slopes
Fill Zone 2	1.5m min. Overall Road Thickness with 1.5H:1V Side Slopes
Fill Zone 3	2.0m min. Overall Road Thickness with 2.0H:1V Side Slopes
Bedrock Zone	0.3m min Road Thickness (ROQ not required) with Side Slopes to be determined in the field

NOTES

1. All dimensions in metres unless noted otherwise.
2. Notes in this drawing apply to all other active drawings.

REFERENCE

1. Engineering drawings for the Madrid South Surface Infrastructure, Hope Bay Project, Nunavut, Canada. Issued for Discussion. Revision F. Project No. 1CT022.001. October 31, 2014.

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
D	Minor Edits	LW	EMR	31Oct14
C	Minor Edits	LW	EMR	12Sep14
B	Issued for Discussion	LW	EMR	5Aug14
A	Issued for Discussion	JK	EMR	14Mar14

REVISIONS

Original Drawings Stamped and Signed by Engineer

PROFESSIONAL ENGINEER'S STAMP

srk consulting

DESIGN:	DRAWN:	REVIEWED:
JK	NV	LW
CHECKED:	APPROVED:	DATE:
LW	EMR	October 31, 2014

FILE NAME: 1CT022_001_Madrid South_all weather road.dwg

TMAC RESOURCES

HOPE BAY PROJECT

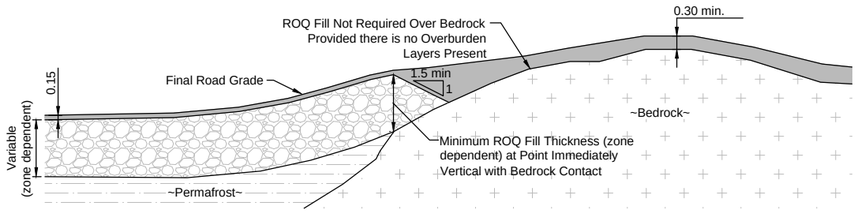
SRK JOB NO.: 1CT022.001

Madrid South All-Weather Road

DRAWING TITLE:
Road Alignment
Plan and Profile
(5 of 5)

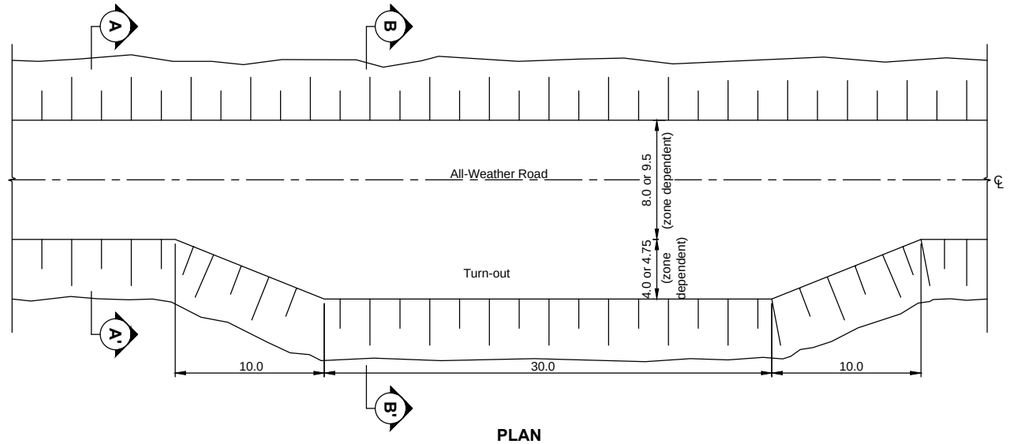
DRAWING NO.	SHEET	REVISION NO.
MSR-07	8 OF 17	D

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ALL-WEATHER ROAD PROFILE
TRANSITION FROM PERMAFROST TO BEDROCK

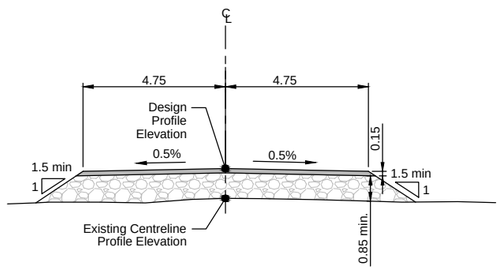
0 1 2 3 4 5
Scale in Metres



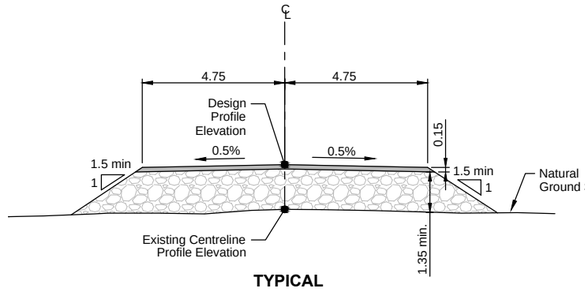
PLAN
TYPICAL ALL-WEATHER ROAD & TURNOUT

0 2 4 6 8 10
Scale in Metres

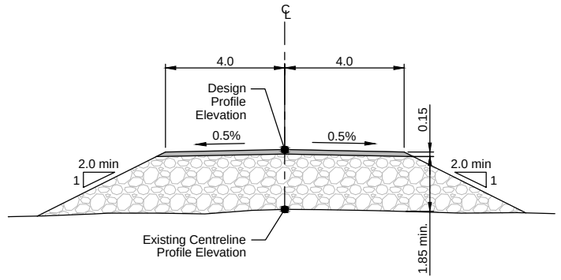
Fill Zone 1



Fill Zone 2

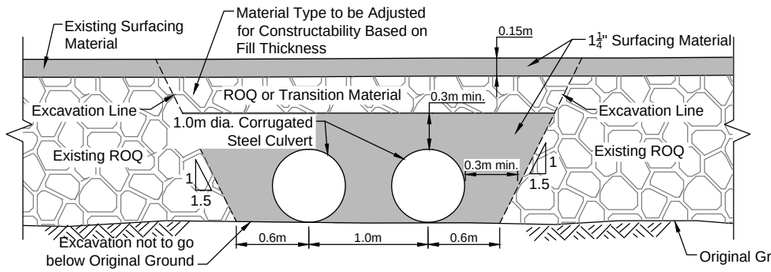


Fill Zone 3



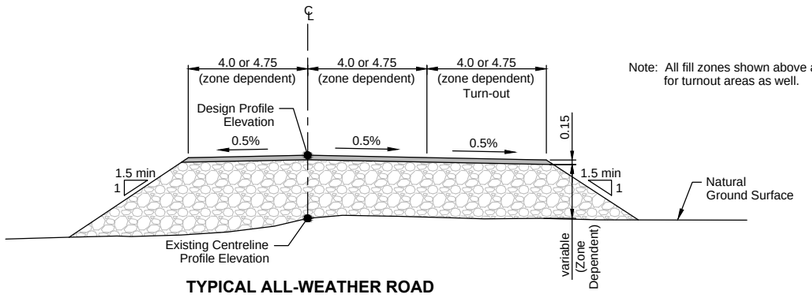
TYPICAL
ALL-WEATHER ROAD SECTION
A

0 1 2 3 4 5
Scale in Metres



DETAIL 6
TYPICAL CROSS SECTION OF CULVERT CROSSING
6

NOT TO SCALE



Note: All fill zones shown above apply for turnout areas as well.

TYPICAL ALL-WEATHER ROAD
WITH TURN-OUT SECTION
B

0 1 2 3 4 5
Scale in Metres

LEGEND

- Surfacing Material
- Run of Quarry Material

NOTES

1. All dimensions in metres unless noted otherwise.
2. Minimum design thickness must be maintained for all sections of the all-weather road including turnouts. See Drawings MSR-01 for fill zone chainage intervals.
3. Notes in this drawing apply to all other active drawings.

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
B	Issued for Discussion	LW	EMR	5Aug14
A	Issued for Discussion	JK	EMR	14Mar14

REVISIONS

Original Drawings
Stamped and
Signed by Engineer

PROFESSIONAL ENGINEERS STAMP

srk consulting

DESIGN:	DRAWN:	REVIEWED:
LW	NV	EMR
CHECKED:	APPROVED:	DATE:
LW	EMR	August 5, 2014

FILE NAME: 1CT022_001_Madrid South plan_sections.dwg

TMAC RESOURCES

HOPE BAY PROJECT

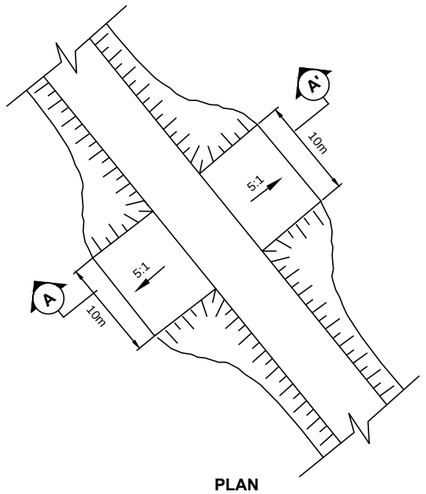
SRK JOB NO.: 1CT022.001

Madrid South All-Weather Road

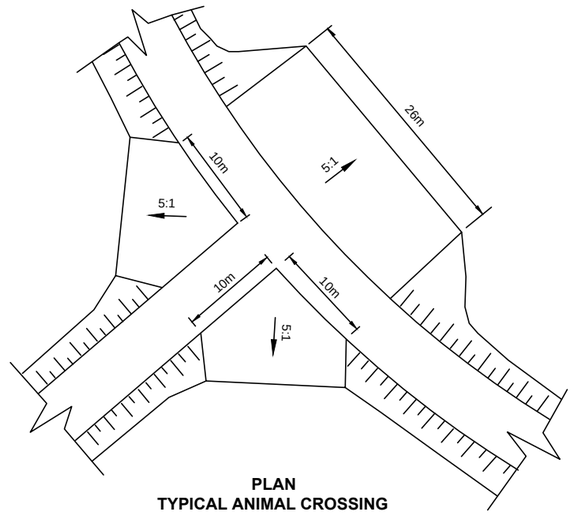
DRAWING TITLE:
Road
Plan and Sections

DRAWING NO.	SHEET	REVISION NO.
MSR-08	9 OF 17	B

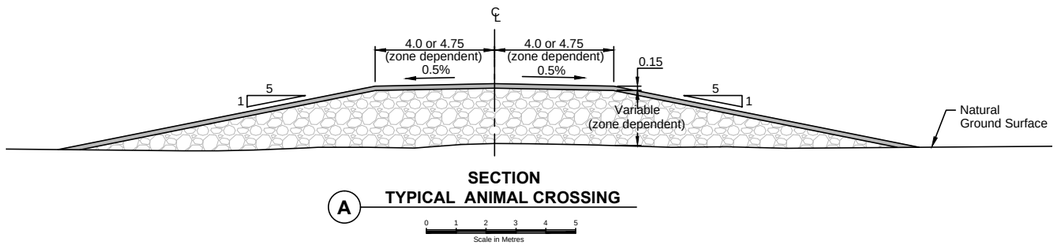
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PLAN
TYPICAL ANIMAL CROSSING
NTS



PLAN
TYPICAL ANIMAL CROSSING
AT ROAD JUNCTION
NTS



SECTION
TYPICAL ANIMAL CROSSING
A

LEGEND

- Surfacing Material
- Run of Quarry Material

NOTES

1. All dimensions in metres unless noted otherwise.
2. Locations for animal crossings will be identified by Land Owner and Elders once road construction is completed.
3. Notes in this drawing apply to all other active drawings.

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issued for Discussion	JK	EMR	14Mar14

REVISIONS

Original Drawings
Stamped and
Signed by Engineer

PROFESSIONAL ENGINEERS STAMP

srk consulting

DESIGN:	DRAWN:	REVIEWED:
LW	NV	EMR
CHECKED:	APPROVED:	DATE:
JK	EMR	Mar. 14, 2014

FILE NAME: 1CT022_001_Madrid South plan_sections.dwg

TMAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.001

Madrid South All-Weather Road

DRAWING TITLE:
Animal Crossings
Plan and Sections

DRAWING NO.	SHEET	REVISION NO.
MSR-09	10 OF 17	A

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Materials List and Quantity Estimates

Item	Quantity / Area / Volume	Description
1. Culverts	4 (Estimated) (Dependant Final Crossing Selected)	AIL Corrugated Steel Pipe 68x13 corrugated profile 1000 mm diameter and 1.6 mm thick Length = 30480 mm per culvert
2. Run of Quarry Material	Road: 63,664m^3 Turnouts (15): 4,140m^3 Total: 67,804m^3	Approximate In-Place Neat-line Volume (3D volume based on Civil 3D surfaces - no allowance has been made for losses and/or tundra embedment)
3. Surface Grade Material	Road: 5,604m^3 Turnouts (15): 360m^3 Total: 6,564m^3	Approximate In-Place Neat-line Volume
4. Geotextile	600m to 800m (Estimated)	12 oz non-woven

Tolerances on Road Material Placement:

Location	Fill (mm)	Excavation (mm)
Vertical Tolerance on Roads	0 to +75	n/a
Horizontal Tolerance on Roads	-150 to +150	

Note: Grade shall not be uniformly high or low.

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REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
B	Issued for Discussion	LW	EMR	5Aug14
A	Issued for Discussion	JK	EMR	14Mar14

REVISIONS

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DESIGN: JK	DRAWN: NV	REVIEWED: EMR
CHECKED: LW	APPROVED: EMR	DATE: August 5, 2014

FILE NAME: 1CT022_001_Madrid South plan_sections.dwg

TMAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.001

Madrid South All-Weather Road

DRAWING TITLE:

Material List and Quantity Estimates

DRAWING NO.	SHEET	REVISION NO.
MSR-16	17 OF 17	B

Appendix 5

(for Chapter 5, Environmental Setting)

TMAC, December 2014 – Madrid Advanced Exploration Program: Environmental Baseline Conditions

TMAC Resources Inc.

MADRID ADVANCED EXPLORATION PROGRAM
Environmental Baseline Conditions



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December 2014

MADRID ADVANCED EXPLORATION PROGRAM

ENVIRONMENTAL BASELINE CONDITIONS

December 2014
Project #0194097-007

Citation:

TMAC. 2014. *Madrid Advanced Exploration Program: Environmental Baseline Conditions.* Prepared by TMAC Resources Inc.: Toronto, Ontario.

Prepared by:

TMAC Resources Inc.
Toronto, Ontario

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MADRID ADVANCED EXPLORATION PROGRAM
ENVIRONMENTAL BASELINE CONDITIONS

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Glossary and Abbreviations

Glossary and Abbreviations

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

Active layer	The relatively thin layer of soil/overburden above continuous permafrost that thaws during the summer months.
ANFO	Ammonium Nitrate and Fuel Oil
asl	Above sea level
BHP	BHP Minerals Canada Ltd. (BHP Billiton)
BMP	Best Management Practice
CCD	Counter current decantation
DFO	Department of Fisheries and Oceans (Fisheries and Oceans Canada)
ESC	Erosion and Sediment Control
FOB	Fine ore bin
Freshet	In channels, the relatively high annual peak water discharge period resulting from spring/summer meltwater runoff of the winter snowpack.
HBML	Hope Bay Mining Ltd.
Hydrograph	A graphical plot of water discharge versus time
ICU	Intensive cyanidation unit
m	Metres
NAD83	North American Datum 1983, based on the spheroid (GRS80)
NIRB	Nunavut Impact Review Board
NPC	Nunavut Planning Commission
NWB	Nunavut Water Board
PMF	Probable Maximum Flood
RSA	Regional Study Area
Runoff	The part of precipitation that appears in surface streams and is a measure of hydrologic response of a watershed, commonly presented as a depth of water over an entire watershed in mm.
TIA	Tailings Impoundment Area
TMAC	TMAC Resources Inc.
TSS	Total Suspended Solids
Unit Yield	A ratio of water discharges normalized to the drainage area for a basin.

UTM	Universal Transverse Mercator
Watershed	The entire geographical area drained by a river and its tributaries; an area characterized by all runoff being conveyed to the same outlet.
WKRLUP	West Kitikmeot Regional Land Use Plan
ZOI	Zone of Influence

1. Environmental and Social Setting

1. Environmental and Social Setting

1.1 BASELINE STUDIES

Baseline environmental studies have been conducted in the Hope Bay Belt (includes the Madrid Advanced Exploration Project, "the Project" region) since 1993, and are still ongoing today (Figures 1.1-1 and 1.1-2).

The following components have been included in historical baseline studies in the Hope Bay Belt:

- Climate and meteorology;
- Air quality;
- Noise and vibrations;
- Hydrology;
- Hydrogeology;
- Bathymetry;
- Fish and fish habitat (marine and freshwater);
- Aquatics (includes marine and freshwater surface water quality, sediment quality, and aquatic biology);
- Ecosystem mapping, vegetation, and overburden;
- Wildlife, including Caribou, Muskox, wolves, Arctic Fox, Wolverine, Grizzly Bear, birds, waterfowl, raptors, seabirds, dens, small mammals, and marine mammals;
- Heritage Resources (archaeology);
- Public consultation;
- Traditional Knowledge;
- Socio-economics; and
- Land and resource use.

Table 1.1-1 provides a list of baseline reports that contain information most relevant to the Madrid Advanced Exploration Project Type B Water Licence Application. Environmental baseline studies have been conducted within the Hope Bay Belt for several years as part of ongoing exploration activities, planning and design, environmental assessment and authorization compliance. The list included in Table 1.1-1 should not be considered an exhaustive list; rather, it provides the sources containing the majority of collected data. Data continues to be collected on an ongoing basis through various baseline and compliance studies occurring in the Hope Bay Belt region.

The following sections provide high-level summaries of the existing environmental conditions within the Hope Bay Belt, with a particular focus on the Madrid Area where appropriate.

Figure 1.1-1

Hope Bay Belt
Regional Location



Figure 1.1-2

Madrid Advanced Exploration Program

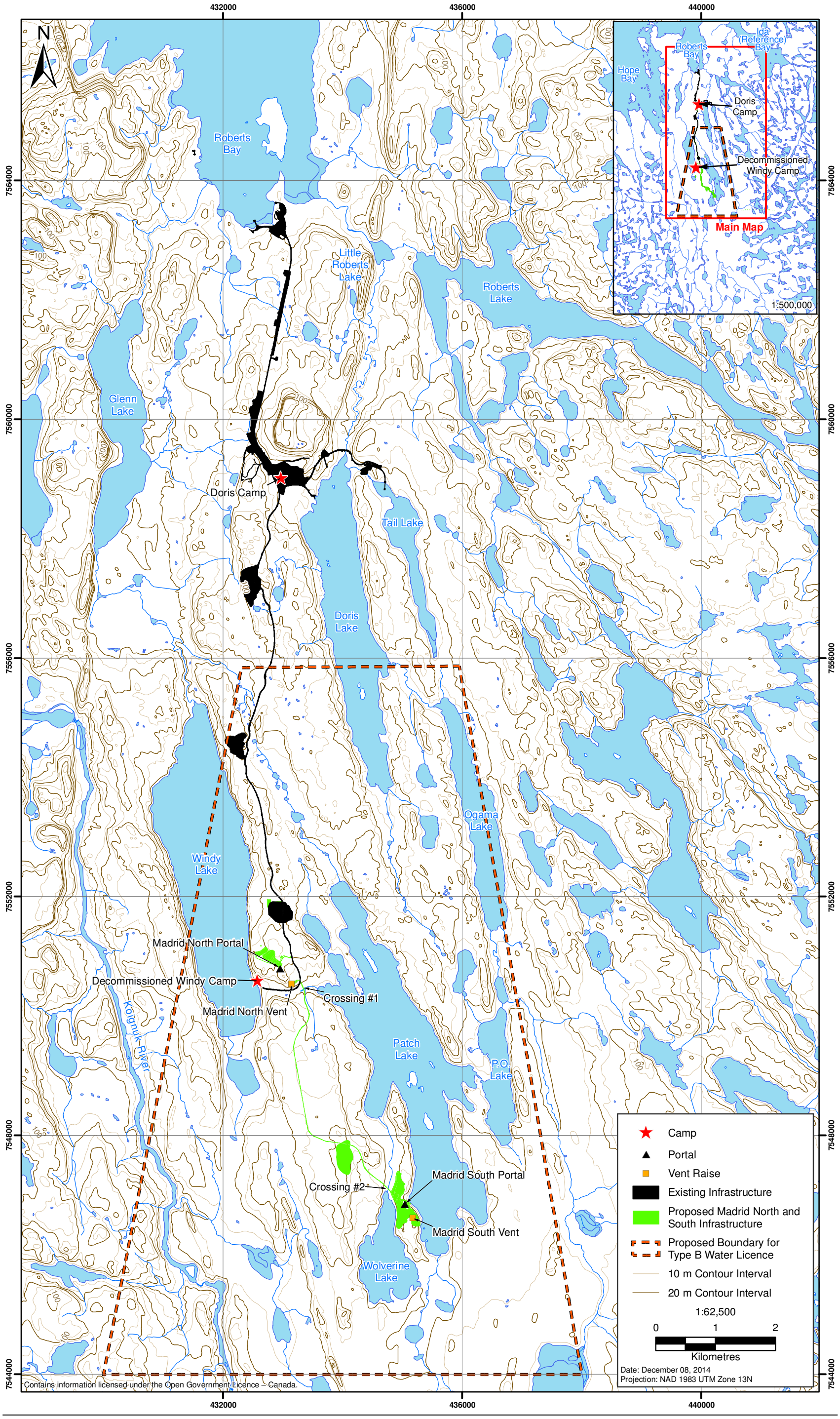


Table 1.1-1. Baseline Studies Relevant to the Madrid Advanced Exploration Project Type B Water Licence Application (as of June 30, 2014)

Topic	Sources
Climate and Meteorology	1993-2002 Data Compilation Report for Meteorology and Hydrology (Rescan 2002) 2009 Meteorology Baseline Report, Hope Bay Belt Project (Rescan 2009a) Hope Bay Belt Project 2011 Meteorology Baseline Report (Rescan 2012e)
Air Quality	Report on Air Quality and Noise Assessment of the Miramar Doris North Project (Golder 2003c) Supporting Document B3 - Doris North Project - Air Quality Assessment Methods (Golder 2005f) Air Quality Monitoring Summary: Doris North 2009 (Golder 2009a) Hope Bay Belt Project 2010 Air Quality Baseline Report (Rescan 2011e)
Noise and Vibrations	Noise Baseline Report (Rescan 2007) Doris North Gold Mine Project Noise Abatement Plan (Rescan 2010c) Hope Bay Belt Project 2010 Noise Baseline Report (Rescan 2011h)
Hydrology	BHP Minerals Canada Ltd - Doris Lake 1995 Environmental Study (Klohn-Crippen Consultants Ltd. 1995) 1993-2002 Data Compilation Report for Meteorology and Hydrology (Rescan 2002) 2006-2008 data: *2008 Hydrology Baseline Update* (Golder 2009c) 2009-2013 data: 2009 Hydrology Baseline Report (Rescan 2009b), 2010 Hydrology Baseline Report (Rescan 2011i), 2011 Hydrology Baseline Report (Rescan 2012d)
Soils, Terrain and Ecology (including Wetlands)	BHP World Minerals Hope Bay Belt Project: Environmental baseline studies and appendices 1996 (Rescan 1997c) BHP World Minerals Hope Bay Belt Project: 1996 Environmental Data Report (Rescan 1997a) BHP World Minerals Hope Bay Belt Project: 1997 Environmental Data Report (Rescan 1997b) Terrestrial Ecosystems and Bioterrain of the Hope Bay Belt, Northwest Territories, Canada (Westroad Resource Consultants 1998) Vegetation classification of the West Kitikmeot/Slave Study Region (RWED 2000) 2000 Supplemental Environmental Baseline Data Report Hope Bay Belt Project (Rescan 2001) Summary of Vegetation Baseline Studies Report, 2003 (Burt 2003) Hope Bay Belt Project: 2010 Ecosystems and Vegetation Baseline Report (Rescan 2011f) Hope Bay Belt Project: 2010 Terrain and Soils Baseline Report (Rescan 2011j) Doris North Project “No Net Loss” Plan Final Report (Golder 2007a) Preliminary Regional Ecological Land Classification (Golder 2009d)
Fish and Fish Habitat (Marine and Freshwater)	BHP Minerals Canada Ltd - Doris Lake 1995 Environmental Study (Klohn-Crippen Consultants Ltd. 1995) 2000 Supplemental Environmental Baseline Data Report Hope Bay Belt Project (Rescan 2001) Aquatic Baseline Studies Doris Hinge Project Data Compilation Report 1995-2000 (RL&L Environmental Services Ltd./Golder Associates Ltd. 2002a) Doris North Project Aquatic Studies 2002 (RL&L Environmental Services Ltd./Golder Associates Ltd. 2002b) Doris North Aquatic Studies 2003 (Golder 2003a) Doris North Aquatic Studies 2004 (Golder 2005d) Doris North Aquatic Studies 2005 (Golder 2006b) Doris North Aquatic Studies 2006 (Golder 2007b) Doris North Project Aquatic Studies 2007 (Golder 2008b) Doris North Aquatic Studies 2008 (Golder 2009b) Boston and Madrid Project Areas 2006-2007 Aquatic Studies (Golder 2008a) 2008 Hope Bay Project: Baseline Review and Gap Analysis Report (Rescan 2008)

(continued)

Table 1.1-1. Baseline Studies Relevant to the Madrid Advanced Exploration Project Type B Water Licence Application (as of June 30, 2014; continued)

Topic	Sources
Fish and Fish Habitat (Marine and Freshwater) *(cont'd)*	2009 Freshwater Fish and Fish Habitat Baseline Report, Hope Bay Belt Project (Rescan 2010b) Doris North Gold Mine Project: Aquatic Effects Monitoring Plan (Rescan 2010e) 2010 Freshwater Fish and Fish Habitat Baseline Report, Hope Bay Belt Project (Rescan 2011a) Bathymetric Surveys Hope Bay Project (Golder 2006a)
Aquatics (including Surface Water Quality)	BHP Minerals Canada Ltd - Doris Lake 1995 Environmental Study (Klohn-Crippen Consultants Ltd. 1995) Aquatic Baseline Studies Doris Hinge Project Data Compilation Report 1995-2000 (RL&L Environmental Services Ltd./Golder Associates Ltd. 2002a) Doris North Project Aquatic Studies 2002 (RL&L Environmental Services Ltd./Golder Associates Ltd. 2002b) Doris North Aquatic Studies 2003 (Golder 2003a) Doris North Aquatic Studies 2004 (Golder 2005d) Doris North Aquatic Studies 2005 (Golder 2006b) Doris North Aquatic Studies 2006 (Golder 2007b) Doris North Project Aquatic Studies 2007 (Golder 2008b) Doris North Aquatic Studies 2008 (Golder 2009b) Boston and Madrid Project Areas 2006-2007 Aquatic Studies (Golder 2008a) 2008 Hope Bay Project: Baseline Review and Gap Analysis Report (Rescan 2008) 2009 Freshwater Baseline Report, Hope Bay Belt Project (Rescan 2010a) Hope Bay Belt Project: 2010 Freshwater Baseline Report (Rescan 2011g)
Wildlife	BHP Minerals Canada Ltd - Doris Lake 1995 Environmental Study (Klohn-Crippen Consultants Ltd. 1995) BHP World Minerals Hope Bay Belt Project: Environmental baseline studies and appendices 1996 (Rescan 1997c) BHP World Minerals Hope Bay Belt Project: Environmental baseline studies and appendices 1997 (Rescan 1998) Hope Bay Belt Project - 1998 Environmental Data Report (Rescan 1999); Abundance and Distribution of Caribou in Hope Bay Study Area: 1996-2000 (Hubert and Associates Ltd. 2002a) Data Report Wildlife Studies May-August 2001 - Hope Bay Joint Venture Gold Project (Hubert and Associates Ltd. 2002c) Data Report Wildlife Studies Jun-July 2002 - Hope Bay Joint Venture Gold Project (Hubert and Associates Ltd. 2002b) Terrestrial Wildlife of Hope Bay, Nunavut: an integration and overview of data collected from 1994-2002 (Hubert and Associates Ltd. 2002d) Data Report - Wildlife Studies Jun-July 2003 - Hope Bay Nunavut (Hubert and Associates Ltd. 2003) Data Report - Wildlife Studies Jun-August 2004 - Hope Bay Nunavut (Hubert and Associates Ltd. 2004) Data Report Wildlife Studies May-August 2000 – Hope Bay Joint Venture Gold Project (Hubert and Associates Ltd. 2001) Report on Wildlife Mitigation and Monitoring (Golder 2006c) Program for the Doris North Gold Mine Project Miramar Doris North Project Wildlife Studies: Annual Report 2005 (Golder 2005e); Doris North Gold Mine Project: Wildlife Baseline Data Synthesis 2005 (Golder 2005a) Doris North Gold Mine Project: Wildlife Habitat Suitability Models 2005 (Golder 2005c) Doris North Gold Mine Project: Wildlife Cumulative Effects Assessment 2005 (Golder 2005b)

(continued)

Table 1.1-1. Baseline Studies Relevant to the Madrid Advanced Exploration Project Type B Water Licence Application (as of June 30, 2014; completed)

Topic	Sources
Heritage Resources	BHP Minerals Canada Ltd. – Doris Lake 1995 Environmental Study (Klohn-Crippen Consultants Ltd. 1995)
	BHP World Minerals – Hope Bay Belt Project - Environmental Baseline Studies Report & Appendices (Rescan 1997c)
	Archaeological Investigations - Hope Bay Joint Venture 2000 (Points West Heritage Consulting Ltd. and Rescan 2000)
	Archaeological Investigations - Hope Bay Joint Venture 1995-2000 (Points West Heritage Consulting Ltd. and Rescan 2002)
	Doris North (Hope Bay) Project, Nunavut, Archaeological Investigations in 2003 (Points West Heritage Consulting Ltd. and Rescan 2003a)
	Doris North (Hope Bay) Heritage Resource Protection Plan 2003 (Points West Heritage Consulting Ltd. and Rescan 2003b)
	Hope Bay Project Summary Report Archaeological Field Work (Points West Heritage Consulting Ltd. 2004)
Socio-economics and Land and Resource Use	BHP World Minerals – Hope Bay Belt Project – Environmental Baseline Studies Report & Appendices 1996 (Rescan 1997c)
	Supporting Document E2 – Socio-Economic Baseline Studies of the Kitikmeot Communities, Nunavut and Yellowknife Northwest Territories (Hornal and Associates Ltd. 2003b)
	A Socio-Economic Impact Assessment of the Proposed Doris North Project in the Kitikmeot Region Nunavut (Hornal and Associates Ltd. 2003a)
	Human and Ecological Risk Assessment for the Environmental Impact Statement for the Proposed Doris North Project (Golder 2005g)

2. Physical Environment

2. Physical Environment

2.1 REGIONAL SETTING

The Hope Bay Belt (Figure 1.1-1) is located within the Queen Maud Gulf Lowlands, which covers the east-central portion of the West Kitikmeot region. The area lies within the Slave Geological Province, which is underlain by granite and related gneisses, as well as by sedimentary and volcanic rocks (more than 2.5 billion years old (WKRLUP 2005). The topography of the area ranges from undulating plains near the coast to massive Archean-age rocks rising to 300 m above sea level in the south (WKRLUP 2005). The coastal areas are mantled by postglacial silts and clays, exposed bedrock, cryosol soils, and marine deposits. Permafrost is continuous and deep (up to 500 m) with low ice content (WKRLUP 2005).

The northern portion of the Hope Bay Belt consists of several watersheds that drain into Roberts Bay near mine infrastructure and the Koignuk River that drains into Hope Bay west of mining activities. Watersheds in the southern portion of the belt flow into the upper Koignuk River. The entire Hope Bay Belt area lies within the Bathurst Inlet-Burnside Watershed.

Climate in the region can be described as a subarctic desert with limited rainfall. Prevailing winds are from the northwest. Most precipitation falls as rain during the summer, and a mean of 10 cm of snow per month falls during the winter (WKRLUP 2005). The region is characterized by long dark winters and short bright summers. The ground is covered in snow from October to June most years. Lakes are ice-covered from approximately October to June most years, with ice thickness reaching depths of 2.0 m.

A number of protected areas exist within the West Kitikmeot region (Figure 2.1-1); however, no sites overlap with the Madrid South or Madrid North Projects or the overall Hope Bay Belt area. The largest is the Queen Maud Gulf Migratory Bird Sanctuary (approximately 30 km east of the Hope Bay Belt area), which is a wetland of international importance and a legislated conservation area that supports nesting grounds for nearly the entire global population of Ross' Geese (NPC 2004). Designated conservation zones are also found near Hood River in the Wilberforce Falls area, and the Huikitak River watershed east of the Bathurst Inlet area. These zones are of cultural importance for local Inuit and serve as a destination for eco-tourists (NPC 2004).

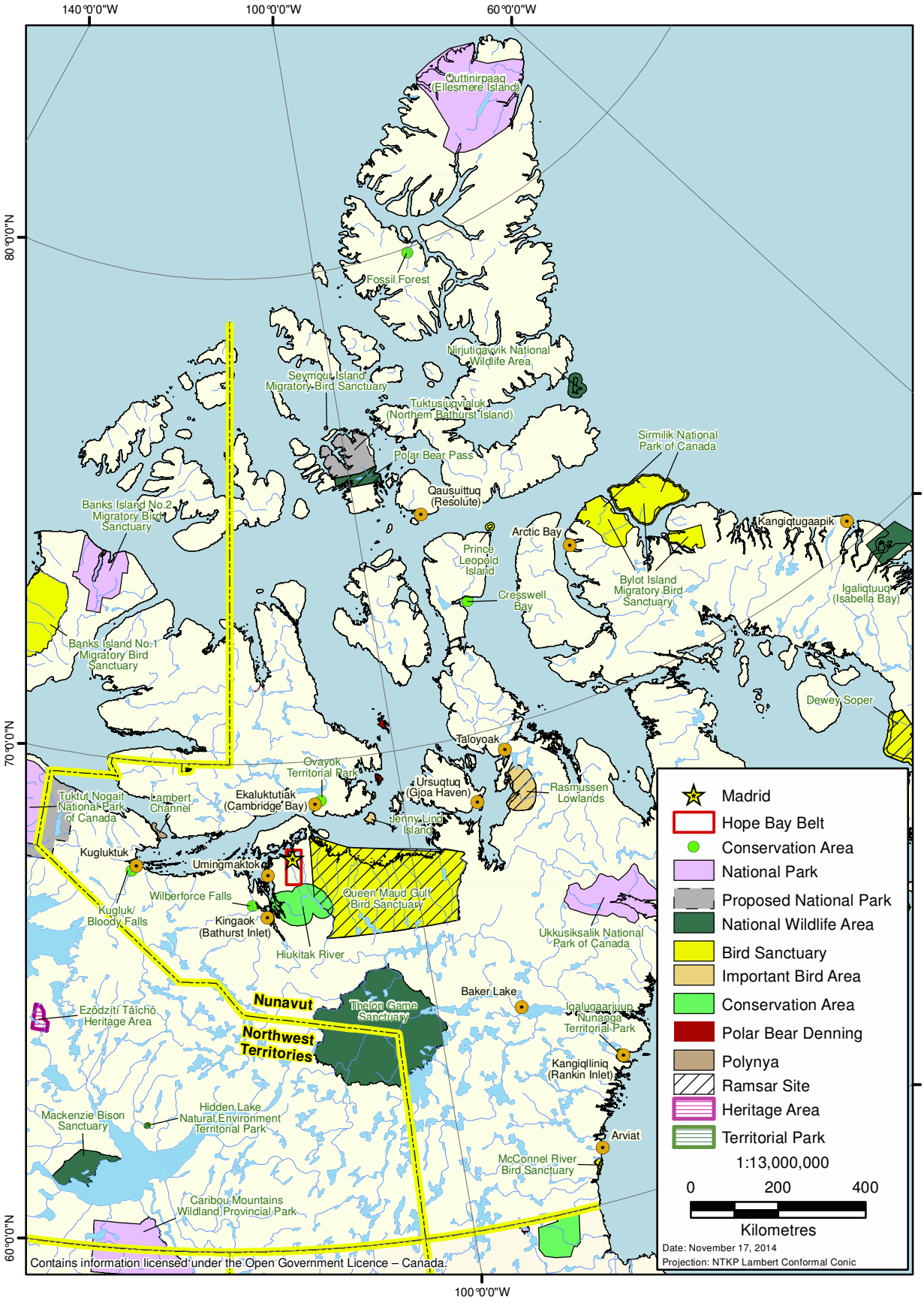
2.2 CLIMATE CONDITIONS AND FUTURE CLIMATE TRENDS

Meteorological baseline studies have been conducted in the northern (Doris station) and southern (Boston station) part of the Hope Bay Belt area since 1993 and have involved a variety of automated and manual methods (Rescan 2002). The Doris meteorological station (30 m asl) contains the most relevant and complete set of data for use (2004 to present[1]) in characterizing the current climate of the Madrid Area (Rescan 2009a, 2010d, 2011c, 2012a; ERM Rescan 2014a).

[1] The Doris meteorological station has been collecting data from 2004 to present. However, the station was upgraded from a 3 m tower to a 10 m tower on August 13, 2009, which may affect the correlation between data pre- and post-2009.

Figure 2.1-1

Parks and Conservation Areas of the Madrid Advanced Exploration Program Region



The annual mean temperature for the Doris station between 2004 and 2013 was -11.2°C, with average minimum and maximum daily temperatures of -12.4°C and -9.9°C respectively and an average relative humidity of 78.5% (Rescan 2009a, 2010d, 2011c, 2012a; ERM Rescan 2014a). Monthly mean air temperatures generally remain above freezing only from June through August or September, with monthly mean temperatures generally ranging between 3°C and 15°C, with July the warmest month of the year. The remainder of the year sees mean temperatures in the minuses, with temperatures generally ranging between -20 and -30°C from December through March, the coldest months of the year (Rescan 2009a, 2010d, 2011c, 2012a).

Normal annual precipitation at Cambridge Bay, the closest regional Environment Canada meteorological station to the Project area, is 139 mm (EC-MSC 2004). Approximately 50% of the annual precipitation occurs as snow, while the remainder occurs as rainfall. This compares relatively well to available rainfall and snow-water-equivalent (SWE) data measured in the Project area. The average total annual rainfall at the Doris station between 2004 and 2013 was 82 mm. Mean SWE values for various terrain types across the Project area was approximately 70 mm based on sampling from 2004 to 2008. This suggests that total mean annual precipitation in the Project area may range from 100 to 150 mm. Based on data from micro-meteorological stations at Doris Lake during the 2009 to 2012 open-water seasons, annual evaporation was calculated to be approximately 150 mm (ranging between 120 mm and 175 mm annually).

Solar radiation in the Arctic is high during the summer and almost zero during the winter. The annual average number of bright sunshine hours (from 2010 to 2012), where average global solar radiation is greater than 120 W/m^2, was 2,324 (EC-MSC 2004). For comparison, the average number of hours of bright sunshine in Cambridge Bay for 1971 to 2000 was 1,720.

In general, wind in the Hope Bay Belt region typically blows from the northwest quadrant year round. The average annual wind speed at the Doris station is 19.1 km/h, with average annual maximum wind gust speeds of 70.8km/h, with a maximum recorded wind speed of 104 km/h.

For future climate trends, literature suggests that mean annual temperature may increase in Canada's north by approximately 2.0°C for the climate normal period for the years 2010 to 2030 and by approximately 6.0% for the climate normal period for the years 2070 to 2100 (Lemmen et al. 2008). Over the same time periods, projections suggest that total annual precipitation could increase from 5 to 8% and 15 to 30%, respectively. The projected increase in mean annual air temperatures would lead to effects on the regional cryosphere. This would likely include alterations to sea, river, and lake ice regimes and winter snow pack, especially during shoulder seasons of spring and fall, as well as permafrost conditions.

2.3 TOPOGRAPHY AND SURFICIAL MATERIAL

The topography of the northern Hope Bay Belt area is typical of coastal lowlands in the Arctic, characterized by low and moderate relief with some high relief features (e.g., Doris Mesa, which is a diabase dike). Numerous lakes and ponds occur in low relief areas and glacial landforms (ridges and eskers) and rock outcroppings (diabase sills and dikes) occur on moderate relief areas. Elevations in the northern portion of the belt range from sea level at Roberts Bay to 158 m asl at the summit of Doris Mesa (Rescan 2011j). Watersheds are generally long and narrow, predominantly orientated along the north-south axis (Plate 2.3-1). The Hope Bay Belt region has been subjected to multiple glaciations during the Quaternary period. During each glaciation, the area was overridden by the northwestern section of the Laurentide Ice Sheet. Evidence of only the most recent glaciation (Late Wisconsinan) is preserved in the present day landscape. Bedrock striations, orientation of eskers, grooves, and drumlins indicate that the predominant glacial ice movement was north-northwest (EBA 1996).

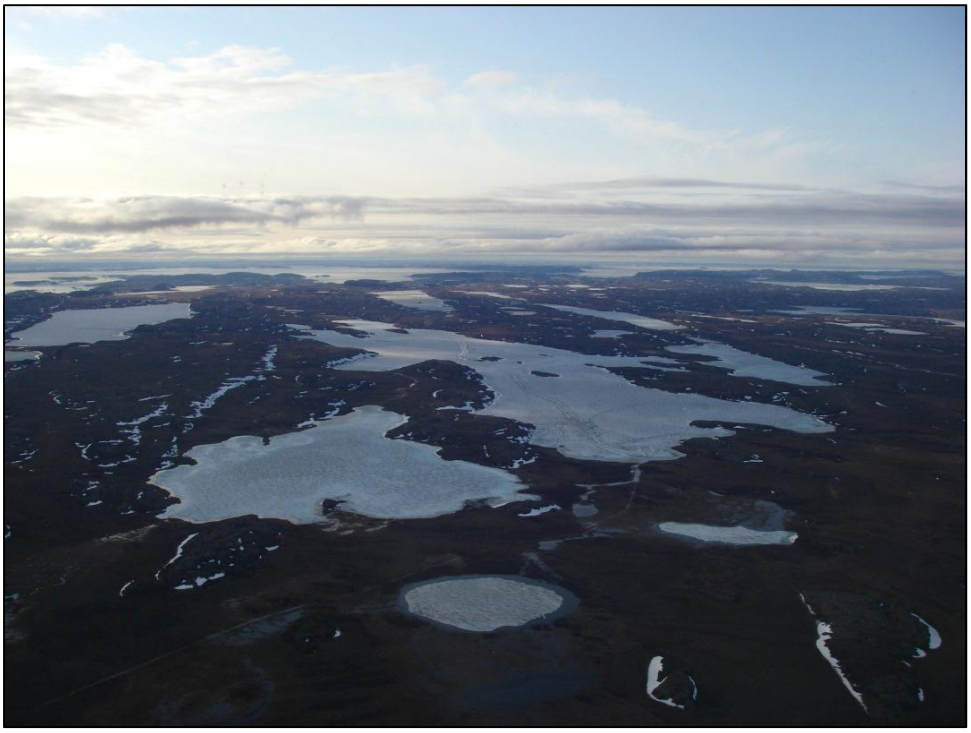


Plate 2.3-1. Oblique aerial view of the Madrid Area. View is to the north. The majority of lakes are elongated and oriented along a north-south axis. Wolverine and Patch lakes are in the foreground of the photograph. Windy Lake is visible on the far left of the photograph. June 7, 2010.

The belt area became ice-free about 8,800 years ago as the ice sheet melted back toward the southeast, leaving a blanket of basal till (morainal deposits (Dyke and Prest 1986). During the period of glacial recession, sea level was approximately 200 m higher and the project area was entirely submerged under ocean water. Marine sediments were deposited over most of the landscape.

Isostatic rebound after de-glaciation resulted in emergent landforms, and during this process ocean waves and currents washed the landscape. Easily eroded materials, including marine sediments, till, and glacio-fluvial sands and gravels, were redistributed by waves, currents, and sea ice. Areas exposed to high energy washing, generally high relief areas, have had marine deposits either completely washed away exposing the underlying moraine and or bedrock, or have had larger, coarser marine sediments (predominantly sands and gravels) deposited as isolated beaches (Rescan 1997c). Washing has also resulted in the accumulation of finer textured marine (glaciomarine) deposits in valley bottoms. At times, these glaciomarine deposits are complexed or are mixed with the finer fractions of morainal deposits that have also been washed down-slope. Since emergence, the natural effects of slope processes, frost action and permafrost have transformed the landscape to its present day shape (EBA 1996).

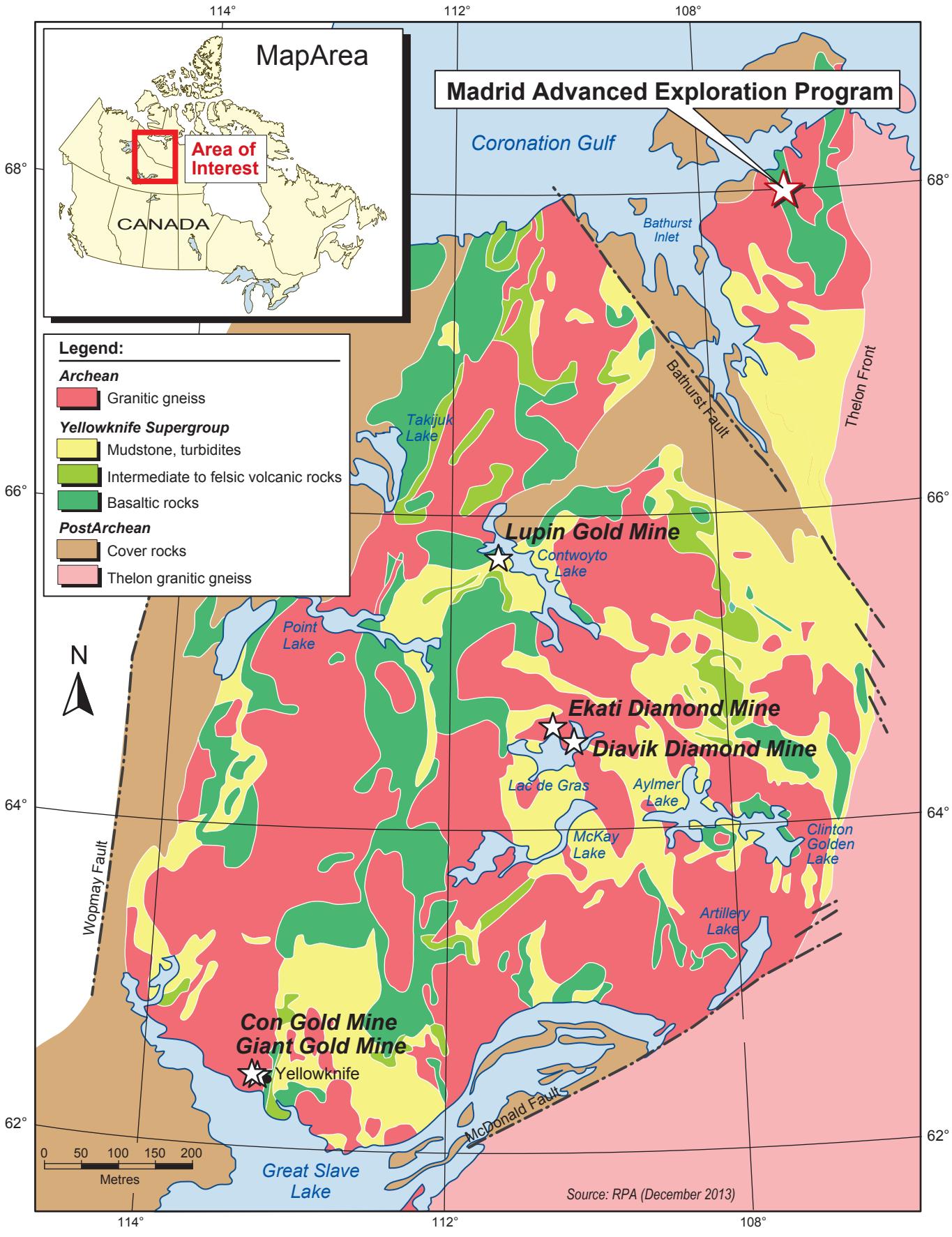
2.4 GEOLOGY AND MINERALOGY

2.4.1 Regional Geology

The Madrid Advanced Exploration Program is located within the Hope Bay Volcanic Belt which is part of a massive structural-geological complex called the Slave Structural Province. The Hope Bay Volcanic Belt lies in the northeast portion of the province (Figure 2.4-1; TMAC 2013).

Figure 2.4-1

Regional Geology of the Hope Bay Belt



U-Pb geochronology brackets volcanism in the Slave Structural Province to between 2715 and 2610 Ma. In general, the pan-Slave deformation event took place between 2.7 Ga and 2.6 Ga and resulted in regional compression, plutonism, and late extension (TMAC 2013).

The Bathurst Block, which covers approximately 16,000 km^2 in the northeast portion of the Slave Structural Province, is isolated from the rest of the province by the Proterozoic cover of the Kilohigok Basin. The Hope Bay Volcanic Belt, within the northern portion of the Bathurst Block, extends over 80 km in a north-south direction and is between 7 km and 20 km wide. The belt is dominated by mafic volcanic rocks with felsic volcanic and volcanoclastic rocks, with subordinate ultramafic bodies and meta-sedimentary rocks. Existing U-Pb geochronology of the belt indicates that felsic volcanism spanned a period of at least 53 Ma. The metamorphic grade in the interior of the belt is lower greenschist with amphibolite grade near the belt margins (TMAC 2013).

2.4.2 Local Geology

The Madrid deposit area is host to the Naartok, Rand, and Suluk gold resources while the Madrid trend hosts the Rand Spur, Marianas, Patch 7, and Patch 14 zones. The rocks within this corridor are predominantly a north-south striking package of mafic volcanic rocks, comprising a sequence of Fe-Ti tholeiitics, Mg tholeiitics, komatiitic basaltics, synvolcanic to late gabbroic and ultramafic rocks. Gold mineralization in this corridor is most commonly associated with the high Fe-Ti tholeiites and is structurally controlled by a large-scale zone of deformation referred to as the Madrid Deformation Zone. The Madrid Deformation Zone trends north-south along Patch Lake and at its northern end sharply changes orientation to an east-west trend across to Windy Lake (TMAC 2013). The geology of the Madrid Area is illustrated in Figure 2.4-2a with accompanying figure legend in Figure 2.4-2b.

Ductile strain is largely represented in the Madrid Area by the main corridor of the Madrid Deformation Zone and its splays, as well as within local zones of moderate to high strain (outside of the Madrid Deformation Zone). Intensity of the ductile strain increases towards the Madrid Deformation Zone where mafic volcanic rocks begin to exhibit pervasive intense foliation and locally exhibit mylonitic textures. Splays off of the Madrid Deformation Zone preferentially develop along volcanic-sediment horizon, possibly related to the large competency contrast between massive flows and argillite-volcanoclastic layers. It is clear that the Madrid Deformation Zone is not a single planar structure, but a complicated anastomosing feature with several splays and local pinch-and-swell textures (TMAC 2013).

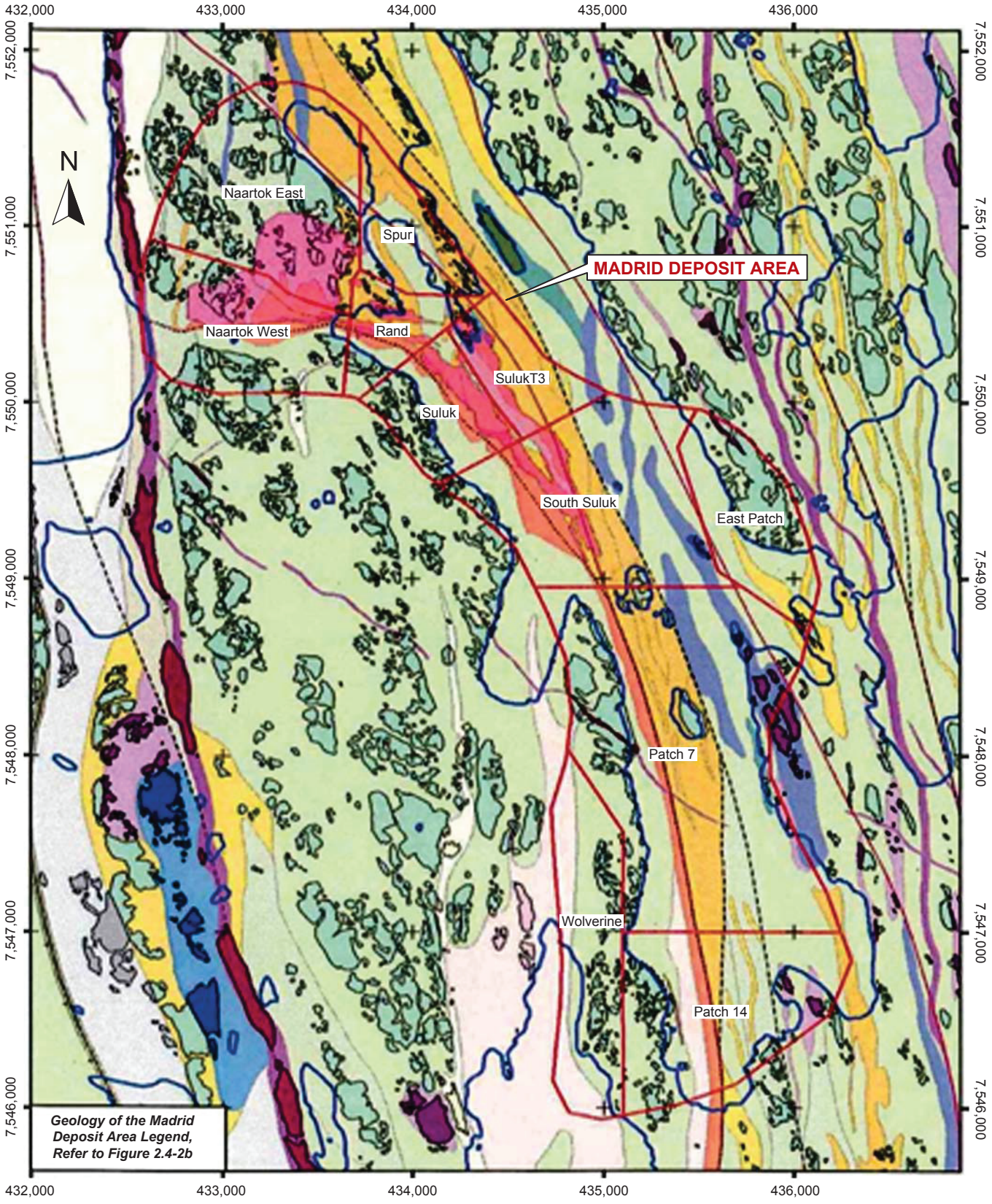
Apparent discontinuities in alteration, mineralization, and lithological units generally define a set of northwest trending steep structures in the Naartok area and a structure partially the contact of the Naartok east mineralized horizon (TMAC 2013).

The general stratigraphy of the northern Madrid Area (Naartok West to Suluk) is composed of three major volcanic packages: the Wolverine Group (C-type rocks), the Patch Group (A-type rocks), and C-type tholeiitic andesite. Stratigraphy at Naartok West includes a moderately to steeply westerly dipping package of intercalated C-type and A-type basalts and interflow sedimentary rocks. At Naartok East, the stratigraphy comprises a moderately westerly dipping package of intercalated C-type and A-type basalts and interflow sedimentary rocks. The Suluk stratigraphy is similar to the other areas of Madrid (TMAC 2013).

The Wolverine volcanic suite is separated into north and south components by the Madrid Deformation Zone. The rocks of the Wolverine Group south of the Madrid Deformation Zone comprise a series of distinctive C-type pillowed flows which are in the gradational contact with intercalated aphanitic to massive to amygdaloidal basaltic flows that also represent normal tholeiitic rocks. They demonstrate weak to moderate strain and have a predominantly chlorite-calcite alteration assemblage.

Figure 2.4-2a

Geology of the Madrid Deposit Area



Source: Newmont, 2012.

Figure 2.4-2b
Geology of the Madrid Deposit Area Legend

Proterozoic

- Lamprophyre (minette) dyke; pre-dates 1267 Ma
- Goulburn Supergroup - Burnside Formation (ca. 1.9 Ga); alluvial siliciclastic rocks dominated by quartzite, sandstone, conglomerate, and siltstone with minor gabbro/diabase sills and dykes
- Diabase dykes and sills; various ages
  - Franklin diabase (ca. 723 Ma)
  - Mackenzie diabase (ca. 1,267 Ma)
  - Brichta diabase (ca. 2.2 - 2.1 Ga)
  - unsubdivided diabase dykes

Archean

- "Late"mafic intrusive rocks. Subdivisions indicated by suffix: a = gabbro; d = diorite; f = feldspar-phyric; h = hornblende-phyric; l = locally xenolithic; m = magnetite-bearing; y = amygdaloidal/vesicular
- Xenolithic mafic intrusions. Subdivisions indicated by suffix: a = gabbro; d = diorite; h = hornblende-phyric; b =fine-to-medium-grained dyke; w ="Wog Suite"(variably magneticfine-grained diorite, commonly with epidote +/- hematite) & similar rocks
- Gabbro or diorite with demonstrable or inferred"B-type"geochemical affinity (Al203/TiO2 = 5.5 - 11); enhanced magnetism common
- "Late"granitoids - multiphase, foliation typiclly moderate to absent. Subdivisions indicated by suffix: a = granite; b = granodiorite; c = tonalite; d = monzonite and quartz monzonite; e = monzodiorite and quartz monzodiorite; h = diorite and quartz diorite; p = porphyritic; q = quartz-phyric; f = feldspar-phyric; m = magnetite-bearing; l = xenolithic; t = with extensive supracrustal rafts (transitional zone)
- Syenite and allied alkaline rocks; quartz-undersaturated; generally massive & unfoliated; uncertain age (may be Proterozoic)
- "Early"granitoids - multiphase, commonly well foliated. Subdivisions indicated by suffix: a = granite; b = granodiorite; c = tonalite; d = monzonite and quartz monzonite; e = monzodiorite and quartz monzodiorite; h = diorite and quartz diorite; p = porphyritic; q = quartz-phyric; f = feldspar-phyric; m = magnetite-bearing; l = xenolithic; t = with extensive supracrustal rafts; l =fine-grained rock of possible extrusive origin
- Mafic granitoids dominated by diorite and quartz diorite, with lesser tonalite, trondjhemite and granodiorite; enhanced magnetism common
- Migmatite suite: heterogeneous, variably foliated tonalite, granodiorite and quartz diorite, with abundant amphibolite zones; migmatitic and gneissic textures common; in part, paragneiss
- Ultramafic intrusions ("early"= 7u or"late"= 10u). Subdivisions indicated by suffix: u = composition not specified; o = pyroxenite; h = anorthosite; r = peridotite; m = magnetite-bearing
- "Early"mafic intrusive rocks (mainly synvolcanic). Subdivisions indicated by suffix: a = gabro; b = leucogabbro; c = melanogabbro; d = diorite; m = magnetite-bearing; h = anorthosite; u = ultramafic components; r = peridotite; o = pyroxenite; f = feldspar-phyric; g = with feldspar glomerocrysts; t = mixed amphibolite, gabbro & granitoids; l = xenolithic; l =fine-grained rock of possible extrusive origin
- Gabbro or diorite with demonstrable or inferred"C-type"geochemical affinity (Al203/TiO2>11)
- Gabbro or diorite with demonstrable or inferred"B-type"geochemical affinity (Al203/TiO2 = 5.5 - 11); enhanced magnetism common
- Gabbro or diorite with demonstrable or inferred"A-type"geochemical affinity (Al203/TiO2< 5.5); enhanced magnetism common
- "Late"sedimentary rocks - primarily offluvial or shallow marine facies (post volcanic)
  - Conglomerate; suffix o = polymictic
  - Argillite - arenite series; subdivisions indicated by suffix: a = argillite; b = siltstone; c = arenite; d = conglomerate; l = lithic arenite; f = feldspathic arenite; q = quartzose arenite
  - Primary carbonate rocks: dolostone, dololutite, dolostone-siltstone rhythimites, carbonaceous siliciclastic rocks, limestone/marble
- "Early sedimentary rocks of the wacke-mudstone facies (primarily syn- to post-volcanic; commonly turbiditic). Subdivisions indicated by suffix: a = argillite; b = siltstone; c = wacke/arenite; d = conglomerate; g = iron formation; f = feldspathic wacke; q = quartzose wacke; m = magnetite- bearing; s = metasedimentary schist; v = volcanic sandstone and conglomerate; t = with extensive granitoid intrusions
- Primary carbonate rocks: dolostone, dololutite, dolostone-siltstone rhythmites, carbonaceous siliciclastic rocks, limestone/marble
- Volcanogenic sedimentary rocks: transitional or interlayered resedimented dacitic volcaniclastic rocks and wacke-mudstone sequences. Subdivisions indicated by suffix: a = argillite; b = siltstone; c = wacke; d = conglomerate; o = polymictic; l = lithic wacke
- Felsic (rhyolitic) volcanic rocks. Subdivisions indicated by suffix: a =flow; b = tuff; c = lapillistone; d = breccia; e = amphibolite metamorphic facies; f = feldspar-phyric; j = sandstone to conglomerate; o = heterolthic fragmental rock; q = quartz-phyric; s = quartz-sericite schist; y = amygdaloidal/vesicular; n = thin-bedded; t = with extensive granitoid intrusions; l = transitional to hypabyssal intrusive rocks
- Dacitic to rhyodacitic volcanic rocks/ Subdivisons indicated by suffix: a =flow; b = tuff; c = lapillistone; d = breccia; e = amphibolite metamorphic facies; f = feldspar-phyric; j = sandstone to conglomerate; o = heterolithic framental rock; q = quartz-phyric; s = quartz-sericite schist; y = amygdaloidal/vesicular; n = thin-bedded; t = with extensive granitoid intrusions; l = transitional to hypabyssal intrusive rocks
- Andesitic volcanic rocks - (may include some bleached mafic volcanic rocks). Subdivisions indicated by suffix: a = massiveflow; p = pillowedflow; b = tuff c = lapillistone; d = breccia; e = hornblende-bearing (amphibolite facies); f = feldspar-phyric; g = with interflow iron formation; j = with interflow sedimentary rocks; m = magnetite +/- ilmenite bearing; s = chloritic schist; v = variolitic; y = amygdaloidal/vesicular
- Mafic to intermediate volcaniclastic rocks. Subdivisions indicated by suffix: a = argillaceous zones; b = tuff; c = lapillistone; d = breccia; e = amphibolite metamorphic facies; m = magnetite-ilmenite bearing; o = heterolithic fragmental rock; q = quartz-crystal bearing
- Mafic volcanic rocks - primarily of tholeiitic basalt to basaltic andesite composition. Subdivisions for all subsets of Unit 1 indicated by suffix: a = massiveflow; p = pillowedflow; b = tuff; c = lapillistone; d = breccia; e = hornblende-bearing (amphibolite facies); f = feldspar-phyric; g = with interflow iron formation; j = with interflow sedimentary rocks; m = magnetite +/- ilmenite bearing; s = chloritic schist; v = variolitic; y = amygdaloidal/vesicular; x = spinifex textured; u = ultramafic composition locally; t = with extensive granitoid intrusions; l = transitional to hypabyssal intrusions. May include abundant synvolcanic gabbro. Primarily with "C-type"geochemistry (Al203/TiO2 > 11), but locally with intercalations of"B-type" and"A-type"tholeiites
  - Broad area dominated by varioliticflows
  - Fine-grained ultramafic rocks of presumed extrusive origin; pillows and varioles locally recognizable
  - Interflow sedimentary rocks of mappable thickness: chert, jasper, iron formation, argillite, arenite
  - Hornblende-bearing volcanic rocks (amphibolite or"transition zone"metamorphic conditions); primary structures commonly obscured; locally"layered"or thinly laminated
  - Transitional zone with abundant granitoid intrusions
- Fe- andTi- enriched tholeiites ("B-Type") and associated gabbro; commonly magnetite-bearing;Al203/TiO2 = 5.5 - 11
- Fe- andTi- enriched andAl-depleted tholeiites ("A-Type") and associated gabbro; commonly magnetite-bearing;Al203/TiO2 < 5.5
- Deformation Zone: complex cataclastic and alteration zone hosting Madrid group of deposits (syn-volcanic?)

Source: Newmont, 2012.

North of the Madrid Deformation Zone, the Wolverine volcanic suite is composed of a series of coalesced variolitic pillowed flows and subordinate flow breccia. The suite exhibits weak to moderate strain and is overprinted by a predominantly chlorite-calcite alteration assemblage. The suite may also be locally unstrained to strongly strained and intensely (sericite-dolomite) altered (TMAC 2013).

As mentioned earlier, the Madrid Deformation Zone is an east-west trending to north-south trending corridor of intense strain and alteration. The Madrid Deformation Zone represents the contact between the Wolverine and Patch groups near the western shore of Patch Lake and through the east-west oriented valley between Windy and Patch lakes. Four lithologies have been truncated and entrained in this high strain-alteration zone: the Wolverine volcanic rocks, Wolverine porphyry, quartz-feldspar phyric porphyry, argillaceous sedimentary rocks, and Patch Group A-type volcanic rocks (TMAC 2013).

The volcanic rocks of the Madrid Deformation Zone are defined as strongly foliated (schistose) with domains of dolomite and millimetre-wide bands of sericite that define the foliation. Within the Madrid Deformation Zone, the Wolverine porphyry occurs as salmon pink to beige coloured segregations, which are also affected by and demonstrate the pervasive foliation (TMAC 2013).

The Patch Group volcanic suite is composed of a series of flows which grade from aphanitic, massive basal flows exhibiting poorly formed, small rubble pillows to flow top breccias, capped by argillaceous interflow sediments. Gabbroic intrusive phases are rarely present, and where present, are found near the bottom of flows. Some of the flows to the east are variolitic and their occurrence is correlated with that of ultramafics and “melanocratic” basalts (TMAC 2013).

Patch Group volcanics are characteristically A-type volcanic rocks with rare horizons of Btype. At Suluk, variolitic phases are olivine green, fine grained, chloritized basalt with discontinuous variolitic texture. Variolites are ovoid to round and are typically less than a few centimetres in size but generally larger than varioles seen in the Wolverine basalts (TMAC 2013).

2.4.3 Mineralization of Madrid Area

The gold mineralization within Madrid trend includes the Naartok West, Naartok East, Rand Suluk, and Patch 14 zones. These zones consist of quartz-carbonate stockwork veining, which overprints dolomite-sericite-albitepyrite altered mafic volcanic rocks of the Patch Group. The gold mineralization is characterized by multi-stage brecciation and alteration with at least two separate gold mineralization events. Gold occurs within north-northeast, east, southeast, and north-northwest trending brecciated and carbonate altered zones and is associated with disseminated pyrite which has replaced brecciated mafic fragments.

The Patch 14 zone, which is the focus of the Madrid South Bulk Sample, is located adjacent to the Madrid Deformation Zone approximately four kilometres south of the Suluk zone. Gold mineralization is hosted within a zone of moderately to strongly carbonate-sericite altered mafic volcanic rocks and narrow intermediate porphyry dykes (Wolverine porphyry dykes). This moderately to intensely strained zone is wedged between two wider (±20 m), thick dykes of porphyry. Mineralization occurs as visible gold and disseminated pyrite hosted within massive bull quartz and quartz-carbonate veins. At least three sub-parallel veins have been identified which exhibit a north-south strike and steep (80°) dip to the west.

The West Vein is the most significant structure at Patch 14 and has been traced discontinuously along strike for 400 m. However, the mineralized portion has only about a 100 m strike extent. The East Vein extends for approximately 80 m along strike but has much less vertical extent. Mineralization is open down a steep southerly plunge (about 70°) and along strike at the depth. Drilling to a depth of 300 m below the bottom of Patch Lake has intersected multiple veins and gold mineralization. The main quartz lenses appear to be steep, southerly plunging bodies that appear to be open at depth.

2.4.4 Geochemical Characterization

SRK (2009) contains complete details pertaining to geochemical characterization of the Doris-Windy All-Weather Road Quarries confirming the suitability of these quarries for use in construction.

A geochemical characterization program for proposed Quarry G and H was conducted in summer 2010 (SRK 2014). Using a backpack-type drill, for each quarry, the program consisted of obtaining shallow drill core samples across the strike of the geology, with the objective of examining geochemical variability according to lithology and/or sample location. For Quarry H, two drillholes were located in overburden to determine the recessive geology. A total of 36 samples were analyzed for elemental analysis by aqua regia digestion with ICP finish and acid-base accounting (ABA) parameters, including paste pH, total sulphur, sulphate sulphur, total inorganic carbon (TIC) and modified NP. Based on this geochemical characterization program, the material from Quarry G and H was considered to have a low potential for ARD generation based on NP/AP ratios and low sulphur content. Accordingly, materials from these quarries are suitable to be used as construction material for the road and infrastructure associated with the Madrid Advanced Exploration Program.

2.4.5 Seismicity

The Project is located in the lowest category seismic hazard zone of Canada in accordance with the 2010 National Building Code of Canada (National Research Council Canada 2011); the Project area is thus considered relatively stable and not prone to earthquakes. Descriptions relative to seismic hazard that follow pertain primarily to design purposes and project-related risks associated with seismicity hazards.

The seismic hazard, which is considered relatively low for this Project, is described by spectral-acceleration (Sa) values at periods of 0.2, 0.5, 1.0 and 2.0 seconds. Spectral acceleration is a measure of ground motion that takes into account the sustained shaking energy at a particular period. This is a better measure of potential damage than the peak measures used by the 1995 code; however, Peak Ground Acceleration (PGA) still needs to be used for foundation design.

Site specific ground motion probability values provided in Table 2.4-1 are expressed in terms of probable exceedance, that is the likelihood of a given horizontal acceleration or velocity being exceeded during a particular period. The probability used is 0.000404 per annum, equivalent to a 2% probability of exceedance over 50 years. This means that over a 50-year period there is a 2% chance of an earthquake causing ground motion greater than the given expected value (SRK 2011b).

Table 2.4-1. Project Specific Seismic Hazard Values

Spectral Acceleration (Sa; s)	Ground Motion (*g*)
Sa (0.2)	0.095
Sa (0.5)	0.057
Sa (1.0)	0.026
Sa (2.0)	0.008
PGA	0.036

Note:
1 g (acceleration due to Earth's gravity, equivalent to g-force) = 9.81 m/s^2

2.4.6 Permafrost and Permafrost-related Features

Permafrost characteristics are discussed in (SRK 2011b) and are summarized below.

Surficial geotechnical investigations across the entire Hope Bay Belt confirm that the site is within the region of continuous permafrost. Thermistor strings were installed during site investigations in 1997, 2004, and 2008. Regular temperature measurements obtained from these thermistor strings have been used to characterise subsurface temperature and permafrost conditions.

Mean near-surface ground temperatures are approximately -8°C, with seasonal variability. The active layer is generally less than 1 m thick in morainal sediments, but is expected to vary considerably with surficial geology and may be as much as 5 m deep in coarse sediments such as glaciofluvials.

Thermistor string records indicate the depth of zero amplitude (i.e., the point at which there is no discernable change in temperature) is approximately 10 m below grade. Based on data from deep (200 m) thermistors, the basal permafrost depth is estimated to be greater than 500 m (SRK 2009). A basal cryopeg layer, where flowing groundwater is present at temperatures below 0°C, is expected to be present in the deep permafrost due to the measured salinity of the groundwater (discussed further in Section 2.4.8).

Taliks (unfrozen ground in the otherwise continuous permafrost) are expected to be present beneath current and pre-existing surface water features. Open taliks (talik connected with ground surface) are expected beneath existing lakes with depths greater than two-thirds of the mean annual lake ice thickness. More extensive open taliks are expected to be present beneath larger lakes. Closed taliks (bounded by permafrost on all sides) are expected to be present beneath ancient surface water bodies that have not sustained significant surface water for more than two years. Through taliks (connected with ground surface and the unfrozen ground beneath the permafrost) are expected to be present beneath existing very large lakes.

Patterned ground, usually consisting of surface drainage rills, masks the underlying soils. Small, frost-heaved clay-silt polygons are very common. Linear frost cracks are noted in raised marine spit deposits. Ice wedge polygons are common in muskegs. There is also evidence of naturally degrading permafrost in the Project area. Permafrost degradation can also be attributed to past human activity such as exploration drilling and transportation corridors (Thurber Engineering Ltd. 2003).

2.4.7 Groundwater

In general, groundwater flow in the Hope Bay Belt region is controlled by topography, the distribution of hydraulic conductivity, and permafrost extents. From a regional perspective, topography slopes gently towards the ocean in the north, with local variability. The regional groundwater flow direction is inferred to be roughly south to north, aligned with regional topography (HBML 2011).

The presence of liquid groundwater is controlled by the extents of subsurface freezing conditions (permafrost). As discussed in Section 2.4-6, permafrost is continuous from approximately 1 m below surface to approximately 500 m, except where taliks are present. *Open taliks* exist beneath surface water bodies whereas *through taliks* exist beneath very large surface water bodies. Flowing groundwater does not exist within the permafrost, except where salinity depresses its freezing temperature. Thus, flowing groundwater is present in pore spaces in the active layer (summer only), in taliks, beneath the permafrost, and in cryopegs (liquid groundwater within the permafrost exhibiting a freezing temperature below 0°C).

Groundwater quantity and quality characterization for the Doris, Madrid and Boston areas were completed as part of a combined geotechnical and hydrogeological study. These included installation of three Westbay monitoring systems in 2010 (Doris North, Doris Central, Boston), and down-hole packer testing (including 39 at the Madrid South deposit).

The measured range of hydraulic conductivity in the bedrock at the Madrid South area is 2.7×10^{-9} m/s to 5.5×10^{-9} m/s with a mean value of 3.3×10^{-9} m/s. Hydrogeological field investigations have not yet been conducted at Madrid North, though results are expected to be similar to those at Madrid South due to the similar geologic and permafrost conditions.

Groundwater in the active layer only flows during months with thawed surface conditions (generally June to September).

Groundwater beneath the permafrost moves under hydraulic gradients dictated by lakes overlying through taliks. Hydraulic conductivity is expected to be low, as indicated by packer testing. Pore pressure measured beneath the permafrost indicates a piezometric surface close to ground surface, indicating the permafrost behaves as a confining unit (HBML 2011).

All of the bedrock lithologies within the Hope Bay Belt region appear to have very low primary porosity, indicating that hydraulic conductivity is controlled by the presence and nature of joint sets and fault zones. Lithology is interpreted to exert indirect control on hydraulic conductivity by affecting the presence and/or characteristics of fractures or structures. Available data indicates a tendency for hydraulic conductivity to decrease with depth (HBML 2011).

2.4.8 Groundwater Quality

Groundwater within the Madrid Advanced Exploration Program area has been identified as saline, with a salinity (total dissolved solids) content similar to seawater (Roscoe Postle Associates Inc. 2013).

Groundwater chemistry within the Madrid Advanced Exploration Program area is inferred to be similar to that of the Doris Lower area, due to similarity in geologic and permafrost controls. The deep groundwater samples expected to best represent with groundwater conditions at Madrid were collected at well 10WBW001 in Doris Central (Zone 1), the deepest sampling port at a depth of 485 m below surface (SRK 2011a).

The groundwater collected from the deepest zone at the Doris Central Westbay (Table 2.4-2) can be characterized as follows:

- calcium, sodium, and chloride were the dominant ions;
- the groundwater may be regarded as saline, with a TDS of 41,000 mg/L;
- the majority of total metals had concentrations below detection limits; and
- detected trace metals included cobalt, copper, iron, manganese, molybdenum, nickel, and zinc.

Table 2.4-2. Summary of Groundwater Quality Data for Doris Central Westbay Zone 1

Parameter	Unit	10WBW001-Zone1 (548 m) 6-Apr-2011
pH	pH	7.1
Total Dissolved Solids	mg/L	41,000
Alkalinity (as $CaCO_3$)	mg/L	2.7
Chloride (Cl)	mg/L	19,000
Sulfate (SO_4)	mg/L	940
Bicarbonate (HCO_3)	mg/L	-

(continued)

Table 2.4-2. Summary of Groundwater Quality Data for Doris Central Westbay Zone 1 (completed)

Parameter	Unit	10WBW001-Zone1 (548 m) 6-Apr-2011
Dissolved Metals		
Aluminum (Al)	mg/L	<0.005
Arsenic (As)	mg/L	<0.002
Cadmium (Cd)	mg/L	<0.00005
Calcium (Ca)	mg/L	4,800
Chromium (Cr)	mg/L	<0.0005
Cobalt (Co)	mg/L	0.000059
Copper (Cu)	mg/L	0.00083
Iron (Fe)	mg/L	0.034
Lead (Pb)	mg/L	<0.0003
Magnesium (Mg)	mg/L	71
Manganese (Mn)	mg/L	0.73
Mercury (Hg)	mg/L	<0.00001
Molybdenum (Mo)	mg/L	0.011
Nickel (Ni)	mg/L	0.0016
Potassium (K)	mg/L	39
Selenium (Se)	mg/L	<0.002
Sodium (Na)	mg/L	7,000
Zinc (Zn)	mg/L	0.16

2.5 SURFACE WATER

2.5.1 Hydrology

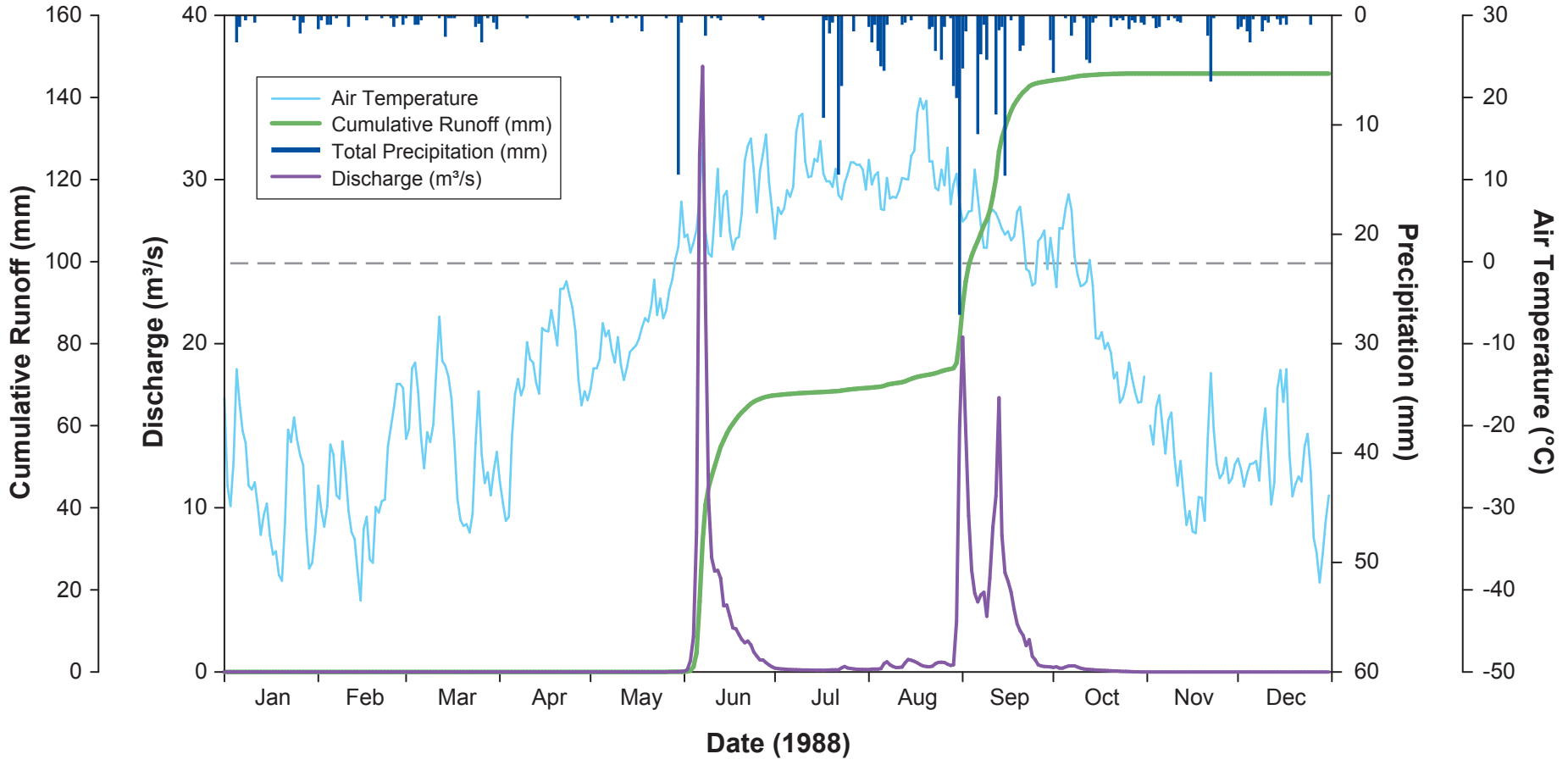
2.5.1.1 Regional Hydrologic Regime

Hydrometeorologic data from a typical Arctic nival stream (Atitok Creek near Dismal Lake, Water Survey of Canada station 10PC002) and weather station (Kugluktuk A, Meteorological Service of Canada station 2300902) are displayed on Figure 2.5-1. The monitoring station at Atitok Creek is located approximately 440 km west-southwest of the Madrid Area. Although the Atitok Creek station is a substantial distance from the Madrid project area, the two sites are influenced by similar climate, and their watersheds have physiographic similarities which result in comparable hydrologic regimes. Also, at 270 km^2 Atitok Creek is a relatively small watershed by WSC standards, making its hydrologic regime similar to the regime in Madrid project area watersheds.

Rivers in the Hope Bay belt area have stream flow typical of the Arctic nival regime (Church 1974). The long and severe Arctic winter, and brief time when air temperatures are above freezing, limit surface water activity to a short period. Surface water flow typically begins in late May or early June, and rapidly rises to peak annual flow by early- to mid-June. Snow that accumulated over the long winter is usually the dominant contributor of water to stream flow on an annual basis. Shortly after air temperature rises above freezing, the snow melts rapidly.

Figure 2.5-1

A Typical Example of Discharge and Runoff in an Arctic Nival River (Atitok Creek near Dismal Lake, 1988), with Air Temperature and Precipitation



After the snowmelt-fed freshet, stream flow steadily decreases to a summertime minimum, which typically occurs in August. Due to the presence of permafrost, there is limited groundwater supply to smaller streams; however, there may be interaction between groundwater systems and larger rivers and/or lakes through taliks. Autumn rain events often augment stream flow (Figure 2.5-1). Although snowmelt is typically responsible for the majority of runoff in most years, this may not be the case in exceptionally rainy seasons. In October, air temperature normally dips below freezing, precipitation begins to fall as snow, and stream flow ceases for the winter except in rivers with very large watersheds. Based on the results of hydrometric monitoring in the Project area, all monitored streams freeze solid in the winter with the exception of the Koignuk River, which retains under-ice liquid water in isolated pools separated by frozen sections of the river (Rescan 2009b, 2011i). However, no under-ice flow has been measured in the Koignuk River.

Lakes are common in the region. Runoff is stored in lakes and gradually released, attenuating hydrologic events that would otherwise cause a rapid response in stream flows, such as the nival peak flood and responses to precipitation events. Evaporation from lake surfaces is more efficient than evaporation from tundra, so runoff is generally lower in watersheds with extensive open water.

2.5.1.2 Watersheds in the Project Area

The northern portion of the Hope Bay Belt (Doris and Madrid areas) consists of two main watersheds: Windy-Glenn (48 km^2) and Doris-Roberts (194 km^2). Both of these watersheds drain north into Roberts Bay (Figure 2.5-2). A topographic drainage divide separates the Windy-Glenn watershed from the Koignuk River watershed (2,937 km^2; not pictured), which encompasses the southern portion of the belt (Boston area) and drains into Hope Bay to the west of Roberts Bay. The Madrid South bulk sample site and the Doris North Project are located in the Doris-Roberts watershed, whereas the Madrid North bulk sample site is located in the in the Windy-Glenn watershed.

2.5.1.3 Hydrometric Monitoring in the Project Area

Numerous hydrometric stations have been installed and operated throughout the Hope Bay Belt since the mid-1990s. Multiple years of data are available for many of the major lake drainage outlets within the Doris and Madrid areas. Hydrometric monitoring in the belt began in 1993 at several sites where stream flow and water levels were manually measured. Automated hydrometric monitoring began in 1996 and has continued to the present, although the size of the monitoring network has varied over time to accommodate changes in project scope.

Hydrometric monitoring in the Madrid Area has included lake level monitoring at Wolverine, Patch, and Windy lakes, and discharge measurements at the lake outlets. Monitoring stations Wolverine Hydro, Patch Hydro, and Windy Hydro are pictured in Figure 2.5-3 and summarized in Table 2.5-1. Monitoring was initiated in 2006 at all three lakes and continued until 2011 at Wolverine and Patch lakes. Monitoring at Windy Lake has continued to the present; the most recent data available are from 2013. Baseline results from 2009 to present are summarized below. Data prior to 2009 are included in the *Doris Project Area 2008 Hydrology Baseline Update Report* (Golder 2009c).

Streams in the Madrid Area generally have low gradients and low bank slopes. Lakes may drain through channelized, permanent outlet streams (e.g., Patch Lake and Windy Lake outflows, pictured respectively in Plates 2.5-1 and 2.5-2) or undefined, dispersed, and ephemeral drainages (e.g., Wolverine Lake, pictured in Plate 2.5-3). In defined channels, substrate is generally composed of sand, gravel, and cobbles.

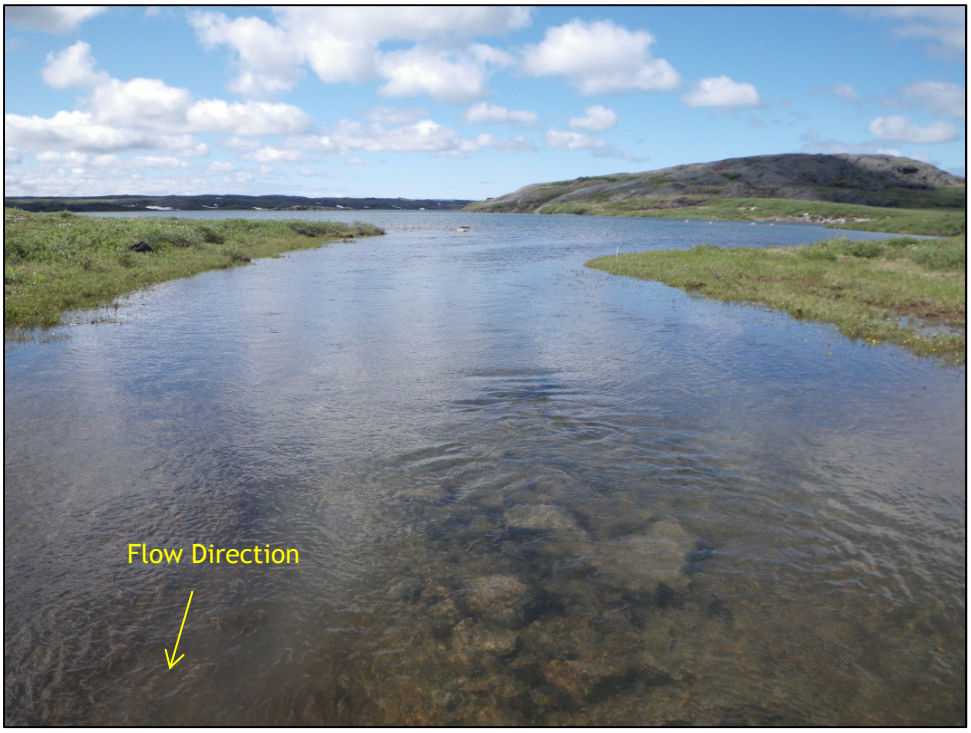


Plate 2.5-1. Patch Lake Outflow Stream. View is upstream (west) towards the lake. Channel width is approximately 10 metres. Photo taken August 23, 2011.



Plate 2.5-2. Windy Lake Outflow Stream. View is upstream (south) towards the lake. Channel width is approximately 1 metre. Photo taken September 8, 2013.

Figure 2.5-2

Main Watersheds in the Doris and Madrid Areas

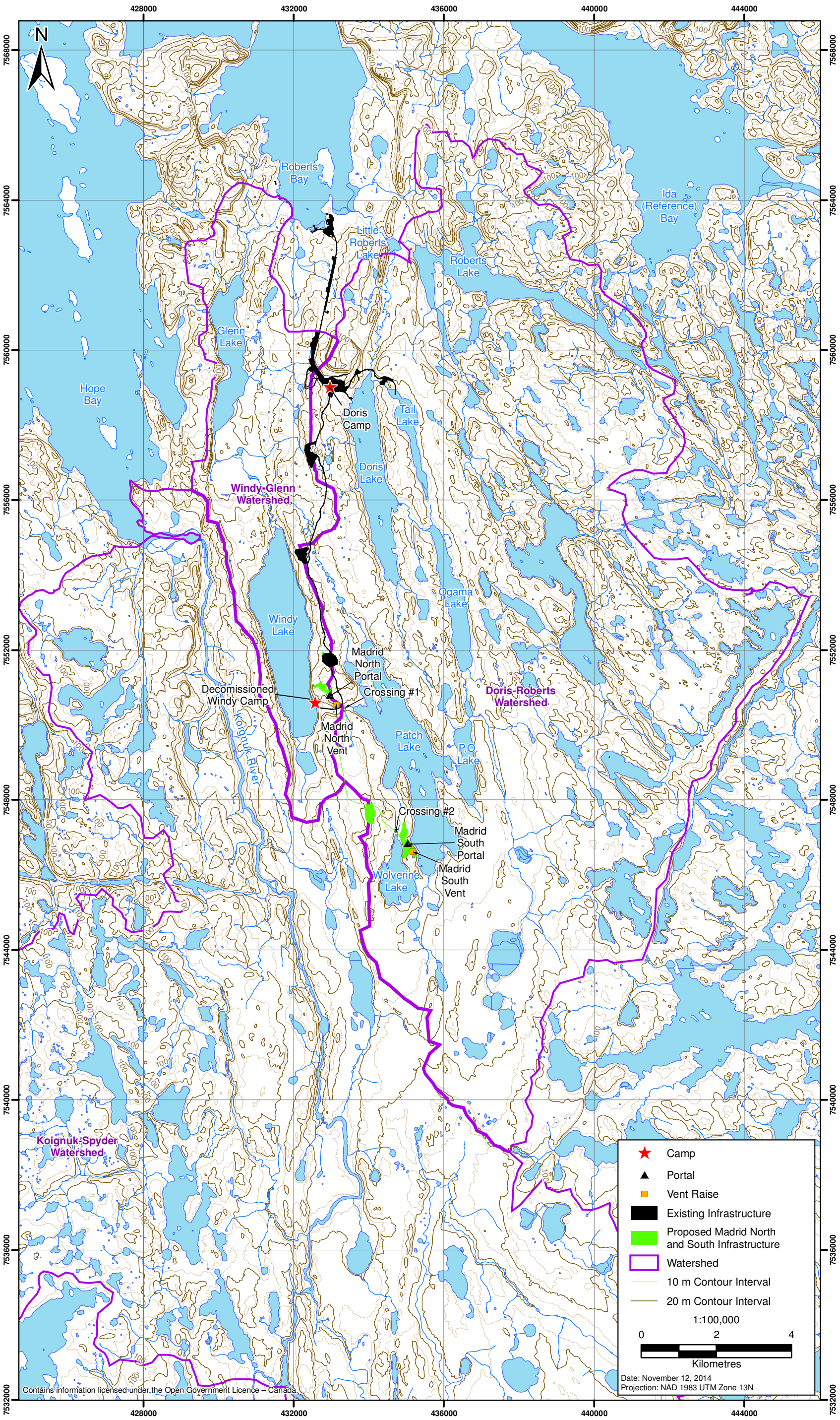


Figure 2.5-3

Hydrometric Monitoring Stations in the Madrid Area

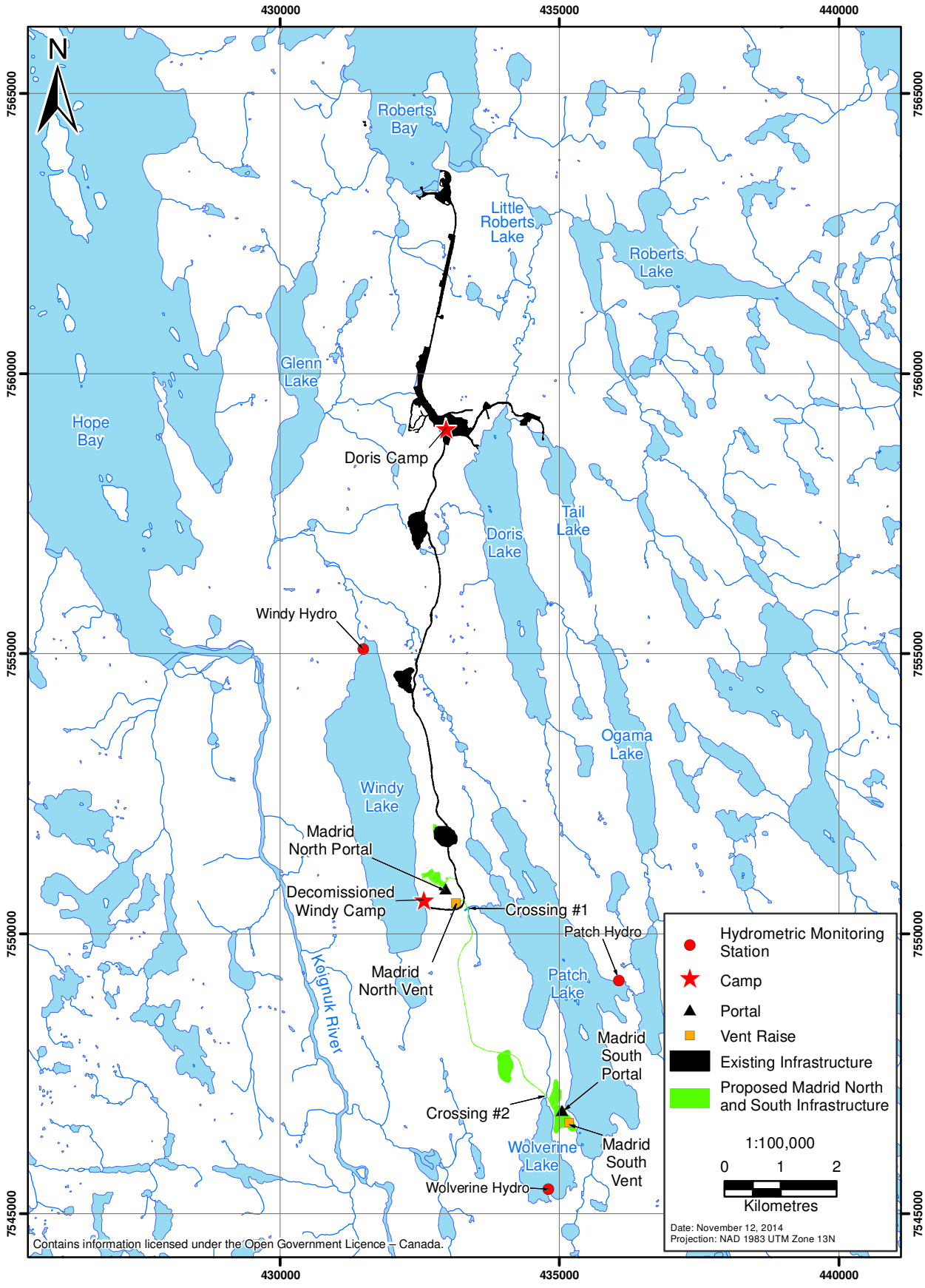


Table 2.5-1. Station and Watershed Information for Automated Hydrometric Monitoring Stations in the Madrid Advanced Exploration Program Area, 2006 to 2013

Station	UTM Coordinates		Drainage Area (km^2)	Lake Area (km^2)	Years of Automated Data Collection
	Easting	Northing			
Wolverine Hydro	434,802	7,545,443	3.0	1.0	2006-2011
Patch Hydro	436,062	7,549,169	32.0	5.7	2006-2011
Windy Hydro	431,481	7,555,089	14.1	5.3	2006-2013

Note: Data from 2006-2008 are available in Golder 2009c.

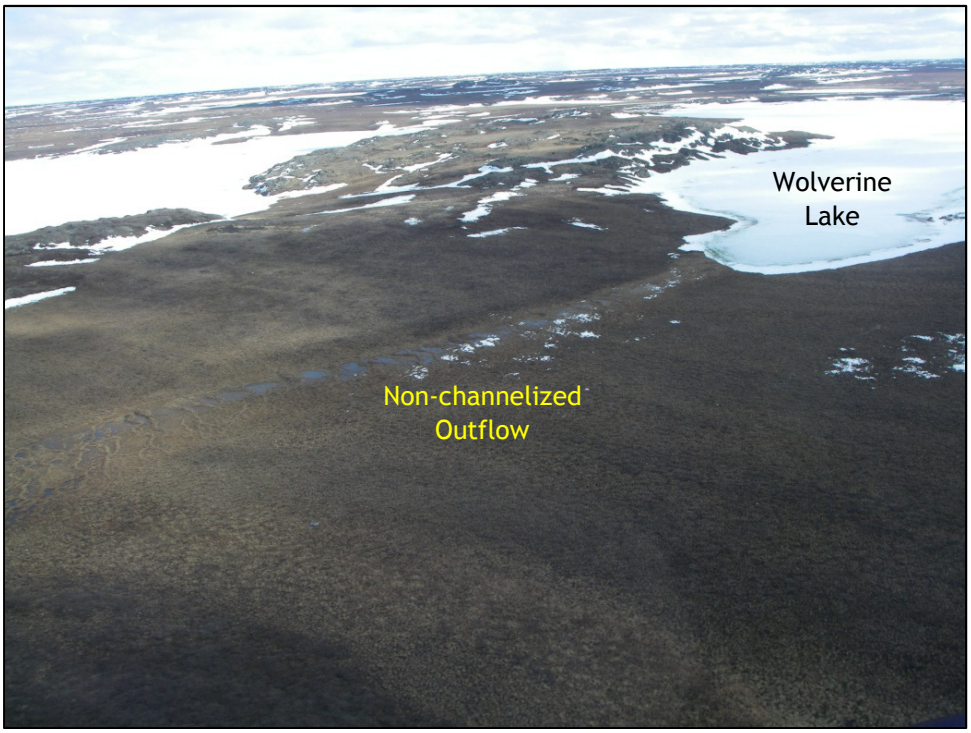


Plate 2.5-3. Southeast side of Wolverine Lake. View is northwest. Note non-channelized water in marsh-like outflow area of lake. Photo taken June 12, 2009.

Prior to construction of the bulk samples and all-weather road, further studies will be undertaken to determine the channel morphology of streams potentially affected by the bulk samples (e.g., roads or other infrastructure). These studies will adhere to methodology and standards of the *British Columbia Channel Assessment Procedure* (BC MOF and BC MFLNRO 1996) or similar guidelines.

During the 2009 to 2011 monitoring period, surface flows were not measured at Wolverine Hydro because no defined outlet channel existed. Negligible amounts of dispersed flow were observed over relatively wide areas with marsh-like features on the north and southeast ends of Wolverine Lake (Plate 2.5-3).

Table 2.5-1 summarizes selected hydrometric indices for the Windy Hydro and Patch Hydro monitoring stations. The streams freeze to the bed in winter; therefore, annual low flows are assumed to be zero. Open water season lake level fluctuation at Wolverine, Patch, and Windy lakes was generally 0.2 to 0.3 m (Tables 2.5-2 and 2.5-3).

Table 2.5-2. Selected Hydrometric Indices for Patch Lake and Windy Lake Outflow Streams (2009 to 2013)

Hydrometric Station	2009	2010	2011	2012	2013	Min	Mean	Max
Observed Total Runoff (mm) [a]								
Patch Hydro	85	88	123	n/d	n/d	85	99	123
Windy Hydro	141	197	143	112	42	42	127	197
Annual Total Runoff (mm) [b]								
Patch Hydro	95	98	175	n/d	n/d	95	123	175
Windy Hydro	168	222	152	118	43	43	141	222
Observed Mean Discharge (m^3/s) [a]								
Patch Hydro	0.32	0.30	0.48	n/d	n/d	0.30	0.37	0.48
Windy Hydro	0.23	0.30	0.26	0.22	0.07	0.07	0.22	0.30
Annual Mean Discharge (m^3/s) [b]								
Patch Hydro	0.10	0.22	0.42	n/d	n/d	0.10	0.25	0.42
Windy Hydro	0.07	0.22	0.19	0.05	0.02	0.02	0.11	0.22
Daily Peak Flow (m^3/s)								
Patch Hydro	0.51	0.55	2.51	n/d	n/d	0.51	1.19	2.51
Windy Hydro	0.34	0.46	0.64	0.36	0.12	0.12	0.38	0.64
Observed Low Flow (m^3/s) [a]								
Patch Hydro	0.17	0.14	0.13	n/d	n/d	0.13	0.15	0.17
Windy Hydro	0.15	0.16	0.11	0.06	0.02	0.02	0.10	0.16

Notes: Site-specific periods of record for historic data are presented in baseline and compliance reports (Rescan 2009b, 2011d, 2011i, 2012d, 2012b; ERM Rescan 2014b).
n/d = No data; the Patch Hydro monitoring station was not active in 2012 and 2013.
[a] *Statistics from the open water season are calculated from recorded values during the periods of station operation.*
[b] *Annual values include estimated data for periods when stations were demobilized over winter.*

Table 2.5-3. Recorded Ranges of Seasonal Lake Levels for 2009 to 2013 Open-water Seasons

	Water Level Change (m)							
Lake	2009	2010	2011	2012	2013	Min	Mean	Max
Wolverine	0.25	0.24	0.26	n/d	n/d	0.24	0.25	0.26
Patch	0.18	0.30	0.44	n/d	n/d	0.18	0.31	0.44
Windy	0.23	0.10	0.24	0.18	0.10	0.10	0.17	0.24

Notes: Site-specific periods of record for historic data are presented in published baseline and compliance reports (Rescan 2009b, 2011d, 2011i, 2012d, 2012b; ERM Rescan 2014b).
n/d = No data; Wolverine and Patch lake levels were not monitored in 2012 and 2013.

2.5.2 Bathymetry and Limnology

2.5.2.1 Bathymetry

Between 1993 and 2007, systematic bathymetric surveys were conducted across the Hope Bay Belt (HBML 2011). Wolverine, Patch, and Windy lakes are the three major waterbodies in the Madrid Area; all lakes were surveyed for bathymetry in 2006 (Golder 2006a). Physical properties of the lakes measured by the 2006 bathymetric surveys are provided in Table 2.5-4.

Table 2.5-4. Physical Properties of Wolverine, Patch, and Windy Lakes, 2006

Lake	Lake Area (km^2)	Volume (m^3)	Maximum Depth (m)	Mean Depth (m)	Fetch (m)	Maximum Width (m)	Shoreline Length (m)
Wolverine Lake	1.0	2.1×10^6	4.7	2.1	1,875	980	6,146
Patch Lake	5.7	23.6×10^6	15.1	4.1	6,470	1,175	23,013
Windy Lake	5.3	59.1×10^6	21.2	n/a	n/a	n/a	n/a

Notes: Data for Wolverine and Patch lakes from Golder (Golder 2006a, 2009c).
Data for Windy Lake from Golder (2006b) and Rescan (2013).
n/a = data not available

Wolverine Lake (Figure 2.5-4), the southernmost of the major lakes in the Madrid Area, is located to the southwest of Patch Lake (Figure 2.5-5). Wolverine Lake is relatively small and shallow, with a maximum depth of approximately 4.7 m and an area of 1.0 km^2 (Table 2.5-4). Wolverine Lake drains into Patch Lake via a non-channelized, marshy area (Plate 1.2-6). Measurable flow has only been observed in the Wolverine Lake outflow during spring snow melt or heavy rain events (Golder 2009e); (Rescan 2012d). Patch Lake (Figure 2.5-5) is both deeper and larger than Wolverine Lake. The Patch Lake outflow is short (<200 m), and is located on the east shore, where it empties directly into P.O. Lake. Windy Lake is the largest of the three lakes by volume and is also the deepest reaching depths upwards of 21.2 m (Table 2.5-4; Figure 2.5-6).

2.5.2.2 Limnology

Physical limnology characteristics are available for Madrid Area lakes from 1995 to 1998, 2007, 2009, and 2010 (Table 1.1-1; Figure 2.5-7). Physical profiles were collected during the ice-covered season and/or the open-water season. A comprehensive baseline sampling program was conducted in the Madrid Area in 2009 (Rescan 2010f, 2011g).

Profiles of winter dissolved oxygen concentrations and temperatures were typical of ice-covered Arctic lakes. In April/May 2009, the ice cover was approximately 2 m thick on all lakes, and water temperatures were coldest just below the ice (0.2 to 0.8°C). In deep lakes, temperature gradually warmed with depth to maximum temperatures of approximately 2°C near the water-sediment interface. Dissolved oxygen concentrations were highest near the water-ice interface, averaging 13.0 mg/L, and gradually declined with depth. Bottom waters in some lakes (e.g., Ogama and Wolverine lakes) were nearly anoxic (≤ 1 mg/L dissolved oxygen; Rescan 2010f, 2011g).

Profiles of dissolved oxygen concentrations and temperatures during the open-water season were also typical of Arctic lakes. The lakes in the area mix fully at least two times per year: during ice breakup in the spring and during periods of high winds and low temperatures in the autumn just prior to freeze-up. In addition, the lakes around the Madrid Area are shallow enough to become fully mixed during the summer, depending on wind and temperature conditions. In August 2009, even the deepest lakes surveyed tended to be well mixed or weakly stratified. Water temperatures ranged from 8°C to 13°C. Dissolved oxygen concentrations were generally saturated to super-saturated, and remained relatively constant throughout the water column (Rescan 2010f, 2011g).

The Canadian Council of Ministers of the Environment (CCME) has established guideline oxygen concentrations for the protection of (cold-water) aquatic life of 9.5 mg/L for early life stages and 6.5 mg/L for other life stages (CCME 1999). Most lakes had dissolved oxygen concentrations above these guidelines in the upper portions of the water column; however, bottom water concentrations were below guidelines in Wolverine, Ogama, and Windy lakes in the winter and in Patch Lake in the summer. Oxygen concentrations in Wolverine Lake were consistently lower than 6.5 mg/L throughout the water column during winter under-ice sampling.

Figure 2.5-4

Bathymetric Map of Wolverine Lake, 2006

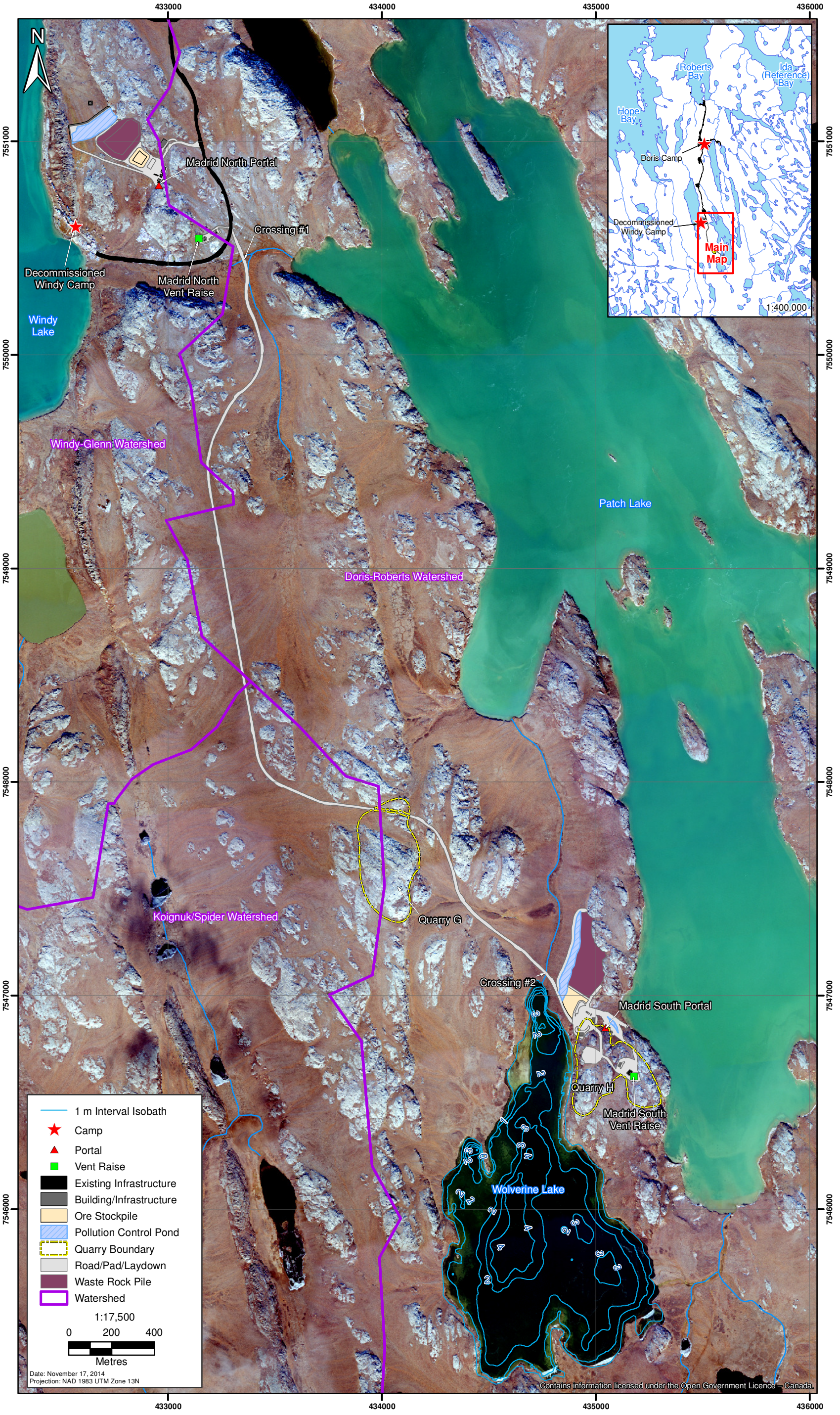


Figure 2.5-5

Bathymetric Map of Patch Lake, 2006

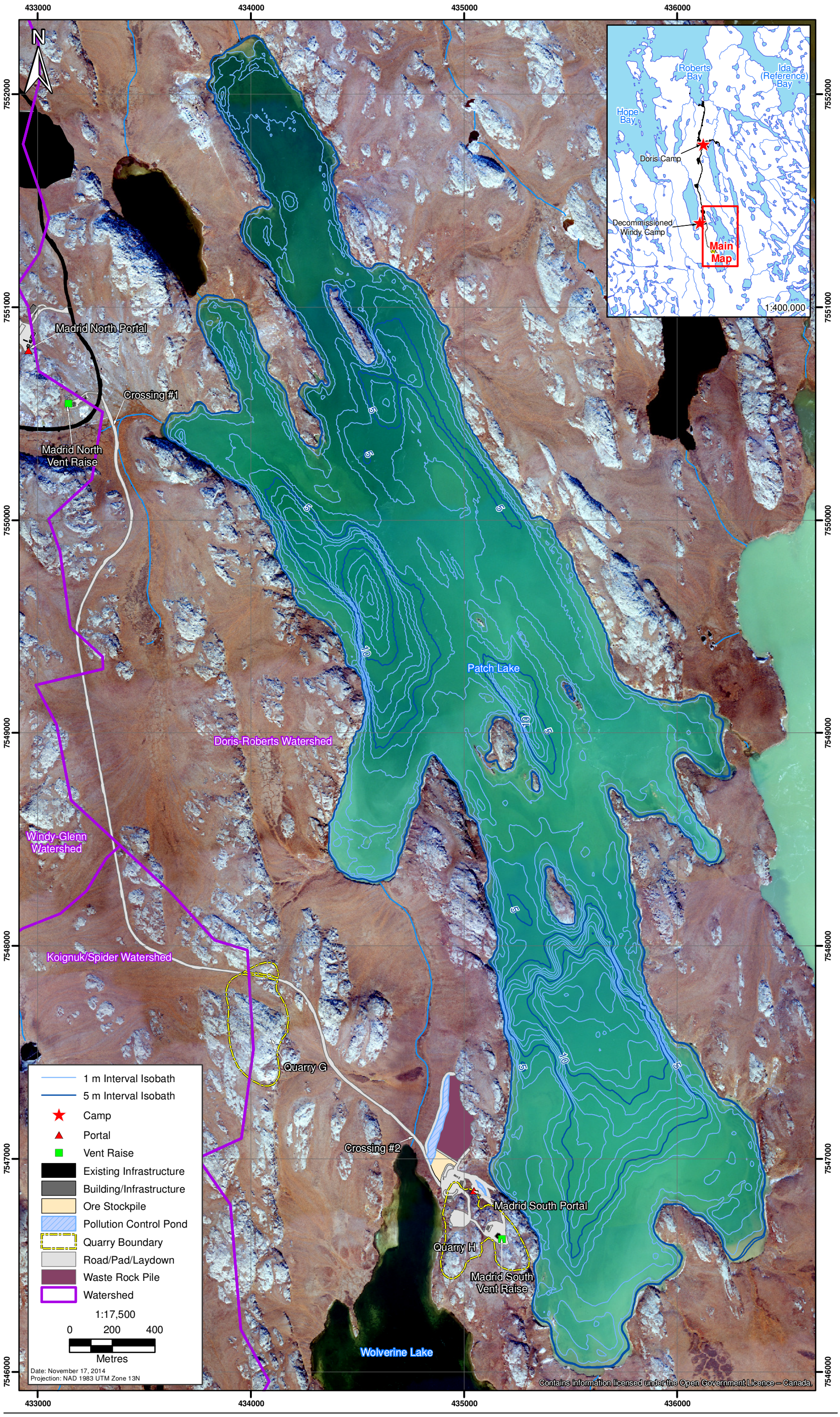


Figure 2.5-6

Bathymetric Map of Windy Lake, 2006

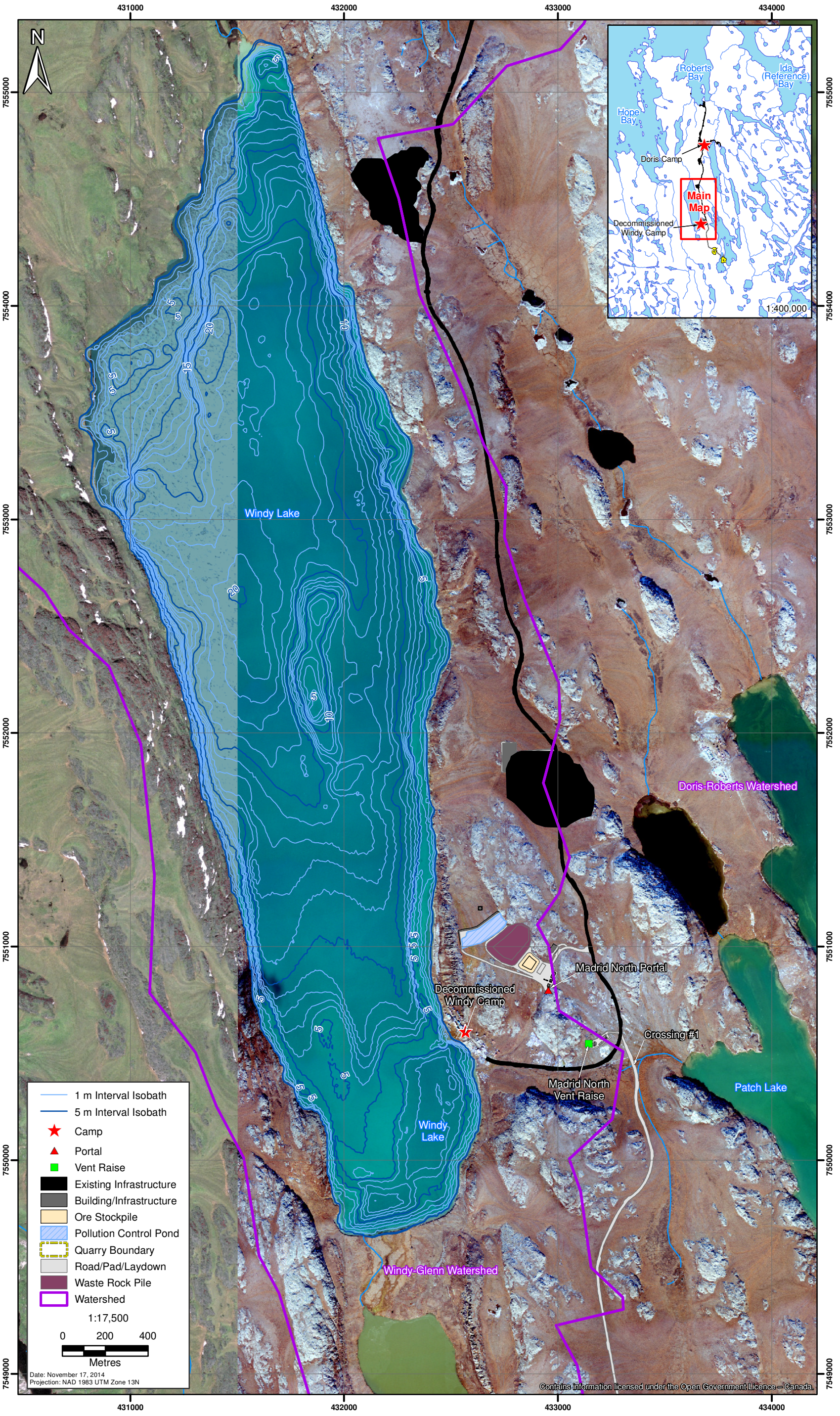
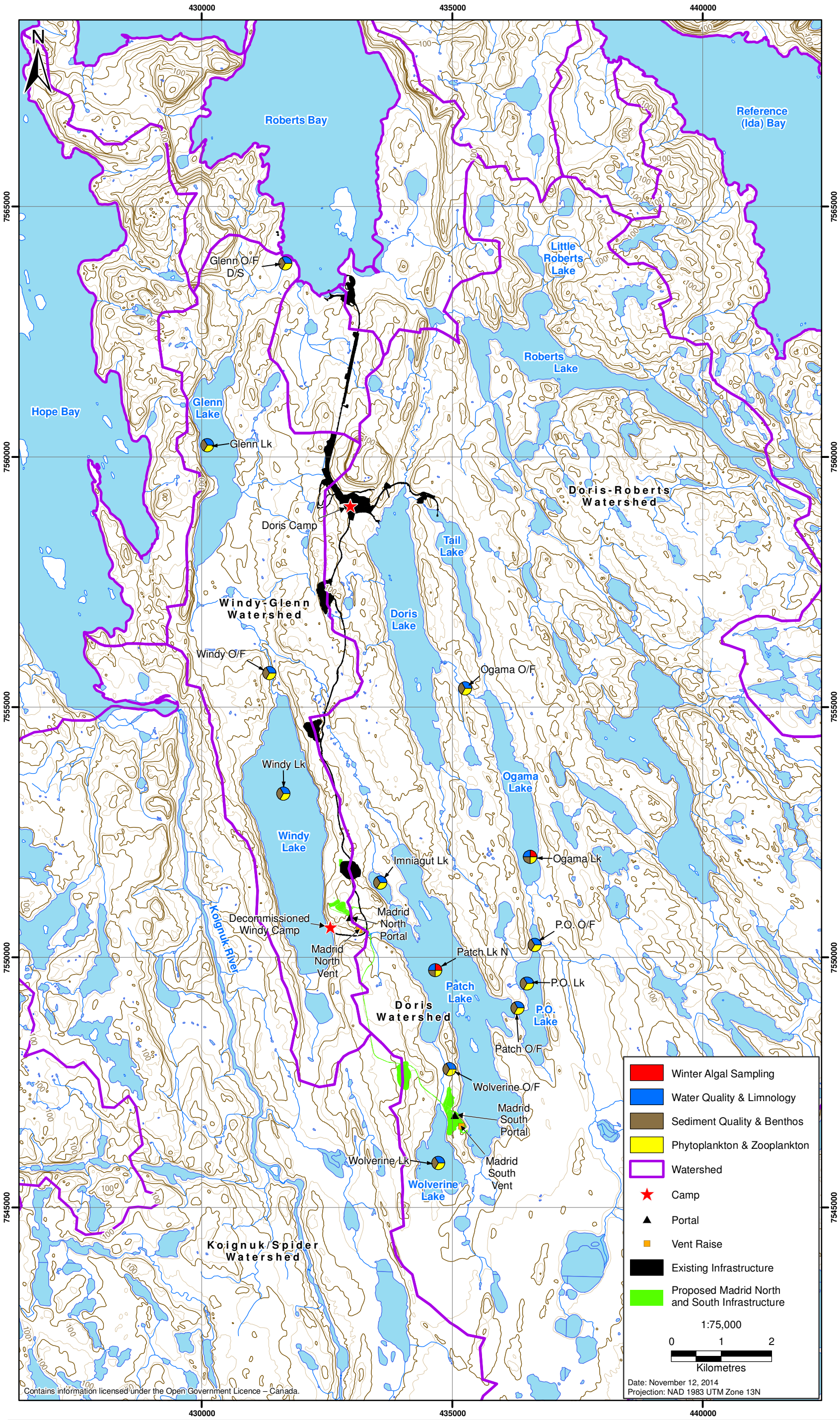


Figure 2.5-7

Physical Limnology, Water and Sediment Quality, and Aquatic Biology Sampling Locations, Madrid Advanced Exploration Program



The Canadian Council of Ministers of the Environment (CCME) has established guideline oxygen concentrations for the protection of (cold-water) aquatic life of 9.5 mg/L for early life stages and 6.5 mg/L for other life stages (CCME 1999). Most lakes had dissolved oxygen concentrations above these guidelines in the upper portions of the water column; however, bottom water concentrations were below guidelines in Wolverine, Ogama, and Windy lakes in the winter and in Patch Lake in the summer. Oxygen concentrations in Wolverine Lake were consistently lower than 6.5 mg/L throughout the water column during winter under-ice sampling.

Water clarity varied among lakes. Secchi depths (an index of water clarity) in Glenn, P.O., and Ogama lakes were relatively low (less than 1.3 m). Reduced water clarity was likely attributable to relatively high phytoplankton biomass or to the re-suspension of fine sediments along the shorelines of lakes resulting from wave action and high winds common to the area. Secchi depths in the clearest lakes, Windy, Wolverine, and Imniagut, ranged from 3 to 3.5 m. The calculated euphotic zone depth extended through the entire water column in all but the deepest lakes (Windy, Glenn, and Patch Lake South). This indicates that light levels were generally sufficient to support phytoplankton photosynthesis throughout the water column (Rescan 2010f, 2011g).

Table 2.5-5 summarizes data collected at sampling sites near the proposed Madrid Area sample locations.

2.5.3 Surface Water Quality

In 2009, surface water baseline studies were conducted to complement existing data. These studies focused on the northern portion of the Hope Bay belt as well as reference areas well away from future Project activities. Lakes and streams sampled near the Madrid Area included stations at Windy Lake, Wolverine Lake, Patch Lake, Imniagut Lake, and Wolverine Outflow. Lakes and streams downstream of the Madrid North and South areas were also sampled, including Glenn Lake, P.O. Lake, Ogama Lake, Windy Outflow, Glenn Outflow, Patch Outflow, P.O. Outflow, and Ogama Outflow (see Figure 2.5-7).

2.5.3.1 Lakes

Baseline historical surface water quality data are available for some Madrid Area lakes for periods from 1995 to 2000, and 2006 to 2010 (Table 1.1-1). Samples were collected during the ice-covered season and/or the open-water season. A comprehensive sampling program was conducted in 2009 (Rescan 2010f), and additional baseline samples were collected in 2010 (Rescan 2011g).

Lakes in the Madrid Area were neutral to slightly alkaline and contained variable concentrations of nutrients and metals. Several of these lakes were characterized as being relatively clear (e.g., Imniagut, Wolverine, and Windy lakes), while others were more turbid (e.g., Glenn Lake). Seasonal water quality trends were apparent in some lakes, with winter concentrations of certain parameters greatly exceeding summer concentrations. This trend was particularly evident for total dissolved solids (TDS), total organic carbon (TOC), sulphate, total phosphorus, ammonia, nitrate, and several metals (e.g., chromium, copper, iron, and lead; Rescan 2010f).

Concentrations of nutrients were typically low in lakes surrounding the Madrid Area, particularly during the summer when growth of phytoplankton draws down surface nutrients. Nitrate, nitrite, and ammonia concentrations were below applicable CCME water quality guidelines (Rescan 2010f). Total phosphorus concentrations were variable among lakes and across seasons, ranging from 0.003 to 0.018 mg/L. Based on the CCME recommended trigger ranges for total phosphorus, lakes in the Madrid area of the Belt can be categorized as ultra-oligotrophic to mesotrophic. The trophic status of some lakes was dependent on the season because phosphorus concentrations were highest during winter (Rescan 2010f).

Table 2.5-5. Lake Dissolved Oxygen Concentrations and Secchi Depths (2009) in the Vicinity of the Madrid South and North Sites

		Winter					Summer						
		Bottom Depth (m)	Dissolved Oxygen Concentration (mg/L)*		Dissolved Oxygen Saturation (%)*		Bottom Depth (m)	Dissolved Oxygen Concentration (mg/L)*		Dissolved Oxygen Saturation (%)*		Secchi Depth D_s (m)	Euphotic Zone Depth (m)
Watershed	**Lake**		**Min.**	**Max.**	**Min.**	**Max.**		**Min.**	**Max.**	**Min.**	**Max.**		
Windy-Glenn	Windy Lake	17.7	9.3	15.0	67.0	104	18.0	11.6	11.8	99.7	101	3.00	12.2
	Glenn Lake	11.5	14.7	16.9	101	117	19.7	10.9	11.5	94.6	96.9	1.00	4.1
Doris-Roberts	Wolverine Lake	4.3	1.3	6.2	8.6	43.4	3.7	10.8	11.1	105	106	3.00	12.2
	Patch Lake (North)	4.0	13.0	14.6	92.3	102	8.5	7.7	10.5	73.0	95.6	2.20	8.9
	Patch Lake (South)	14.5	10.2	16.3	73.4	114	14.0	10.5	10.7	92.9	95.4	2.00	8.1
	Imniagut Lake	2.5	Ice thickness extended to the bottom				4.0	9.71	10.7	96.2	99.6	3.50	14.2
	P.O. Lake	2.2	13.7	13.7	94.3	94.3	3.3	10.7	10.9	95.3	96.2	1.25	5.1
	Ogama Lake	7.3	0.1	9.5	1.0	66.4	5.0	10.8	11.4	95.8	102	1.20	4.9

** CCME guideline for dissolved oxygen is 9.5 mg/L for early life stages, 6.5 mg/L for other life stages.* ***Bold values*** *indicate concentrations that are below at least one CCME guideline level.*

Windy Lake (Table 2.5-6) would be categorized as ultra-oligotrophic to oligotrophic (depending on the season), Patch North and South (Table 2.5-7), P.O., and Imniagut lakes would be categorized as oligotrophic, and Glenn, Wolverine, and Ogama lakes would be categorized as mesotrophic (Rescan 2010f). Mean metal concentrations in Madrid Area lakes were generally below CCME guidelines, with the following exceptions:

- aluminum in P.O., Ogama, and Glenn lakes;
- chromium in Wolverine and Glenn lakes;
- copper in Ogama and Glenn lakes; and
- iron in Wolverine and Glenn lakes.

These elevated metal concentrations occur naturally within lakes in the area. Glenn Lake (in the Windy-Glenn Watershed) tended to contain the highest mean aluminum, copper, and iron concentrations. Nickel concentrations in Imniagut Lake were markedly higher than in other lakes, but remained below the CCME guideline for nickel (Rescan 2010f).

2.5.3.2 Streams

Baseline historical surface water quality data are available for some streams in the Madrid Area for the following periods: 1996, 1997, and 2006 to 2009. A comprehensive sampling program was conducted in 2009 (Rescan 2010f). Streams in the Madrid Area of the Belt were neutral to slightly basic, with pH ranging from 7.1 to 8.0 in 2009. Turbidity levels were variable across streams, and seasonal trends were apparent in some streams. The hydrological cycle varies dramatically during the open-water season, which can cause significant changes in stream water quality. Freshet (typically in June) is when the majority of water passes through streams due to melted snow and ice. This water has been in contact with soil, tundra, and rocks. In addition, the large volume of water passing through streams can cause mixing and erosion. Hence, freshet is usually when maximum concentrations of some nutrients and metals occur. This was generally true of the streams sampled in the Belt as parameters such as ammonia, total phosphorus, chromium, and nickel tended to be highest during freshet and lowest during the summer (Rescan 2010f).

Nitrate, nitrite, and ammonia concentrations were usually below detection limits in stream samples, and were always below CCME guidelines for the protection of freshwater aquatic life. Total phosphorus levels were variable across streams in 2009, ranging from 0.002 mg/L (Wolverine Outflow in June) to 0.053 mg/L (Glenn Outflow Downstream in June). Within the watersheds in the Madrid Area, total phosphorus concentrations generally increased with distance downstream. In the Doris Watershed, the lowest levels of total phosphorus were observed in Wolverine and Patch outflows, which would be categorized as ultra-oligotrophic and oligotrophic, respectively, based on the CCME trigger ranges for total phosphorus. A similar trend was apparent in the Windy Watershed, where the upstream Windy Outflow would be categorized as ultra-oligotrophic to oligotrophic, while the downstream Glenn Outflow Downstream would be considered mesotrophic to eutrophic. The trophic status of streams was dependent on the season because phosphorus concentrations were highest during freshet (Rescan 2010f).

In general, concentrations of total metals were highest in Glenn Outflow Downstream and lowest in Windy Outflow. Molybdenum levels tended to be highest within the streams of the Windy Watershed compared to the other watersheds. These trends are consistent with the lake water quality data, indicating that the water quality of streams reflects the water quality of the upstream lakes that feed them.

Table 2.5-6. Mean Seasonal Concentrations of Water Quality Variables in Windy Lake

Variable	Units	CCME[a]	Winter[b]		Spring		Summer		Fall	
			Average	SD	Average	SD	Average	SD	Average	SD
Conductivity	µS/cm		482.3	41.5	417.0	163.0	407.4	70.1	448.1	47.5
Hardness (as $CaCO_3$)	mg/L		73.2	13.4	79.7	2.5	67.1	5.2	66.3	6.3
pH	pH	*6.5-9.0*	7.8	0.2	7.1	0.5	7.6	0.5	8.0	0.1
Total Suspended Solids	mg/L		1.38	0.44	0.50	0	1.22	0.86	3.18	5.43
Alkalinity, Total (as $CaCO_3$)	mg/L		60.0	5.8	49.4	19.7	45.9	7.5	48.8	1.0
Ammonia as N	mg/L		0.0047	0.0021	0.0116	0.0077	0.0085	0.0070	0.0040	0.0024
Nitrate (as N)	mg/L	*3.0 long term; 124 short term*	0.0094	0.0067	0.0093	0.0179	0.0039	0.0063	0.0029	0.0041
Aluminum (Al)-Total	mg/L	*0.005-0.1*[c]	0.0122	0.0038	0.0106	0.0050	0.0585	0.0296	0.0929	0.0414
Arsenic (As)-Total	mg/L	*0.005*	0.0004	0.0001	0.0007	0.0001	0.0006	0.0007	0.0012	0.0014
Cadmium (Cd)-Total	mg/L	*0.00004-0.00037 long term; 0.00011-0.0077 short term*	0.000048	0.000049	0.000026	0.000046	0.000021	0.000029	0.000021	0.000028
Copper (Cu)-Total	mg/L	*0.002-0.004*[d]	0.0014	0.0006	0.0008	0.0003	0.0009	0.0003	0.0011	0.0004
Iron (Fe)-Total	mg/L	*0.3*	0.008	0.005	0.004	0.005	0.048	0.020	0.088	0.046
Lead (Pb)-Total	mg/L	*0.001-0.007*[d]	0.0003	0.0004	0.0002	0.0004	0.0002	0.0002	0.0002	0.0002
Mercury (Hg)-Total	mg/L	*0.000026*	0.000013	0.000010	0.000001	0.000001	0.000010	0.000010	0.000001	0.000002
Molybdenum (Mo)-Total	mg/L	*0.073*[e]	0.0006	0.0001	0.0008	0.0001	0.0006	0.0002	0.0006	0.0001
Nickel (Ni)-Total	mg/L	*0.025-0.15*[e]	0.0004	0.0001	0.0001	0.0001	0.0003	0.0003	0.0006	0.0005
Selenium (Se)-Total	mg/L	*0.001*	0.0003	0	0.0014	0.0008	0.0011	0.0009	0.0021	0.0010
Zinc (Zn)-Total	mg/L	*0.03*	0.0015	0.0017	0.0030	0.0043	0.0017	0.0020	0.0026	0.0017
Cyanide, Total	mg/L		-	-	0.00067	0.00026	0.00054	0.00014	0.00050	0
Radium-226	Bq/L		-	-	0.0025	0	0.0036	0.0023	0.0025	0

Note: Table includes all available data and shows parameters included in current AEMP or considered relevant (conductivity and selenium).

[a] *Canadian water quality guidelines for the protection of aquatic life (CCME 2014)*

[b] *Seasons were determined as follows; winter, April to early May; spring, end of May to June; summer, July to mid August; fall, late August to September.*

[c] *0.005 mg/L at pH <6.5; 0.1 mg/L a pH ≥6.5*

[d] *Hardness dependent*

[e] *Interim guideline*

Table 2.5-7. Mean Seasonal Concentrations of Water Quality Variables in Patch Lake

			Winter[b]		Spring		Summer		Fall	
Variable	**Units**	**CCME[a]**	**Average**	**SD**	**Average**	**SD**	**Average**	**SD**	**Average**	**SD**
Conductivity	µS/cm		417.3	70.0	359.6	223.7	328.7	93.4	299.0	39.0
Hardness (as $CaCO_3$)	mg/L		73.8	15.9	93.9	7.3	61.5	12.0	52.3	10.4
pH	pH	*6.5-9.0*	7.4	0.4	6.7	0.4	7.3	0.4	7.6	0.4
Total Suspended Solids	mg/L		1.50	1.28	0.50	0	1.23	1.07	2.87	2.82
Alkalinity, Total (as $CaCO_3$)	mg/L		52.0	4.4	39.9	25.1	35.4	8.9	33.8	2.5
Ammonia as N	mg/L		0.0098	0.0054	0.0164	0.0088	0.0077	0.0039	0.0075	0.0048
Nitrate (as N)	mg/L	*3.0 long term; 124 short term*	0.0110	0.0120	0.0138	0.0134	0.0044	0.0054	0.0025	0.0000
Aluminum (Al)-Total	mg/L	*0.005-0.1*[c]	0.0434	0.0331	0.0406	0.0179	0.1331	0.0948	0.1181	0.0707
Arsenic (As)-Total	mg/L	*0.005*	0.0005	0.0002	0.0008	0.0000	0.0005	0.0002	0.0006	0.0004
Cadmium (Cd)-Total	mg/L	*0.00004-0.00037 long term; 0.00011-0.0077 short term*	0.000087	0.000059	0.000031	0.000047	0.000021	0.000041	0.000042	0.000050
Copper (Cu)-Total	mg/L	*0.002-0.004*[d]	0.0035	0.0016	0.0014	0.0005	0.0015	0.0007	0.0012	0.0006
Iron (Fe)-Total	mg/L	*0.3*	0.050	0.020	0.030	0.019	0.106	0.071	0.088	0.041
Lead (Pb)-Total	mg/L	*0.001-0.007*[d]	0.0006	0.0006	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Mercury (Hg)-Total	mg/L	*0.000026*	0.000014	0.000011	0.000001	0.000002	0.000006	0.000013	0.000005	0.000006
Molybdenum (Mo)-Total	mg/L	*0.073*[e]	0.0003	0.0002	0.0002	0.0000	0.0002	0.0001	0.0010	0.0034
Nickel (Ni)-Total	mg/L	*0.025-0.15*[e]	0.0007	0.0002	0.0017	0.0030	0.0005	0.0001	0.0009	0.0011
Selenium (Se)-Total	mg/L	*0.001*	0.0006	0.0006	0.0012	0.0010	0.0011	0.0005	0.0008	0.0006
Zinc (Zn)-Total	mg/L	*0.03*	0.0055	0.0063	0.0079	0.0081	0.0022	0.0017	0.0015	0.0010
Cyanide, Total	mg/L		0.00250	0	0.00060	0.00022	0.00071	0.00045	0.00058	0.00020
Radium-226	Bq/L		-	-	0.0025	0	0.0031	0.0013	0.0025	0

Note: Table includes all available data and shows parameters included in current AEMP or considered relevant (conductivity and selenium).

[a] *Canadian water quality guidelines for the protection of aquatic life (CCME 2014)*

[b] *Seasons were determined as follows; winter, April to early May; spring, end of May to June; summer, July to mid August; fall, late August to September.*

[c] *0.005 mg/L at pH <6.5; 0.1 mg/L a pH ≥6.5*

[d] *Hardness dependent*

[e] *Interim guideline*

Mean total metal concentrations in streams were generally below CCME guidelines, with the following exceptions:

- aluminum in all streams except Wolverine Outflow;
- chromium in P.O. Outflow and Glenn Outflow Downstream;
- copper in Glenn Outflow Downstream; and
- iron in Glenn Outflow Downstream and P.O. and Ogama outflows.

These elevated metal concentrations occur naturally within streams in the area (HBML 2011).

2.5.4 Sediment Quality

2.5.4.1 Lakes

Characteristics of sediments are less temporally variable than water, providing useful markers of environmental conditions over longer periods of time. Sediments also play an important role in benthic invertebrate habitat quality. Baseline historical sediment quality data are available for some lakes in the Madrid Area for the following open-water seasons: 1996, 1997, 2007, 2009, and 2010 (Table 1.1-1). A comprehensive sampling program was conducted in 2009 (Rescan 2010f), and additional baseline samples were collected in 2010 (Rescan 2011g).

Sediments in the north end of the Belt were largely composed of clay, silt, and sand, with little gravel. The proportion of fine particles in sediments increased with depth. An increase in fine sediments (clay and silt) within a lake was generally associated with an increase in sediment metal and organic carbon concentrations. There were few clear trends in sediment chemistry among lakes surveyed in 2009, though sediments from Wolverine and Imniagut lakes in the Doris Watershed contained relatively high concentrations of TOC, ammonium, total nitrogen, and total sulphur (Rescan 2010f).

All sediment samples collected in 2009 were compared to CCME guidelines for the protection of aquatic life: the interim sediment quality guidelines (ISQGs) and the probable effects levels (PELs). The more conservative ISQGs are levels below which adverse biological effects are rarely observed, whereas the higher PELs correspond to concentrations above which negative effects frequently occur. Lake sediments in the Madrid Area were naturally elevated in arsenic, chromium, and copper, and concentrations of these metals were often higher than CCME ISQGs. Metal concentrations in sediments were always below PELs, with the exception of one sediment sample collected from Glenn Lake which contained elevated levels of chromium (Rescan 2010f).

2.5.4.2 Streams

Baseline historical sediment quality data were collected for some streams in the Madrid Area in 2009 (Rescan 2010f). Stream sediments consisted of a highly variable mixture of gravel, sand, silt and clay. There was no apparent relationship between sediment particle size distribution and sediment metal concentrations, but the proportion of TOC in sediments tended to be highest in sediments containing more fine sediments. The mean TOC content of sediments ranged from 0.3% in Ogama Outflow sediments (which consisted of more coarse sediments) to 2.9% in P.O. Outflow sediments (which consisted of more fine sediments). In general, stream sediments contained lower metal concentrations than lake sediments. Stream sediments in the Madrid Area were naturally high in chromium. Concentrations of chromium and copper in sediments collected from Ogama and Windy outflows were occasionally higher than CCME ISQGs. Sediment metal concentrations were always below CCME PELs (Rescan 2010f).

3. Biological Environment

3. Biological Environment

3.1 VEGETATION

Baseline vegetation studies have been conducted in the Hope Bay Belt area from 1996 to 2011 (Rescan 1997b, 1997c; Golder 2009d; Rescan 2010g). A comprehensive site level ecological classification system has not been developed for Nunavut or the Northwest Territories. A coarse level vegetation classification system (based on satellite imagery interpretations conducted in 2000) was developed for the West Kitikmeot/Slave Study (WKSS) region (RWED 2000), which includes the Hope Bay Belt area (Golder 2009d). At local scales, multiple ecosystem classification projects were also completed (Rescan 1997b, 1997c; Burt 2003). From these studies, Golder (2009d) created a preliminary regional Ecosystem Land Classification (ELC) system. The ELC was developed to compare local ecosystems with the broad level WKSS classification system, and to enable the assessment of environmental impacts at both local and regional levels (Golder 2009d). The ELC system was used to classify vegetation in the Madrid area in 2010 (Rescan 2010g).

3.1.1 Ecoregions

The Hope Bay Belt area lies north of the tree line in the "tundra, high shrub zone", in the Southern Arctic Ecozone (WKRLUP 2005). It is situated on the border between the Queen Maud Gulf Lowland and Bathurst Hills Ecoregions (Figure 3.1-1). The Madrid Area falls in the Queen Maud Gulf Lowland Ecoregion. The Queen Maud Gulf Lowland ecoregion is also considered to have a low Arctic ecoclimate. Archean rocks form broad, sloping uplands that reach about 300 m in elevation in the south, and subdued undulating plains near the coast. The coastal areas are mantled by silts and clay of postglacial marine overlap. Bare bedrock is common, and turbic and static cryosols developed on discontinuous, thin, sandy moraine, level alluvial, and marine deposits are the dominant soils in the ecoregion. Permafrost is continuous and deep with low ice content. Vegetation is characterized by shrub tundra, consisting of dwarf birch, willow, northern Labrador tea, *Dryas* spp., and *Vaccinium* spp. Tall dwarf birch, willow, and alder occur on warm sites; wet sites are dominated by sphagnum moss and sedge tussocks.

3.1.2 Vegetation Communities

Using the ELC system for the Madrid Area, there were eleven dominant vegetation communities identified (Table 3.1-1; Rescan 2010g). Of the eleven dominant vegetation communities, Eriophorum Tussock meadow was the most common (Rescan 2010g).

3.1.3 Rare Plants

A formal ranking system for identification or status determination for plant species potentially at risk has not been established in Nunavut. Thus, the NWT Department of Environmental and Natural Resources database was used to create a list of species at risk known to occur within Nunavut. The resultant plant list was used to identify potential habitat that may support rare species. A list of dominant plants in each field plot from baseline vegetation field surveys (Rescan 1997b, 1997c; Burt 2003; Golder 2009d; Rescan 2010g) was recorded and evaluated for the presence of rare/at risk plants according to the NWT General Status Ranking Program (GSRP; Northwest Territories Environment and Natural Resources 2010).

Figure 3.1-1
Arctic Ecozones and Ecoregions

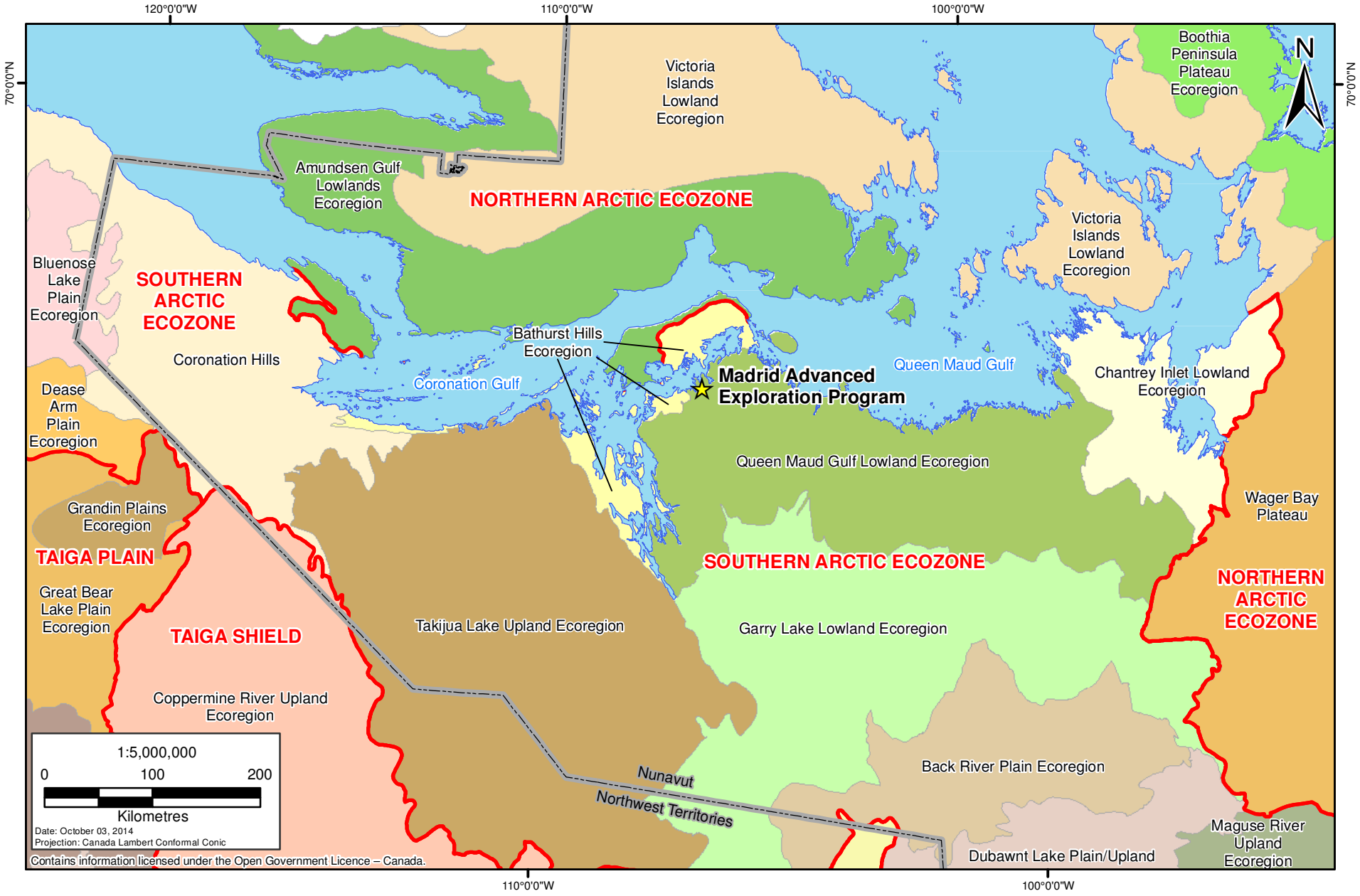


Table 3.1-1. ELC Vegetation Communities in the Madrid Area

General Ecosystem Unit	Description
Dry Carex-Lichen	Dry, nutrient poor community restricted to exposed bedrock outcrops characterized by a sparse cover of sedges, lichens and dwarf shrubs.
Riparian Willow	Wet to very wet, medium to rich nutrient community restricted to active floodplains and seasonally fluctuating water tables with a thick cover of willow species and variable (often extensive) cover of sedges, cotton-grass, and moss species.
Dryas-Herb Mat	Dry to mesic, poor to medium nutrient community occurring on very thin, poorly developed soils on bedrock outcrops and morainal deposits dominated by Arctic avens and a high diversity of dwarf shrubs and herbs.
Wet Meadow	Wet to very wet, medium to rich nutrient community occurring on plains and gentle lower slopes with constant water seepage dominated by thick covers of cotton-grass and sedges, few shrubs and lichens, and limited moss cover.
Betula-Ledum-Lichen	Dry to mesic, poor to medium nutrient community occurring on hillslopes of glacial till containing thick covers of low dwarf birch, Labrador tea and a variety of dwarf shrubs, sedges, herbs and lichens.
Emergent Marsh	Permanently saturated rich to very rich communities which are rarely extensive and dominated by sedges, some hydrophilic herbs, and no shrubs of lichens, typically occurring along watercourses and ponds.
Dwarf Shrub-Heath	Mesic, poor to medium nutrient community restricted to moderate to steep slopes of glacial till over bedrock (often containing frost mounds) containing arctic heather and a highly variable assemblage of dwarf shrubs, herbs, moss and lichen in response to microtopography and aspect.
Betula-Moss	Mesic to moist, poor to medium nutrient community located in depressions or gently sloping fluvial and lacustrine plains typified by a high cover of dwarf birch (and often willow) and a thick moss layer, with few herbs or lichens present.
Eriophorum Tussock	Moist to wet, medium to rich nutrient, widespread community type characterized by deep tussocks of sheathed cotton-grass and a variety of dwarf shrubs (on drier tussock tops), herbs, and mosses found in low lying plain of organic material overlying fine textures marine and lacustrine materials (permafrost almost always occurs at the organic – mineral transition).
Dry Willow	Mesic, medium nutrient community occurring on steep slopes (typically fluvial, marine or lacustrine) with a thick cover of willow (occasionally dwarf birch) and few other species.
Polygonal Ground	Mosaic of disjunct communities comprised of drier communities (raised palsa mounds with communities similar to birch-ledum-lichen or birch-moss) and wet depressions (normally wet meadows) which typically occur in depressions and valley bottoms near lakes and ponds.

No species of conservation concern were identified during the baseline field surveys for the Madrid Area; however, three species considered vulnerable or at risk were identified in previous baseline studies in the Hope Bay Belt (Golder 2009d). Three species were identified as being rare, including the bryophyte *Sphagnum orientale* (considered vulnerable with a global ranking status of Globally Imperilled to Apparently Secure [G2G4]), as well as *Cinclidium latifolium* and *Frullania tamarisci*. One exotic species, common dandelion (*Taraxacum officinale*), was also identified during field surveys.

3.1.4 Wetlands

The Federal Wetland Class was used to classify wetlands, which could not be distinguished from satellite imagery, during ground field surveys (Warner and Rubec 1997). Over half of the wetlands surveyed in the HB Belt were characterized as fens, followed by bogs. Of the form types, lowland polygon fens were the most common, followed by lowland polygon bogs, and lacustrine marshes. The ecological characteristics and typical vegetation communities for each of these ecosystems are summarized in Table 3.1-2.

Table 3.1-2. Wetland Form Types in the Madrid Area

Primary Wetland Form	Description
Lowland polygon fens	Lowland polygon fens form when the active layer within the soil directly influences surface landscape morphology. They are characterised by repeating variations of wet depressions (flarks) and dry linear hillocks (ribs) resulting from the displacement of soil due to freeze thaw cycles and permafrost dynamics. The wet soil conditions within the depressions support predominantly *Carex* species, including *C. aquatilis* (Plate 3.2-4), *C. membranacea, C. rotundata and C. atrofusca,* as well as *Eriophorum Angustifolium*. The drier hillocks support plant species assemblages characteristic of Arctic bog ecosystems, such as bog blueberry (*Vaccinium uliginosum*), lingonberry (*Vaccinium vitis idaea)* and to a lesser extent bearberry (*Arctostaphylos* spp).
Lowland polygonal bog	Lowland polygonal bogs are perennially frozen peatlands characterized by linear ridges underlain by ice-wedges. This ecosystem occurs in conjunction with the lowland polygon fen and represents the raised drier portions of the wetland complex. Lowland polygon bogs occur most commonly near estuaries, along river floodplains, and in depressions.
Lacustrine marsh	Lacustrine marshes occur along lake margins or, less commonly, along unconfined low-gradient streams in microsites protected from erosional flows and ice and wave scour. Water sources are a combination of inputs from adjacent lakes, rivers and streams flowing into the lake, as well as surface runoff from adjacent catchment areas.

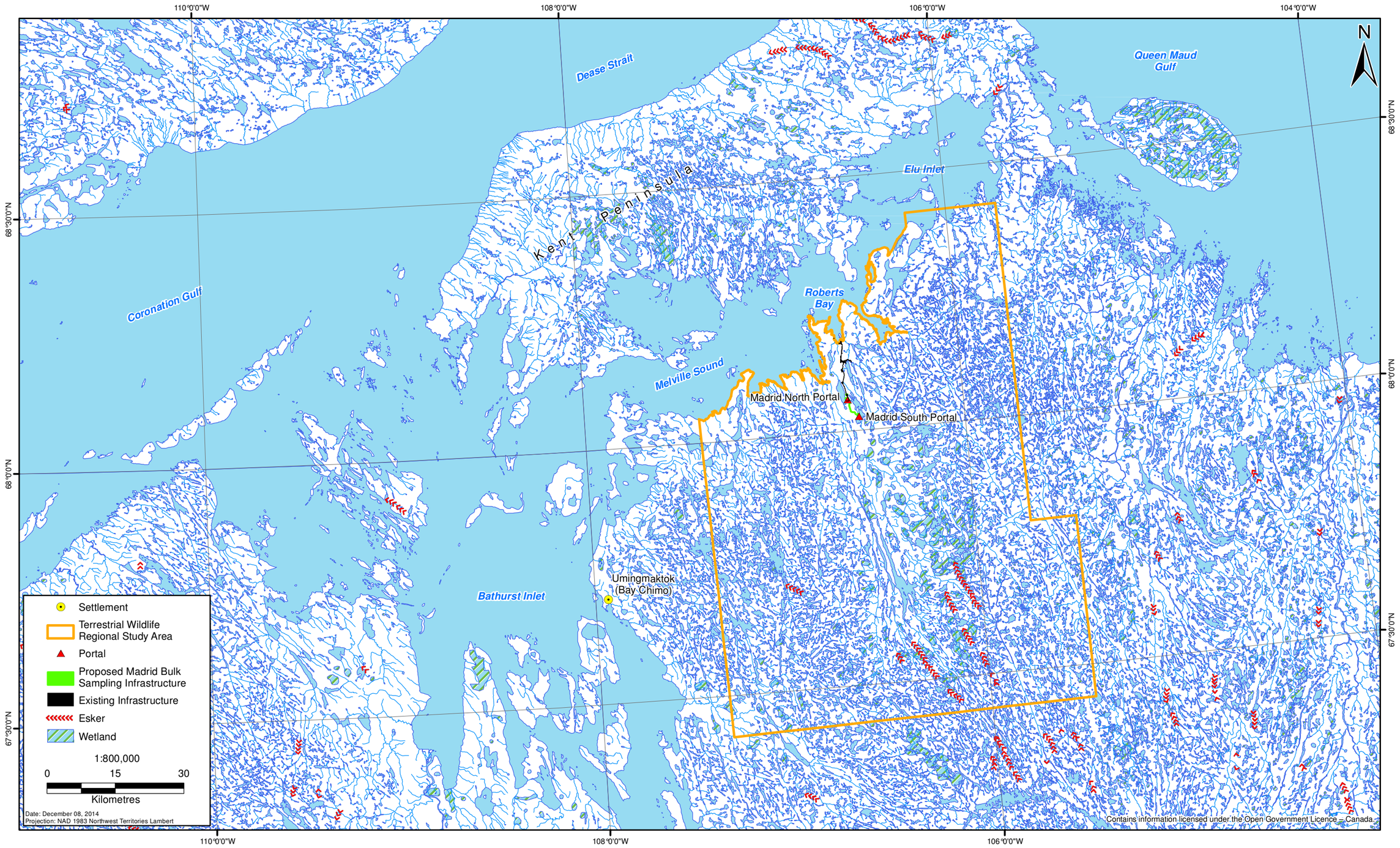
3.2 TERRESTRIAL FAUNA

Terrestrial vertebrate studies have been conducted in the Hope Bay Belt area from 1996 through 2013. An active Wildlife Mitigation and Monitoring Program (WMMP) has been in place since 2006 across the entire Regional Study Area (RSA) of the Hope Bay Belt (Figure 3.2-1), and continues to collect information on wildlife species in the area. Wildlife in the area is evaluated at the RSA scale to account for the extensive home ranges and seasonal movements of large mammals such as Caribou (*Rangifer tarandus*), muskoxen (*Ovibos moschatus*), and Grizzly Bear (*Ursus arctos horribilis*). In 2010 and 2011, deoxyribonucleic acid (DNA) studies were conducted to determine Grizzly Bear and Wolverine (*Gulo gulo*) abundance and distribution patterns.

Additional wildlife surveys have been conducted in the region since the 1970s. These other wildlife surveys have included descriptions and mapping of wildlife habitats, inventories of wildlife sightings and signs (e.g., tracks and scat) collected during ground and helicopter reconnaissance trips, government radio-collar data, academic research projects and other historical work. Existing data sources from historical studies include the following:

- status reports of the Canadian Endangered Species Conservation Council (CESCC);
- assessment and status reports of COSEWIC;
- published literature on general ecology and population dynamics of wildlife species in the area (e.g., McLoughlin, Taylor, Cluff, Gau, Mulders, Case and Boutin 2003; McLoughlin, Taylor, Cluff, Gau, Mulders, Case and Messier 2003; McLoughlin et al. 2004);
- wildlife research conducted as part of the WKSS;
- satellite-collar data from wolf studies (Walton et al. 2001); and
- satellite-collar data from barren-ground Grizzly bears and Caribou collected by the Northwest Territories Department of Environment and Natural Resources.

Figure 3.2-1
Wildlife Mitigation and Monitoring Program Area



Baseline bird information has also been collected in the Hope Bay Belt area from 1995 to 2013. As with other wildlife species, annual monitoring of birds has been conducted since 2006 as part of the WMMP. Surveys conducted for bird species have included point counts and prism plots for terrestrial breeding birds (shorebirds, passerines, and game birds); aerial surveys for raptors, waterbirds (waterfowl, gulls), and seabirds; as well as ground nesting surveys for seabirds.

Inuit Traditional Knowledge is also available for the general region from the following sources: Thorpe et al. (2002), Keith et al. (2005).

3.2.1 Ungulates

Results from the baseline studies and WMMP monitoring have identified two ungulate species in the RSA: Barren Ground Caribou (Ahiak and Dolphin-Union herds) and Muskoxen.

3.2.1.1 Barren Ground Caribou

Barren ground Caribou (a species of Special Concern) is a keystone species in the Arctic, both biologically and culturally (COSEWIC 2007, 2014). Caribou are a main prey item of Grizzly bears, wolves, Wolverines and foxes, and can alter the landscape. Historically, the Inuit have relied on Caribou for food and clothing. Three herds have historically been identified in the Hope Bay Belt area, notably the Bathurst, Ahiak, and Dolphin-Union herds.

Survey results during the period of 1996 to 2011 suggest that Ahiak Caribou used portions of the RSA for calving and post-calving during the late 1990's, reducing their use of the area by 2003. Collar data suggest that the calving range of the Ahiak herd has moved east and out of the RSA during this period. During the late 1990's, when spring (northern) and winter surveys were conducted, Caribou were found to use the RSA, likely Dolphin-Union Caribou. These spring and winter surveys were discontinued in the early 2000's. Spring surveys were again conducted between 2008 to 2010, and 2011 and Caribou use of the area during this period appears consistent with that observed in the late 1990's. A re-analysis of the post-calving Caribou data from 1996 and 2005 was conducted in 2010 to determine whether a zone of influence (ZOI) could be detected with either count or presence-absence data. No consistent ZOI was found, and it was determined that Caribou numbers from recent years (2006 to 2012) are too low to detect a ZOI during the post-calving period, if one exists. As a result, 2011 was the last year of aerial surveys for Caribou. In their place, TMAC plans to contribute to Government of the Northwest Territories Department of Environment (GN-DOE) regional Caribou monitoring programs and utilize wildlife cameras to monitor wildlife movements near Hope Bay operations, including the proposed Madrid Advanced Exploration Program bulk sample sites.

3.2.1.2 Muskoxen

Muskoxen are observed in the RSA throughout the year, but numbers between years and seasons are highly variable. Based on historical surveys and incidental observations, muskoxen appear to be more common in the RSA during summer than during winter. Muskox are not a VEC, but were counted during aerial transect surveys for Caribou. In most years, both the proportion of groups with calves and the calf:adult ratio is low. The cause of this low calf:adult ratio is unknown. In 2012, however, a group of 20 young was recorded in a herd of approximately 50 animals. As with Caribou, 2011 was the last year of aerial surveys for Muskox. Moving forward, TMAC will utilize wildlife cameras to monitor wildlife movements near Hope Bay operations, including the proposed Madrid Advanced Exploration Program bulk sample sites.

3.2.2 Carnivores

Results from the baseline studies and WMMP monitoring have identified five carnivore species in the RSA: Grizzly Bear, Wolverine, Wolf (*Canis lupus*), Arctic Fox (*Vulpes lagopus*), and Red Fox (*Vulpes vulpes*).

3.2.2.1 Grizzly Bears

Grizzly bears are a species of Special Concern (COSEWIC 2002) and are classified as Sensitive in Nunavut (COSEWIC 2005). Approximately 800 grizzly bears are found in the West Kitikmeot region at low densities (COSEWIC 2002). Grizzly bears are vulnerable to decline from increased adult mortality (McLoughlin, Taylor, Cluff, Gau, Mulders, Case and Boutin 2003; McLoughlin, Taylor, Cluff, Gau, Mulders, Case and Messier 2003; Meteorological Services of Canada (MSC) 2004). They also have low ecological resiliency, are sensitive to human activity, and are frequently displaced by industrial developments (Weaver, Paquet, and Ruggiero 1996; Ross 2002). Grizzly bears are regularly observed throughout the Hope Bay Belt area, and in 2009 at least eight individual Grizzly bears were identified in the northern Belt. Between 2005 and 2008, habitat use by Grizzly bears at various distances from the Project footprint was quantified as the proportion of riparian vegetation plots which had been used by Grizzly bears in each year. This study was discontinued due to safety concerns and replaced in 2010 with a more intensive one year-long assessment of Grizzly Bear population and distribution using a DNA hair capture study. Grizzly Bear DNA studies confirmed that this coastal system in northern Nunavut is highly productive for grizzly bears. Although it was not possible to estimate Grizzly Bear density because the study area does not represent a geographically closed population, results suggest that approximately 8 to 11 individual grizzly bears may be detected for every 1,000 km^2. Densities in western Nunavut are approximately 7 bears/1,000 km^2 (M. Dumond, GN-DOE, pers. comm.).

3.2.2.2 Wolverine

Wolverine populations in the central Arctic are stable (COSEWIC 2003) and classified as Secure in Nunavut (CESCC 2005), while the western Canadian population (which includes parts of Nunavut) is listed as a species of Special Concern (COSEWIC 2003). Wolverines use large home ranges and populations are generally of low density in the central Arctic (Mulders 2000). Wolverines use reproductive dens from February through April (Magoun and Copeland 1998). Food availability is the driving factor influencing movement patterns and home range selection by Wolverines (Banci 1994).

Wolverines have been observed in the HB Belt area during aerial surveys and incidental observations. Between 2005 and 2008, Wolverine use of the Hope Bay Belt area was examined through a study of snow tracks across the study area. Wolverine DNA studies conducted in 2010 and 2011 detected a total of eight males and three females in the Hope Bay Belt area. Sample sizes and recapture rates were too small to conduct any population level analyses.

3.2.2.3 Wolves and Foxes

Wolves and foxes are classified as Secure in Nunavut (CESCC 2005); they are found throughout the Hope Bay Belt area and den in the area. Satellite-collar data indicate that wolves in the central Arctic migrate over large areas in the fall, winter and early spring, following the migratory Caribou herds (Walton et al. 2001). Wolves occupy smaller home ranges around the den during parturition and pup rearing (May to September; Walton et al. 2001). Wolf and fox dens are preferentially located in eskers, which can be limiting (McLoughlin et al. 2004). Carnivore den surveys located three wolf dens in the Hope Bay Belt area, with only one den that was active in 2009. Productivity of this den was not determined.

3.2.3 Birds

A number of bird species, including upland breeding birds, waterbirds, and raptors, have been identified in the Hope Bay Project area through baseline and Wildlife Mitigation and Monitoring Program WMMP studies, as well as incidental sightings. Results from previous baseline and monitoring studies have identified 25 species of upland breeding bird, 28 species of waterbirds, and 9 species of raptors to be present in the RSA (Table 3.2-1).

Table 3.2-1. Incidental Observations of Birds in the Hope Bay Belt Area, 1996 to 2013

Species	Type	Total	Species	Type	Total	Species	Type	Total
Canada Goose	V	>1,522	Long-tailed Duck	V	>100	Savannah Sparrow	V	>75
	N	9		N	>2		N	1
Snow Goose	V	>787	Gadwall	V	10	American Tree Sparrow	V	>32
Greater White-fronted Goose	V	>705	Glaucous Gull	V	>55		N	2
Brant Goose	V	1	Herring Gull	V	>17	White-crowned Sparrow	V	>30
Tundra Swan	V	>200	Common Raven	V	>99	Horned Lark	N	2
	N	1		N	2	Snow Bunting	V	>9
Sandhill Crane	V	>151	Rough-legged Hawk	V	>69	Horned Lark	V	>15
	N	>1		N	1	American Pipit	N	2
Pacific Loon	V	>253	Northern Harrier	V	2	Common Redpoll	V	>15
Common Loon	V	6	Golden Eagle	V	>65	American Pipit	V	>5
	N	1	Bald Eagle	V	3	Hoary Redpoll	V	58
Red-throated Loon	V	>29	Peregrine Falcon	V	>29	Lapland Longspur	V	>42
	N	3	Gyrfalcon	V	7		N	2
Yellow-billed Loon	V	4	Short-eared Owl	V	44	Gray-cheeked Thrush	V	yes
King Eider	V	>8	Snowy Owl	V	7	Semipalmated Sandpiper	V	>6
Common Eider	V	5		N	1	American Golden Plover	V	5
Red-breasted Merganser	V	>65	Arctic Tern	V	>9	Least Sandpiper	V	>11
Common Merganser	V	1	Parasitic Jaeger	V	>4	Baird's Sandpiper	V	2
Greater Scaup	V	98	Long-tailed Jaeger	V	>1	Pectoral Sandpiper	V	2
Lesser Scaup	V	9	Willow Ptarmigan	V	>98	Wilson's Snipe	V	12
American Green-winged Teal	V	16	Rock Ptarmigan	V	13	Red-necked Phalarope	V	>9
Northern Pintail	V	>210	Harris' Sparrow	V	1	Semipalmated Plover	V	2

Notes:
V = Visual observation
N = Nest observation
Sightings noted as "yes" were recorded as being "several".

Birds in Nunavut are protected under various forms of federal and territorial legislation. All upland breeding birds and waterbirds identified at Hope Bay through baseline and monitoring studies, with the exception of ptarmigan species, are considered "migratory birds" and are protected under the *Migratory Bird Convention Act* (1994). Raptors and Common Raven are not considered migratory birds under *the Migratory Bird Convention Act*. However, all bird species, including raptors, are protected under the Nunavut *Wildlife Act* (2003).

Several species encountered during baseline and monitoring studies in the Hope Bay Belt are of conservation concern at the federal and territorial level. Of the 62 species identified, two are listed under the federal *Species at Risk Act* (SARA; 2002). Peregrine Falcon and Short-eared Owl are listed as species of Special Concern under Schedule 1 of SARA. Several others are listed as Sensitive in Nunavut by the Canadian Endangered Species Conservation Council (CESCC 2010), including American Golden-plover, American Pipit, American Tree Sparrow, Arctic Tern, Common Eider, Glaucous Gull, Golden Eagle, Gyrfalcon, Harris' Sparrow, Hoary Redpoll, King Eider, Least Sandpiper, Long-tailed Duck, Red-necked Phalarope, and Rough-legged Hawk, Semipalmated Sandpiper, Snow Bunting, and White-crowned Sparrow.

3.2.3.1 Upland Breeding Birds

Upland breeding birds were surveyed in 2012 using the PRISM method, and the same six ubiquitous passerine species accounted for over 86% of detections. Shorebirds and ptarmigan were detected significantly less often than songbirds. When averaged across plots, results (numbers of species, adults, breeding territories, and nests detected) were similar for plots located within 1 km of Hope Bay Belt infrastructure and those farther away in both 2011 and 2012. Compared to upland habitats, lowland and mixed habitats supported on average one more species of upland breeding birds, and about four more breeding territories per 12 hectares of tundra. Active or recently active nests indicate breeding success is occurring within 1 km of Hope Bay Belt infrastructure.

3.2.3.2 Raptors

Raptors are relatively common in the northern Hope Bay Belt. Nest productivity and success, the number of eggs per occupied nest, and the proportion of occupied nests that successfully raised chicks, is highly variable between years. Results from 2012 indicate that raptor breeding success across the northern Hope Bay Belt was low for rough-legged hawks, but within the normal range for all species combined. There were four occupied raptor nests within 1 km of Doris North facilities in 2012, two of which were successful. In 2011, only one of ten occupied raptor nests within 1 km of Hope Bay Belt facilities was successful.

3.3 AQUATIC ECOSYSTEMS

Aquatic systems comprise organisms from multiple trophic levels, and include periphyton, phytoplankton, zooplankton, benthic macroinvertebrates (also known as benthos), and fish (highest trophic level). Periphyton, algae that grows on the surfaces of rocks or larger plants (along with bacteria and protozoa that live with the algae), are an important food item for many benthic invertebrates, which are in turn the main food source for fish in streams and rivers. Due to their short life cycles, periphyton are among the first organisms to respond to environmental stressors, and tend to exhibit taxon-specific changes to stressors, making them good indicators of current environmental conditions. Phytoplankton (free-floating autotrophic algae) also play an important role in many aquatic systems as primary producers and prey for higher trophic levels. Phytoplankton biomass and taxonomic composition can be affected by environmental changes and have been widely used to examine effects of nutrient and metal pollution. Zooplankton, the heterotrophic component of aquatic plankton, provide an important link to the aquatic foodweb, consuming phytoplankton and providing food for may

fish species. Zooplankton can be sensitive to changes in water quality and have short life-cycles, rendering them good indicators of environmental change. Benthos (greater than 0.5 mm in size) are also good indicators of environmental change because these organisms are in close contact with the sediments and feed on algae, bacteria, and detritus. Benthos also tends to be less mobile than fish, making them good indicators of local conditions. In addition to their potential use as indicator species, benthic organisms are important food sources for fish, particularly in streams. These various components have been studied in the Madrid Area and are described in the sections that follow.

3.3.1 Plankton and Periphyton

Comprehensive phytoplankton, zooplankton, and periphyton baseline sampling programs were conducted in the Madrid Area in 2009 (Rescan 2010f, 2011g). Additional baseline data are available for some lakes from 1996, 1997, 2007, and 2010 and for some streams from 1996 and 1997 (Table 1.1-1; Figure 2.5-7).

3.3.1.1 Phytoplankton

In 2009, lake phytoplankton biomass (as indexed by the concentration of chlorophyl *a* in ug chl *a*/L) and density (number of cells/mL) varied among lakes in the Madrid Area. Biomass levels ranged from 0.3 to 5.6 µg chl *a*/L, and density ranged from 69 to 4,980 cells/mL. Biomass and density tended to be highest in Ogama Lake and lowest in Windy, P.O., and Patch lakes.

During the summer, lakes with the highest levels of phytoplankton biomass and density were dominated by cyanobacteria (blue-green algae). Cyanobacteria, largely the nitrogen-fixing species *Aphanizomenon flosaquae*, made up 84% of the phytoplankton assemblage in Ogama Lake. In lakes with low phytoplankton biomass and density, diatoms, chlorophytes (green algae), and cryptophytes were abundant, and cyanobacteria generally made up much smaller fractions of the phytoplankton assemblages. Phytoplankton richness ranged from 11 to 20 taxa/sample, and Simpson's diversity index ranged from 0.4 to 0.87 across all sites, seasons, and years. Phytoplankton diversity was lowest in the cyanobacteria-dominated Ogama Lake. Phytoplankton diversity and richness generally followed similar trends.

Patterns in phytoplankton density and community composition were consistent with those observed in previous years.

3.3.1.2 Zooplankton

In 2009, mean zooplankton density was highly variable among lakes in the Madrid area. Imniagut Lake had the highest zooplankton density of the lakes surveyed (255,000 organisms/m^3). The lowest density was observed at Windy Lake (2,210 organisms/m^3). Lake zooplankton assemblages were composed mainly of rotifers, copepods, and cladocerans. Common zooplankton species encountered in the area included the rotifers *Kellicottia longispina* and *Keratella quadrata* and the cladoceran *Bosmina longirostris*. Zooplankton genera richness ranged from 3 genera/sample in Windy and Glenn lakes to 12 genera/sample in Lake Wolverine. Simpson's diversity indices ranged from 0.14 in Glenn Lake to 0.72 in Patch Lake.

Patterns in zooplankton density and community composition were consistent with those observed in previous years.

3.3.1.3 Periphyton

In 2009, periphyton biomass (as chlorophyll *a*) in the Madrid area ranged from 251 µg chl *a*/m^2 in Patch Outflow to 2,500 µg chl *a*/m^2 in Ogama Outflow. Periphyton density ranged from 70,200 cells/m^2 in P.O. Outflow to 427,000 cells/cm^2 in Ogama Outflow. Stream periphyton assemblages were almost exclusively

composed of diatoms, which made up more than 99% (numerically) of the sampled periphyton. The most common diatom species found in streams were *Diatoma tenue*, *Achnanthes minutissima*, and *Diatoma tenue elongatum*. Mean periphyton taxa richness ranged from 8 genera/sample at Windy Outflow to 13 genera/sample at Patch and P.O. outflows. Simpson's diversity indices for periphyton communities were relatively high at all sites (0.64 to 0.86) except Windy Outflow (0.32).

3.3.2 Benthic Invertebrates

Comprehensive lake and stream benthos baseline sampling programs were conducted in lakes/ponds and streams in the Madrid Area in 2009 (Rescan 2010f, 2011g). Additional baseline data are available for some lakes from 1995 to 1998, 2000, and 2006 to 2010, and for some streams from 1996, 1997, 2000, and 2006 to 2009 (Table 1.1-1; Figure 2.5-7).

Most lakes in the Madrid Area had benthos densities lower than 4,000 organisms/m^2, with densities ranging from 159 organisms/m^2 in Glenn Lake to 23,600 organisms/m^2 in Imniagut Lake in 2009. Lake benthic communities were generally dominated by dipterans (44 to 100% of organisms numerically), although pelecypods, ostracods, and oligochaetes were also common. Benthic communities in Wolverine and P.O. lakes differed slightly. In these lakes, dipterans comprised smaller fractions of the benthic communities (~15%, numerically) while pelecypods and ostracods were more numerous. Benthic genera richness and Simpson's diversity index were generally higher in the shallow depth zone compared to the mid and deep depth zones of lakes. Within the shallow depth zone, genera richness ranged from 2 genera/sample in Glenn Lake to 10 genera/sample in Wolverine Lake and Simpson's diversity ranged from 0.30 in Glenn Lake to 0.75 in Imniagut Lake.

Stream benthos density ranged from 3,160 organisms/m^2 in Patch Outflow to 12,300 organisms/m^2 in Ogama Outflow in 2009. Stream benthos assemblages were dominated by dipterans, which represented 43 to 88% of the stream benthic organisms. Nematodes, oligochaetes, and ostracods were also common in the study area, although they were not present at all sites. Benthic richness was consistent across streams in the Madrid Area, ranging from 14 to 16 genera/sample. Simpson's diversity was also similar across streams, ranging from 0.66 in Ogama Outflow to 0.83 in P.O. Outflow.

3.3.3 Fish Habitat and Fish Community Sampling

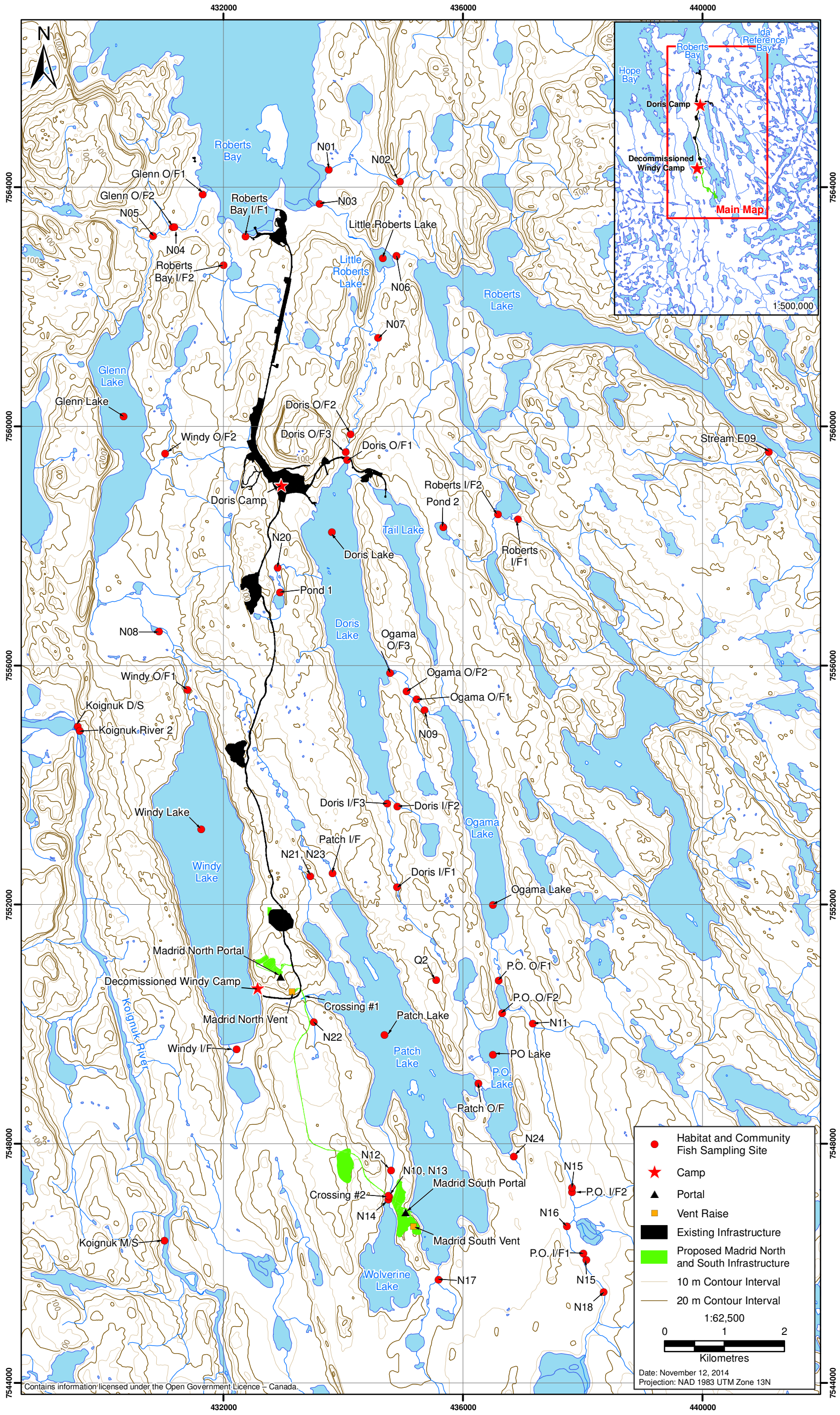
Baseline fish studies were conducted in the Belt from 1993 to 2009. Comprehensive baseline programs were also carried out in 2009 and 2010 within the Madrid Area (Rescan 2010f, 2011a). Baseline fish habitat and fish community information was collected for multiple waterbodies (i.e., lakes/ponds and streams) located adjacent to or at proposed infrastructure over these two years (Figure 3.3-1).

Fish habitat, defined as those environmental components that are required either directly or indirectly by fish to carry out their life processes, including spawning and rearing areas, food production areas, migration routes, and over-wintering areas, was assessed using a variety of methods. Lake and pond habitat was evaluated using hydroacoustics and/or visual observations, whereas streams were evaluated using either the detailed Fish Habitat Assessment Procedure (FHAP) or Sensitive Habitat Inventory Mapping (SHIM) survey methods depending on the site and potential infrastructure effects on the site.

Lakes were the predominant form of fish habitat in the Madrid Area and supplied the greatest amount of perennial fish habitat. A total of eight lakes from the Madrid Area were included in baseline studies, ranging in surface area from 83.1 ha (P.O. Lake) to 1,062.8 ha (Reference Lake B). Fines (e.g., silt clay or mud) were found to be the predominant substrate type in lakes. Reference lakes showed relatively higher percentages of hard substrates such as bedrock and boulder, while Patch Lake showed concentrations of fish associated with deepwater habitat over substrates of mud or fines. Ponds (maximum depth is <3 m) assessed in the Madrid Area were rated as having limited habitat.

Figure 3.3-1

Fish Habitat and Fish Community Sampling in the Madrid Area, 2009 to 2010



The SHIM method is used as a standard for watercourse and fish habitat mapping in British Columbia; methods were tailored and adapted for streams encountered in Nunavut (Mason and Knight 2001). This method attempts to ensure the collection and mapping of reliable, high quality, current and spatially accurate information about fish habitats and watercourses. It is particularly helpful for providing the necessary information when assessing the potential effects of specific infrastructure on fish and fish habitat.

Overall, channel and instream habitat characteristics were similar among streams and typical of slow moving streams flowing through tundra wetlands. Mean channel gradients ranged from 1 to 3.5 % and the dominant habitat unit was wetland. Instream vegetation was the dominant cover type. Deep pools were rarely observed. Organic material was the dominant substrate type in all streams. Hard rocky substrates were rarely observed. Ninespine Stickleback was the only fish species identified in the assessed streams. Overall, habitat quality was generally marginal except in N15 (upstream of Ogama Lake, in which overall habitat quality was classified as important.

Information collected through FHAP surveys indicated that streams in the Madrid Area were generally ephemeral and offered temporary habitat for fish during the spring and early summer months. Outflow streams from lake sources were relatively larger and permanent (e.g., Patch Outflow). These streams supplied relatively high quality habitat, especially for small-bodied fish species such as Ninespine Stickleback (*Pungitius pungitius*). Juvenile Lake Trout (*Salvelinus namaycush*) and Arctic Char (*Salvelinus alpinus alpinus*) were also observed utilizing these large streams for rearing habitat. High quality habitat was also found in P.O. Inflow, P.O. Outflow, Windy Inflow, and N15.

Large-bodied fish communities in lakes were assessed using RISC standard monofilament gillnets and with hydroacoustic gear at Patch Lake. The fish community of stream sites was primarily assessed using backpack electrofishing gear. Fish communities were defined in terms of total number and number-by-species at each sampling location, total Catch-Per-Unit-Effort (CPUE) and species-specific CPUE for each type of assessment gear. Biological features of fish such as length, weight, condition, age and diet were also measured as were tissue metal concentrations.

Specific information with regards to fish habitat and fish community sampling throughout the Madrid Area and pertinent adjacent areas is summarized in Section 4.

4. Fisheries

4. Fisheries

4.1 BACKGROUND

The Madrid Area bulk sample sites are located south of Doris North camp within the Windy-Glenn and Doris-Roberts watersheds (Figure 2.5-2). The Windy-Glenn Watershed originates just south of Windy Lake; it drains north through Windy Lake and then Glenn Lake before discharging into the ocean at Roberts Bay. In the Doris-Roberts Watershed, Wolverine Lake drains into Patch Lake in the upper reaches of the watershed. The watershed then drains through a series of lakes, including P.O., Ogama, and Doris Lake. Downstream of Doris Lake, Doris Creek flows over a 4 m high waterfall, and then joins the Roberts Watershed in Little Roberts Lake (downstream of Roberts Lake). Roberts Creek flows from Little Roberts Lake northwest for approximately 1.5 km where it enters Roberts Bay. The EIS for the Doris North Mine (Miramar 2005) was approved in 2006; this document described the environmental setting for the Doris Watershed adjacent and downstream of the mine, including Doris Lake and Little Roberts Lake. These two lakes will not be addressed further in this application as the EIS (Miramar 2005) provided a comprehensive review.

The proposed Madrid South bulk sample site is located on a narrow section of land between Patch Lake (to the east) and Wolverine Lake (to the west). This site falls completely within the Doris-Glenn Watershed. A new access road 5 km in length would extend south from the existing Windy - Doris Camp road. The proposed access road would primarily be located within the Doris-Roberts Watershed; a section less than 1 km in length would be in the Koignuk Watershed (Figure 2.5-2). The section of road in the Koignuk Watershed is located on top of a ridge far from any Koignuk Watershed waterbody. This section of road will not directly or indirectly impact the Koignuk Watershed, so this watershed will not be assessed further in this application.

This road extension would require two crossings (Figure 2.5-2). The most northern crossing (Crossing #1) is located slightly upstream of an inflow to Patch Lake, whereas the more southern crossing (Crossing #2) is situated at one of the outflows (most southern end) of Wolverine Lake (inflow to Patch Lake). Only Crossing #2 is fish-bearing (with confirmed ninespine stickleback). It is currently anticipated that closed-bottom culverts will be installed at these two locations since neither crossing location contains fish that are part of a recreational, commercial or Aboriginal fisheries, or that support such a fishery, as per the *Fisheries Act* (1985).

The Madrid North bulk sample site is located adjacent to the existing Windy Lake Camp between Patch Lake and Windy Lake (Figure 2.5-2), straddling the divide between the Windy and Doris Watersheds. Access to this site would utilize the existing Windy - Doris Camp road.

Extensive fish and fish habitat studies have been completed in waterbodies around the Madrid Area bulk sample sites between 1995 and 2013 (Table 4.1-1). The following section summarizes historical sampling for lakes and streams in the Doris-Roberts and Windy-Glenn watersheds downstream of the Madrid Area. Waterbodies are organized by watershed; within watersheds they are ordered from upstream to downstream.

Table 4.1-1. Historical Sampling of Freshwater Fish Habitats and Fish Communities in Waterbodies Adjacent to the Madrid Advanced Exploration Program Area, 1995 to 2013

Watershed	Waterbody or Site	Environment	Species	Sampling Years
Doris-Roberts	Wolverine Lake	Lake	CS, NSB	2006, 2007, 2008
	Imniagut Lake	Lake	N/A	Not sampled; to be sampled in 2014
	Patch Lake	Lake	CL, LT, LW, NSB, CS	1995 to 1999, 2006 to 2009
	P.O. Lake	Lake	CL, LT, LW, NSB	2006, 2007, 2009
	Ogama Lake	Lake	CL, LT, LW, NSB	1996, 2006, 2007, 2009
	Wolverine Outflow	Stream	NSB	1997, 2010
	Imniagut Outflow	Stream	N/A	Not sampled; to be sampled in 2014
	Patch Outflow	Stream	N/A	2006, 2009
	P.O. Outflow	Stream	NSB	2006, 2007, 2009
	Ogama Outflow	Stream	LT, LW, CL, NSB	1995, 1997, 2005 to 2007, 2009, 2010
Windy-Glenn	Nakhaktok Lake	Lake	N/A	Not sampled; to be sampled in 2014
	Windy Lake	Lake	LT, LW, CL, NSB	1996, 1997, 1999, 2008, 2009, 2012, 2013
	Glenn Lake	Lake	AC, LT, LW, CL	1997, 2000, 2006, 2007, 2009
	Nakhaktok Outflow	Stream	N/A	Not sampled; to be sampled in 2014
	Windy Outflow	Stream	LT, NSB, AC	1996, 1997, 2003, 2009, 2010
	Glenn Outflow	Stream	AC, LT, NSB, CCG, SFL	1997, 2000, 2003, 2009, 2010

Fish Species Codes: CS = Least Cisco, NSB = Ninespine Stickleback, CL = Lake Cisco*, LT = Lake Trout, LW = Lake Whitefish, AC = Arctic Char, CCG = Slimy Sculpin, SFL = Starry Flounder, N/A = fish community not sampled*
** It is difficult to identify Cisco to the species level, so these identifications should be interpreted with caution.*

4.2 DORIS-ROBERTS WATERSHED

4.2.1 Wolverine Lake and Outflow

Fish community baseline data were collected from Wolverine Lake in 2006, 2007, and 2008 (Golder 2008a, 2008b, 2009e). Over 4,000 fish were sampled using a range techniques and only two species were caught; Least Cisco (Coregonus sardinella) and Ninespine Stickleback (Table 4.1-1). The Least Ciscoes in Wolverine Lake were significantly smaller than in other local lakes, possibly due to the small, isolated size of the lake and the lack of a predatory fish species (Golder 2009b). No habitat data exists for Wolverine Lake.

Wolverine Lake has two outflows that connect this lake to Patch Lake; one flows to the north (Crossing #2) and one to the east. Both channels were sampled once for fish community in 1997 and once for habitat in 2010. Habitat assessments found that neither outflow has a clearly defined channel, as water seeps through vegetation over a broad area. Both channels are ephemeral, typically containing flowing water only during snow melt in spring. Water depth is minimal even during spring snowmelt (maximum water depth was 20 cm during 2010 spring surveys), there are no pools, and habitat is generally of poor quality (Rescan 2011b).

During 1997 spring freshet sampling, Ninespine Stickleback were caught in both outflows immediately upstream of Patch Lake (includes Crossing #2). The sample sites were described as flooded wetlands, reflecting the ephemeral nature of the channels. Both outflows of Wolverine Lake provide limited seasonal rearing habitat for juvenile and small-bodied fish during spring freshet. However, the connectivity between Patch Lake and Wolverine Lake appears to be limited.

4.2.2 Imniagut Lake and Outflow

The fish community and habitat quality of Imniagut Lake and Outflow have not previously been sampled; however, sampling of these waterbodies is scheduled for 2014.

A Sensitive Habitat Inventory and Mapping (SHIM) survey was completed on an inflow to Imniagut Lake in 2010 (Rescan 2011b). A section of creek 1,873 m in length was assessed, ending at the confluence with Imniagut Lake. Channel morphology was primarily a mixture of riffles and flooded wetlands. This inflow does not provide overwintering habitat due to its shallow depth and limited pool habitat. The overall habitat in this tributary was rated as marginal.

An assessment of the outflow of Imniagut Lake has not been completed, but aerial photographs indicate that it discharges into Patch Lake through a short outflow channel (approximately 50 m in length). Connectivity for fish movement between Patch Lake and Imniagut Lake has not been assessed.

4.2.3 Patch Lake, Outflow and Inflow

Fish community studies were conducted at Patch Lake from 1995 to 1999 and from 2006 to 2009, including an extensive Lake Trout population estimation study in 2007. Based on these studies, the fish community is composed of Lake Trout, Lake Whitefish (*Coregonus clupeaformis*), Least Cisco, Lake Cisco (*Coregonus artedii*) and Ninespine Stickleback (Table 4.1-1). CPUE for each fish species was highly variable between years due to various gillnet mesh sizes used for each study. The abundance of the three large-bodied species were relatively similar, regardless of gillnet mesh size. Mean fork length for Lake Trout and Lake Whitefish ranged from 433 to 702 mm and 372 to 475 mm, respectively. Lake Cisco fork length showed consistency between studies, ranging from 225 to 267 mm. Lake Whitefish showed the highest mean condition with values ranging from 1.20 to 1.33 g/mm^3 among studies. Ranges in mean condition for Lake Trout and Lake Cisco were considerably lower, ranging from 0.94 to 1.03 g/mm^3 and 0.77 to 1.09 g/mm^3, respectively. Stomach contents, sampled from Lake Trout and Lake Whitefish in 2008, indicated that Lake Trout fed predominantly on fish at time of sampling, while Lake Whitefish fed on isopods, gammarids and chironomids. Samples of muscle and liver were taken from Lake Trout and Lake Whikefish between 1995 and 1998 for baseline metals analyses.

Patch Lake Outflow is a short section of stream (less than 200 m) that connects Patch Lake to P.O. Lake. Beach seining in the outflow did not catch fish in 2006, but Lake Trout and Ninespine Stickleback were observed in the outflow during habitat assessments in 2009 (Table 4.1-1). The outflow appears to provide good connectivity between Patch and P.O. Lake, and the lower section (closer to P.O. Lake) provides the best quality fish habitat.

An eastern-flowing water source flows into Patch Lake at its northwestern end. The proposed road crossing (Crossing #1) is located along the drier and mostly underground headwater portion of this inflow; however, to the west and slightly upstream, the inflow consists of ephemerally-connected ponds. The most downstream reach situated just upstream of the lake is relatively steep (measured 8% near the mouth). The inflow is considered non-fish bearing; no fish were captured during fishing surveys conducted in 2010 (either through electrofishing along the inflow or minnow traps set in the ponds situated upstream).

4.2.4 P.O. Lake and Outflow

Fish community studies were conducted on P.O. Lake in 2006, 2007 and 2009. Lake Trout, Lake Whitefish, Lake Cisco and Ninespine Stickleback were captured in all studies (Table 4.1-1). Relative abundance of fish species varied among years. In 2006 and 2007 the predominant species captured was Lake Whitefish, while the Lake Cisco were the predominant species in 2009. Mean length of all species

was consistent among study years. The range in mean fork length for each species was: Lake Trout (494 to 597 mm); Lake Whitefish (365 to 408 mm); and Lake Cisco (209 to 227 mm). Mean fork length of Ninespine Stickleback was 47 mm. Mean condition of Lake Whitefish in P.O. Lake was high relative to other lakes in the Project area, with means ranging from 1.36 to 1.53 g/mm3. Lake Trout displayed lower condition, with means ranging from 0.84 to 1.10 g/mm^3. The predominant food items observed through stomach content analysis of Lake Trout conducted in 2009 included chironomids and fish, while amphipods were the main diet of Lake Whitefish at time of fishing. Muscle and liver tissues were also sampled from Lake Trout (n = 10) and Lake Whitefish (n = 4) in 2009 for the evaluation of baseline metals concentrations.

P.O. Lake Outflow flows through a small lake (sometimes referred to as P.O. Connector Lake) and connects P.O. Lake to Ogama Lake. Fish community and fish habitat studies were conducted in 2006, 2007 and 2009. Ninespine Stickleback were the only fish species captured using electrofishing and beach seining gear. The mean fork length of fish captured ranged from 36 to 48 mm, while the mean condition was 0.97 g/mm^3 reported in 2009. The habitat value was highly rated due to varied habitat types and abundant cover for fish.

4.2.5 Ogama Lake and Outflow

Fish community studies were conducted at Ogama Lake in 1996, 2006, 2007 and 2009. The fish community was consistent with other lakes in the Doris Watershed, and included Lake Trout, Lake Whitefish, Lake Cisco and Ninespine Stickleback (Table 4.1-1). Lake Cisco was the most abundant large-bodies species in the catch. Lake Trout were the largest species captured with mean fork lengths ranging from 291 to 646 mm, while Ninespine Stickleback were the smallest with a mean fork length of 58 mm. Lake Trout displayed relatively low condition with means ranging from 0.89 to 0.93 g/mm^3 among study years. Lake Whitefish had the highest mean condition, ranging from 1.24 to 1.29 g/mm^3. Diet and tissue metal concentration data are not available for Ogama Lake.

Ogama Outflow was studied for fish habitat and fish community in 1995, 1997, 2005, 2006, 2007, and 2009. The fish community was represented by four species: Lake Trout, Lake Whitefish, Lake Cisco and Ninespine Stickleback (Table 4.1-1). Lake Trout were the largest species captured, with mean fork lengths ranging from 389 to 535 mm. Ninespine stickle back were the smallest fish captured with mean fork lengths ranging from 43 to 56 mm. Lake Whitefish displayed the highest mean condition at 1.56 g/mm^3, while Lake Trout had the lowest mean condition at 1.08 g/mm^3. Additional fish community variables such as diet and tissue metals were not examined in past studies.

Ogama Outflow is characterized by long stretches (i.e., 100 m) of riffle and glide habitat, and short stretches (i.e., 10 m) of pool habitat. Stream gradient ranged from 1.2 to 4.0%. Stream channel dimensions ranged from 4.0 m to 12.2 m for bankfull width, and 1.5 m to 2.2 m for bankfull depth. While the primary bed material present was fines, there was a diverse mixture of substrates, at least relative to other streams within the Project area. The major source of cover for fish within Ogama Outflow was instream cover. Trace amounts of overhanging vegetation and large woody debris were also present. Overall habitat quality was rated as marginal.

4.3 WINDY-GLENN WATERSHED

4.3.1 Nakhaktok Lake and Outflow

Nakhaktok Lake is a small lake in the upper reaches of the Windy Watershed. The fish community and fish habitat of this lake have not been sampled.

The lake discharges into a wetland area that lacks a clearly defined channel. Field crews working in Windy Lake noted that discharge between Nakhaktok Lake and Windy Lake is braided and ephemeral, and there is likely poor connectivity for fish between these lakes.

4.3.2 Windy Lake and Outflow

Fish habitat and fish community studies were conducted on Windy Lake and Outflow in 1996, 1997, 1999, 2008, 2009, 2010, 2012, and 2013 (Table 1.1-1). The fish community consists of Lake Trout, Lake Whitefish, Lake Cisco, and Ninespine Stickleback (Table 4.1-1). Gillnet CPUE show that Lake Cisco were captured in the highest relative abundance in most studies. Compared to Lake Trout sampled from other lakes in the Project area, Lake Trout sampled from Windy Lake are relatively large. Mean fork length for Lake Trout from Windy Lake ranged from 434 to 910 mm. Lake Cisco were also relatively large with mean fork lengths ranging from 291 to 344 mm. The mean condition of Lake Trout and Lake Cisco ranged from 1.04 to 1.12 g/mm^3, and from 0.93 to 1.11 g/mm^3, respectively. Stomach contents of Lake Trout and Lake Cisco examined in 2008 and 2009 indicated that Lake Trout fed primarily on gammarids, amphipods and fish, while Lake Cisco fed predominantly on mysids. Muscle and liver tissues collected from Lake Trout in 1999 and 2009 showed similar levels of mercury.

Windy Lake was selected for an enhancement project to partly compensate for impacts to fish habitat caused by infrastructure construction. Compensation and reference sites were selected in 2010 and shoals were constructed in 2011 (Figure 4.3-1). Two years of monitoring (2012 and 2013) have tracked the development of periphyton, invertebrate, and fish communities at enhancement sites. Two compensation shoals and one natural shoal reference site are located adjacent to the shoreline immediately to the west of the proposed Madrid North bulk sample sites.

The fish community and habitat of Windy Lake Outflow was sampled in 1996, 1997, 2003, 2009, and 2010 (Table 1.1-1). Windy Outflow is composed of pool, riffle and glide habitat types. Stream gradient ranged from 0 to 1.3%, while the stream bank dimensions ranged from 4.5 m to 9.2 m, for bankfull width, and 0.8 m to 1.5 m, for bankfull depth. The stream bed material was predominantly composed of fines. The total amount of cover available for fish within the stream was abundant, ranging from 78 to 90%. Overall habitat quality was rated as marginal.

Lake Trout, Ninespine Stickleback and Arctic Char (a single juvenile) have been captured in Windy Outflow (Table 4.1-1). Anadromous Arctic Char overwinter in Glenn Lake, but have never been caught in Windy Lake despite extensive sampling. A section of the creek between Windy and Glenn Lake may restrict the ability of migrating Arctic Char to reach potential overwintering habitat in Windy Lake. During habitat surveys, this section was described as a “marshy area” and it was noted that the channel was poorly defined, creating a seasonal restriction when anadromous fish return in the fall.

4.3.3 Glenn Lake and Outflow

Studies of Glenn Lake fish habitat and fish community were conducted in 1997, 2000, 2006, 2007 and 2009. The fish community comprised Arctic Char, Lake Trout, Lake Whitefish and Lake Cisco (Table 4.1-1). Arctic Char were not captured during the 2009 study. Lake Trout have also been documented to migrate to and from Glenn Lake and Roberts Bay via the Glenn Lake outflow. Lake Cisco showed the highest relative abundance in gillnet catches. Lake Trout were the largest species captured, with mean fork lengths ranging from 439 to 527 mm. The mean fork length of Arctic Char was 223 mm, representing the smallest species captured by gillnets in 2006 and 2007. Condition for each species were relatively high throughout the study periods. Lake Whitefish displayed the highest mean condition at 1.45 g/mm^3, while Lake Trout showed the lowest mean condition at 0.85 g/mm^3. Fish tissue metal samples have not been collected from Glenn Lake.

The fish habitat and fish community of Glenn Outflow was sampled in 1997, 2000, 2003, 2009, and 2010. Fish habitat was composed of pool, riffle and glide habitat types. The stream gradient ranged from 0 to 3.2%. Stream bank dimensions ranged from 5.1 m to 8.0 m for bankfull width, and 1.1 m to 1.5 m for bankfull depth. Fines were the predominant substrate type present. Cover available for fish in the outflow ranged from 3.2 to 20%. Instream cover and undercut banks were the primary cover types present. Overall habitat quality was rated as important because Glenn Outflow is a migratory route for anadromous Lake Trout moving to and from Glenn Lake and Roberts Bay. Juvenile Arctic Char, Lake Trout, whitefish spp. and Lake Cisco have also been captured near Roberts Bay (Table 4.1-1).

The fish community of Glenn Outflow was represented by Arctic Char, Lake Trout, Ninespine Stickleback, Slimy Sculpin (*Cottus cognatus*) and Starry Flounder (*Platichths stellatus*). Starry Flounder was captured in 2009 (n = 1), while remaining species were captured in all study years. Mean fork lengths for Arctic Char ranged from 205 to 820 mm, while mean fork lengths for Lake Trout ranged from 142 to 390 mm. Mean fork lengths of Ninespine Stickleback and Slimy Sculpin were 45 mm and 58 mm, respectively. Condition for Arctic Char and Lake Trout were calculated in the 2003 study. Mean condition of Arctic Char and Lake Trout were 1.17 g/mm^3 and 1.01 g/mm^3, respectively.

4.4 ABORIGINAL, COMMERCIAL, AND RECREATIONAL SPECIES SUMMARIES

Baseline fish community sampling identified seven freshwater fish species in the Madrid Area (Table 4.4-1). Life history types and habitat preferences of fish of Aboriginal, commercial or recreational importance are summarized below. Information was summarized from McPhail and Lindsey (1970), Scott and Crossman (1973), Richardson et al. (2001), and references therein.

Table 4.4-1. Fish Species Captured in the Hope Bay Belt Project Area

Common Name	Scientific Name	Habitat	Spatial Distribution	Watershed
Lake Trout	*Salvelinus namaycush*	Freshwater	Benthopelagic	D,W
Arctic Char	*Salvelinus alpinus*	Anadromous	Benthopelagic	W
Lake Whitefish	*Coregonus clupeaformis*	Freshwater	Demersal	D,W
Lake Cisco	*Coregonus artedi*	Anadromous	Neritopelagic	D,W
Least Cisco	*Coregonus sardinella*	Freshwater	Neritopelagic	D
Slimy Sculpin	*Cottus cognatus*	Freshwater	Demersal	W
Ninespine Stickleback	*Pungitius pungitius*	Freshwater	Benthopelagic	D,W

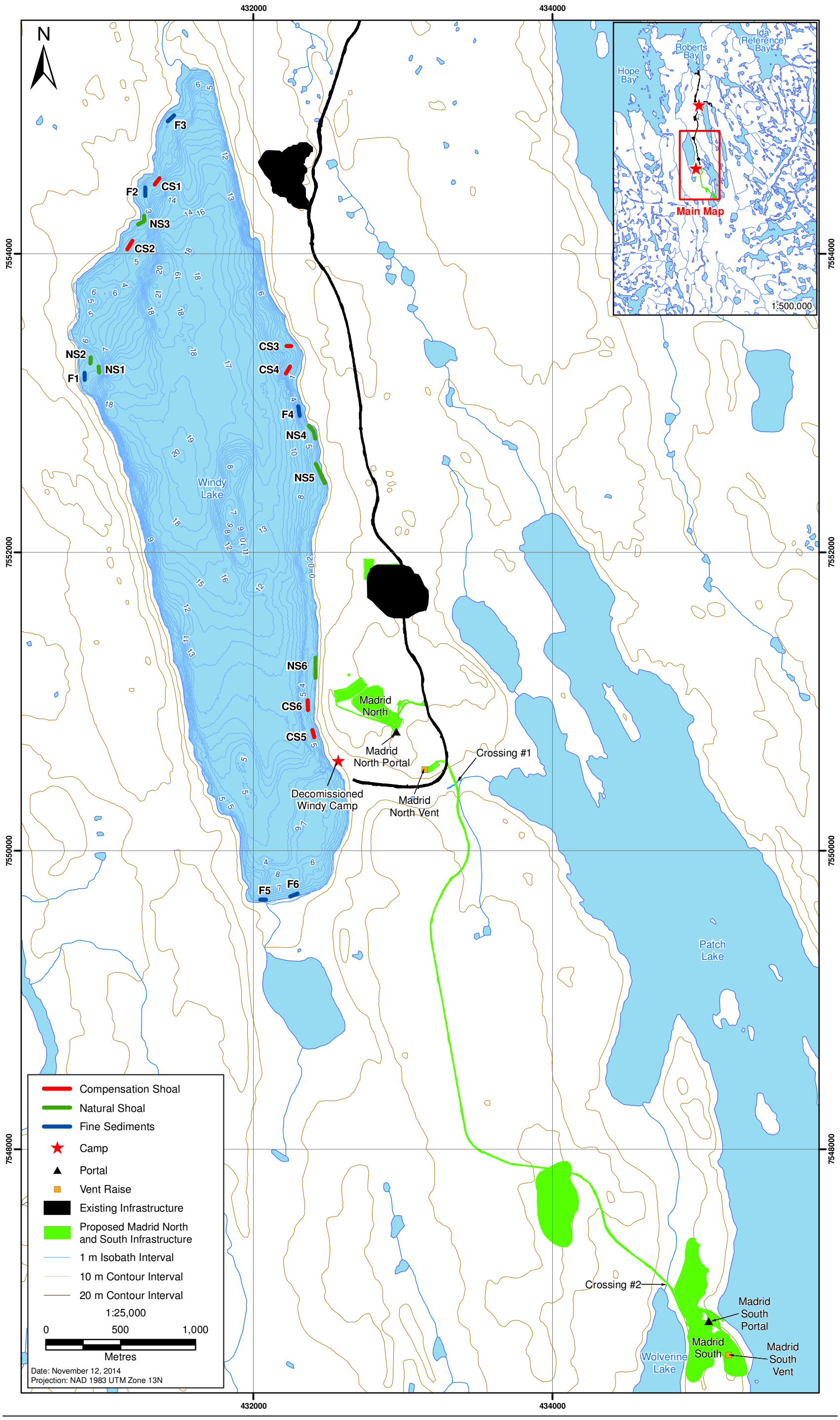
Watershed codes: D = Doris-Roberts, W = Windy-Glenn

4.4.1 Lake Trout

Lake Trout typically exhibit both lacustrine (lake resident) and adfluvial (river resident) life history types, but in the Hope Bay Belt there are unusual anadromous populations (migrate between freshwater and marine environs (Swanson et al. 2010)). Lake Trout spawn in fall, from September to October in northern regions. Spawning grounds are almost always associated with cobble, boulder and gravel substrates, where there is no vegetative cover, in depths less than 1 m to greater than 10 m. Eggs settle into cracks and crevices amongst the rocks, where they incubate for 4 to 5 months, with eggs usually hatching in March or April. Young-of-the-year remain in spawning areas from several weeks to several months, moving into deeper areas as water temperatures rise to greater than 15°C. Young-of-the-year and juveniles both prefer areas of cobble and boulder substrate for cover, and inhabit waters with a depth range of 2 to >10 m or alternatively inflows and outflows of the lake. Juveniles are often associated with large boulders, which they use for cover. Adult Lake Trout disperse into deeper water habitats, >10 m in depth, and are often found in the pelagic zone. Lake Trout feed on a wide variety of prey items including fish, molluscs, crustaceans, freshwater sponges and small mammals.

Figure 4.3-1

Fish Habitat Compensation and Reference Sites in Windy Lake



4.4.2 Arctic Char

Arctic Char occur in northern coastal regions in rivers, lakes, estuaries, and marine environments. They exhibit both anadromous and resident lacustrine life history types. Anadromous Arctic Char are found in several watersheds with a suitable set of habitats. Lakes must be of sufficient size to provide suitable overwintering habitat and these lakes need to be connected to the ocean by streams that can be navigated by adults, even during periods of low discharge in the fall. Freshwater populations feed on planktonic crustaceans, amphipods, molluscs, insects, and fishes, while marine populations are primarily piscivorous and feed almost exclusively on marine resources. Arctic Char require cold, highly oxygenated water and are extremely sensitive to water pollution. Arctic Char are the most economically important fish to the Inuit population of Nunavut. In the Melville Sound area, commercial fisheries operate during upstream runs in Elu Inlet and the Kulgayuk River (DFO 2004).

Arctic Char spawn in freshwater in the fall, usually September or October, over gravel and cobble shorelines of lakes and occasionally larger rivers. In the Belt area, and the central Canadian Arctic in general, spawning usually takes place in lakes because most streams and rivers freeze completely in winter. Males arrive first on the spawning grounds and establish and defend territories. Females are "courted" by males as they arrive later. The female digs a nest or redd in water typically 3 to 6 m deep, in which the eggs are deposited. The eggs incubate under ice for about six months. In most systems char are ready to take their first migration to sea at 4 to 5 years of age and a length of 150 to 250 mm (Johnson 1980). Young Arctic Char do not venture much past the brackish water of river estuaries, but as they grow, they develop a tolerance to higher salinity sea water. They feed in nearshore areas along the coast for the duration of the summer. More abundant food resources in marine waters allow anadromous Arctic Char to grow faster and larger than the freshwater form. At sea, char feed mainly upon invertebrates and fishes. In the fall, all char return to freshwater to overwinter (Johnson 1980).

4.4.3 Lake Whitefish

Lake Whitefish are found throughout Nunavut, predominantly in lakes, although they are also found in large rivers and brackish waters. Lake Whitefish may exhibit lacustrine, adfluvial and anadromous life history types. They spawn in both lakes and rivers over gravel, cobble and boulders at depths of less than 5 m. Eggs are released over the substrate and fall into interstices between rocks where they incubate for several months, hatching sometime from March to May. Young-of-the-year are commonly found in the spawning area in shallow water (<1 m) near the surface, and prefer substrates of boulder, cobble and sand with abundant emergent vegetation and woody debris. Adults are usually found in the open water at depths >10 m and do not show a preference for substrate. Adults are predominantly benthic, although they may be found in the pelagic zone. Lake Whitefish have been reported to make onshore movements into shallow water at night, possibly to feed.

5. Traditional Water and Land Use Areas

5. Traditional Water and Land Use Areas

5.1 BACKGROUND

The Hope Bay Belt Property is located in the Kitikmeot region of Nunavut, approximately 685 km northeast of Yellowknife. The closest settlements to the Madrid district are Umingmaktok (~70 km) and Kingaok (~150 km). The communities of Cambridge Bay (~130 km) and Kugluktuk (~350 km) are the closest major regional centres. Other communities within the region that are further removed from the project location, include Gjoa Haven (~445 km), Taloyoak (~550 km) and Kugaaruk (~690 km; Figure 5.1-1). Distances are approximate and direct (HBML 2011).

The Nunavut Planning Commission (NPC), as established under the Nunavut Land Claim Agreement, is currently developing a Nunavut Land Use Plan (NLUP) for all Nunavut regions that are outside of municipal boundaries. Once in place, the NLUP will be used to guide and direct resource use and development into the future. This Nunavut-wide planning approach was adopted to address inefficiencies in the previous regional approach. Until recently, land use planning in Nunavut had been approached regionally (HBML 2011; Rescan 2012c).

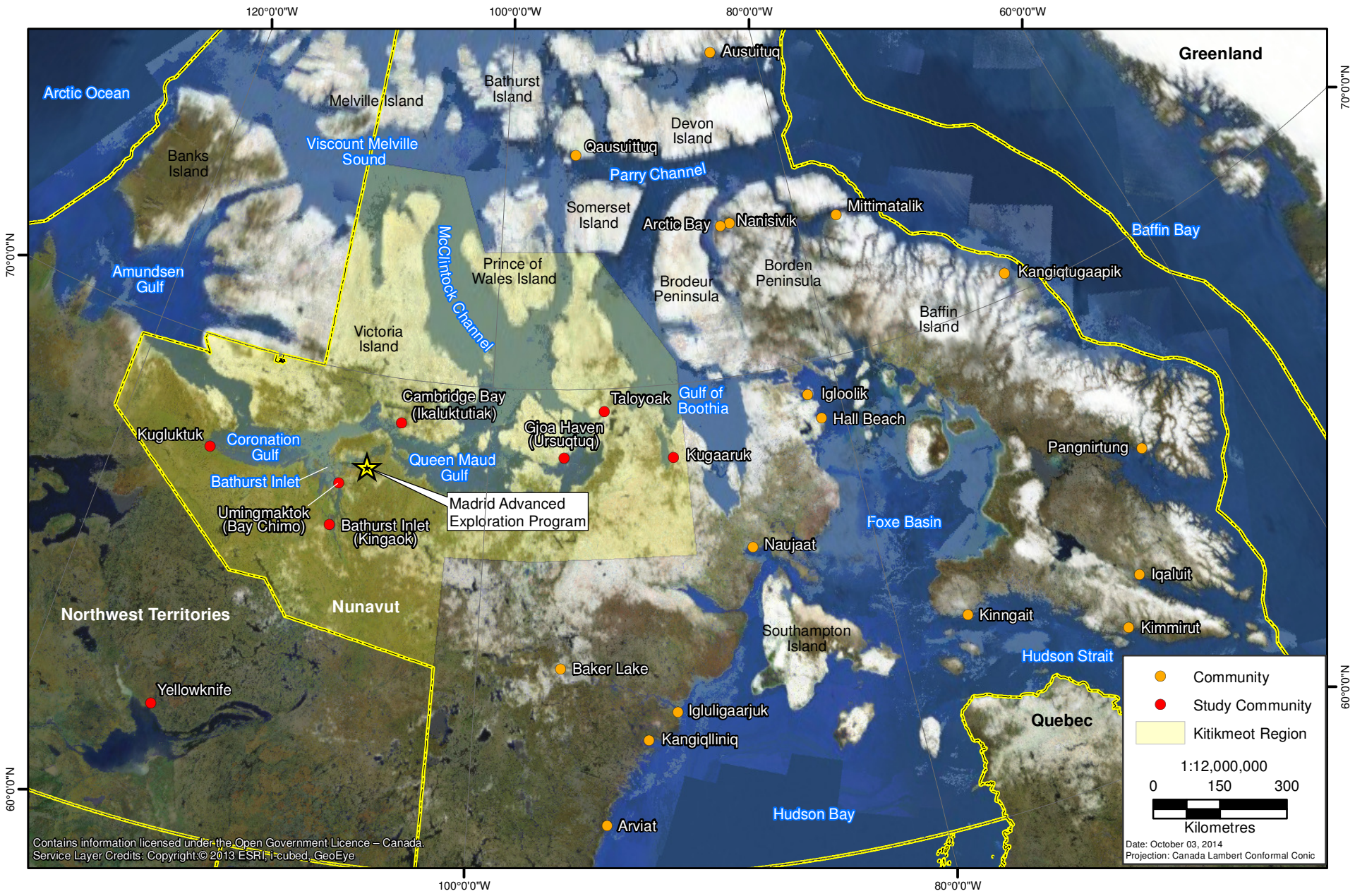
The Hope Bay Belt, including the Madrid North and South site, lies within the former West Kitikmeot Regional Land Use Plan (WKRLUP) boundary. The WKRLUP was in draft form before the regional planning process was halted and replaced with the Nunavut-wide approach. In the absence of an approved plan, the values and interests expressed by the WKRLUP from the original regional planning process are considered. The Hope Bay Belt also falls within the traditional "Areas of Influence" (as defined by the WKRLUP) of the communities of Bathurst Inlet, Umingmaktok, and Cambridge Bay. Areas of Influence encompass broad areas of land and sea that are included in traditional land use patterns by community members (HBML 2011; Rescan 2012c).

The Inuit people of the Kitikmeot have a longstanding relationship of reciprocity and respect with their region's wildlife and environment as a whole, as is manifested within Inuit Qaujimajatuqangit (Golder 2003b). In Inuit culture, the environment is valued as a whole: the value of one ecosystem component cannot be ranked or differentiated from the value of another. As such, the relative value of ecosystem components is not considered within Inuit Qaujimajatuqangit and traditional practices. Despite the ongoing Westernization of Inuit society, Inuit Qaujimajatuqangit, including ways of respecting wildlife and the environment as a whole, persist and continue to be passed from generation to generation (Golder 2003b). The values that guide traditional activities and subsistence harvests are reflected in the Inuit approach to historic and contemporary land and resource use activities in the Kitikmeot Region (Rescan 2012c).

5.2 INUIT QAUJIMAJATUQANGIT

As part of the Environmental Impact Statement (EIS) of the Doris North Project, *Inuit Qaujimajatuqangit* (IQ) provided assistance in obtaining baseline data for the Hope Bay Belt, which includes the Madrid North and South sites (Miramar Hope Bay Ltd. 2005). IQ for the Hope Bay Belt area was augmented with results from a three-day IQ Workshop in 2003 that was held in Iqaluktuuttiaq (Cambridge Bay; Golder 2003b).

Figure 5.1-1
Communities within the Kitikmeot Region of Nunavut



For generations, Nunavummiut have had to monitor water quality to ensure survival. For example, careful observation of variations in suspended sediment determines if water is fit for drinking. Both fish and animals are used as indicators when observing changes in water quality. Given this history, Inuit understand that changes to water quality can have far reaching effects on animals and fish, and the ecosystem as a whole. The record of documented IQ of environmental change includes observations of changes in water levels and water quality throughout the Kitikmeot region (Miramar Hope Bay Ltd. 2005). IQ has also shown that melting permafrost and the consequent increase in suspended sediments in major river bodies, such as in the Coppermine River, has had a profound influence on water quality (Miramar Hope Bay Ltd. 2005).

Lake Trout are important to local Inuit for food, while fishing is central to culture, identity and recreation. Arctic Char are considered most valuable for subsistence living by local communities, followed by Lake Trout and Lake Whitefish. The Hope Bay Belt in general has always been a popular region for fishing. Participants in the IQ Workshop commented that most of the lakes in the Project area were commonly fished. Although many traditional names for waterbodies in the Project area have not been recorded, there is still evidence of fishing camps throughout the region (Golder 2003b; Miramar Hope Bay Ltd. 2005).

In the Kitikmeot region, Caribou continue to be the most important subsistence mammal. Today, as in the past, Caribou are hunted for food, clothing, tools and other materials and the act of Caribou hunting is central to Inuit identity, culture and subsistence.IQ indicates that the region around the Hope Bay Belt is important Caribou habitat, particularly for calving (i.e., historical grounds for the Bathurst herd), and that Caribou are indicators of environmental change (Golder 2003b). There are three Caribou herds whose ranges may occur near the Project Area: the Bathurst, the Ahiak (meaning “berries” or “from where there are berries” [i.e., the mainland]) and the Dolphin-Union herds (Miramar Hope Bay Ltd. 2005). Historically the Hope Bay Belt area has been important for Bathurst Caribou migration and calving. According to IQ, the Bathurst herd has been calving on the west or south side of Bathurst Inlet for the last few years. Inuit expect that the Bathurst herd will return to the east side of the inlet, as it is common for the herd to alter calving ground location between areas of Bathurst Inlet, primarily as a function of annual climatic conditions and the associated state or quality of habitat (e.g., vegetation, ice). Locals report that other factors that influence the shifting of calving grounds include fidelity, human activity, escape from predators, and open spaces. Elders also reported that some mixing occurs between the Bathurst and Ahiak herds, and that the Dolphin-Union Caribou are starting to migrate to the treeline (which they have not done in the past), and are mixing with mainland herds (Golder 2003b).

Inuit have always held respect for Wolverines for their tenacious and often unpredictable behaviour. Wolverines have always been hunted, particularly for their fur. IQ indicates that the Wolverine is common in the Hope Bay Belt, due to the abundance of prey animals for scavenging (i.e., Caribou, Seals) and the presence of suitable habitat, such as eskers (Golder 2003b). Participants from the 2003 IQ Workshop also commented that Grizzly Bears are common in the Hope Bay Belt area, due to the abundance of prey animals (e.g. Caribou) and the presence of suitable habitat, such as eskers (Golder 2003b). Eskers are important for predators such as the Wolverine and the Grizzly Bear in that they provide habitat for denning, feeding and travel (Golder 2003b).

The participants of the 2003 IQ Workshop commented that the Hope Bay Belt area is known to be the home of many nesting bird species. Inuit have long observed that extensive cliff formations throughout Bathurst Inlet and the surrounding region provide important raptor habitat. Accordingly, the participants of the Workshop commented that Eagles and Gyrfalcons are common in the Hope Bay Belt and near the Project area (Golder 2003b). Participants mentioned that raptors nest in the highlands and that cliffs and mesas are important landscape features because they provide key nesting habitat. The workshop participants explained that eagles and Gyrfalcons feed on a variety of prey, including

Ground Squirrels, Arctic Hare and Canada Geese. Fluctuations in raptor populations have been observed, probably due to changes in prey abundance (Golder 2003b).

5.3 HISTORICAL LAND AND RESOURCES USE

Very little was known about the history and people of the central Arctic mainland until several scientific expeditions visited the region in the early 1900s. The local residents of this central Arctic coastline at the time of the early studies were identified as Copper Eskimo (or Inuit) due to their use of copper. Subsistence and settlement patterns of inhabitants of this region in the past were probably fairly similar throughout the period subsequent to the arrival of European explorers (i.e., after the passing of John Franklin's expedition along the coast), since they were dependent on the same types of resources. According to historic sources, from December to May, Copper Inuit people congregated at the coastline to conduct breathing-hole sealing. The period from May to November was spent travelling inland, hunting and fishing in small family groups. The focus was Caribou and people camped at good hunting localities, such as grass meadows or river narrow (Jenness 1922 as cited in HBML 2011).

Local residents reported numerous archaeological and traditional sites in the general region to the Nunavut Planning Commission Transition Team (NPCTT), stating that the Aimaokatalok Lake area was extensively used for Caribou hunting in the early 1900s or earlier (NPCTT 1996 as cited inHBML 2011). The Nunavut Atlas identifies the Koignuk River as an important resource gathering and camp location (Riewe 1992: 44, 167 as cited inHBML 2011). Elders were interviewed during the Doris North traditional knowledge study by Golder in 2003. One informant stated that archaeological sites could be found along any good sized river system, main Caribou migration routes and on islands. It was mentioned that archaeological sites could include sealing, hunting and fishing camps, food caches, burial sites and *inukhuit* or *taluit* (hunting blinds)(Golder 2003b).

5.4 TRADITIONAL LAND AND RESOURCES USE

Throughout Nunavut, traditional pursuits, such as hunting, trapping, and fishing, continue to be an important part of the economy and quality of life for Nunavummiut (Rescan 2012c). The importance of traditional activities and subsistence harvests is reflected in contemporary land and resource use activities and management in the Kitikmeot Region. This includes, most notably, renewable resource use, including hunting, trapping, fishing, and gathering of berries and other products (HBML 2011). Hunting, fishing, and the gathering of plants and berries provide dietary contributions to residents and their families (HBML 2011). Country foods are always available in Kitikmeot communities and, for many, continue to be eaten on a daily basis. This is particularly true for the smaller more traditional communities (Rescan 2012c). Trapping activities are also important, and primarily result in pelts for sale, personal use, and crafts (HBML 2011).

River and lake systems are integral to both fish and wildlife, and are also valued as a source of drinking water. In smaller communities where no public services are available, such as Bathurst Inlet and Umingmaktok, water is sourced from ice and river water (Rescan 2012c). Deep lakes and underground water are also valued highly for their water quality. Water used for drinking purposes possess several qualities that are desirable, including clarity, source, and ultimately taste and smell (Golder 2003b).

A large proportion of residents participate in harvesting activities. In 2006, the majority of Kitikmeot community members hunted, fished, trapped, or gathered wild plants and berries. This compares to data for all Aboriginal residents in Nunavut, in which 71% reported that they hunted, 76% fished, 79% gathered wild plants and berries, and 30% trapped (Statistics Canada 2008a, 2008b). Furthermore, statistics indicate that an increasing proportion of the Kitikmeot population is participating in traditional economic activities (HBML 2011).

Local Hunting and Trapping Organizations (HTOs) are recognized by the Nunavut Department of Environment to represent the interests of hunters and trappers at the local level. Government funding to HTOs depend on the number of general hunting licences within the community, fur returns and HTO work plans (Nunavut Department of Environment 2007 as cited in HBML 2011)). Kingaok, Umingmaktok and Cambridge Bay each have a local HTO. Primary information about current land use activities was obtained through interviews with HTO representatives in each Kitikmeot community, local hunters, and government land and resource managers. Additionally, in November 2011, a land use focus group session was held with people from Umingmaktok (Bay Chimo), the community closest to the Project. Travelling on the land, hunting, and fishing remain important cultural activities within the vicinity of the Hope Bay Belt and throughout the Kitikmeot Region. Subsistence land use in nearby areas is illustrated in Figure 5.4-1.

The results of interviews did not identify any specific locations that people visit for ceremonial and spiritual reasons. However, it was noted that an Elders group has recently started to go to old camp sites and places where relatives were born with the purpose of visiting the sites with family and friends. While prominent fishing areas were noted, fishing occurs throughout the region and is not limited to the specifically identified areas. During the land use focus group session, Roberts Lake was also highlighted as having abundant fish and as being especially important to the family who lived at an outpost camp there for many years (M. Avalak, pers. comm.; Figure 5.4-1). Larger lakes and rivers that connect to the ocean are important as they usually have an abundance of fish such as Char, Whitefish and Trout. Local land users stand up and pile rocks to mark good fishing spots. When travelling the land, people follow big lakes and rivers and look for fish markers. The big lakes, thus, have a long history of use (Land use focus group participants, pers. comm.).

While there are two regularly used camps located near the Madrid North and South sites (Figure 5.4-1), camping may take place anywhere as local land users camp in many places as they travel through the area hunting and fishing (J. Avalak, pers. comm.). In addition, as noted by Elders, camps have historically been located along the shores of Roberts Bay, around Hope Bay, and at river mouths and confluences (Golder 2003b).

Local travel patterns are seasonally-dependent as Kitikmeot residents travel to hunting, fishing, and camping areas. Although most people originally from Umingmaktok have moved to Cambridge Bay, they go back and forth to Umingmaktok. During the ice season (usually late November to early June), travel is predominantly by snowmobile and includes travel over ice and over land covered by ice and snow. During the ice-free period, travel over land is dominated by ATVs, though boats are also used during this period. Inland travel usually ends by mid-May, as snowmelt increases difficulties associated with travel, shifting to use of the coastal areas for travel (Anonymous, pers. comm.; Land use focus group participants, pers. comm.).

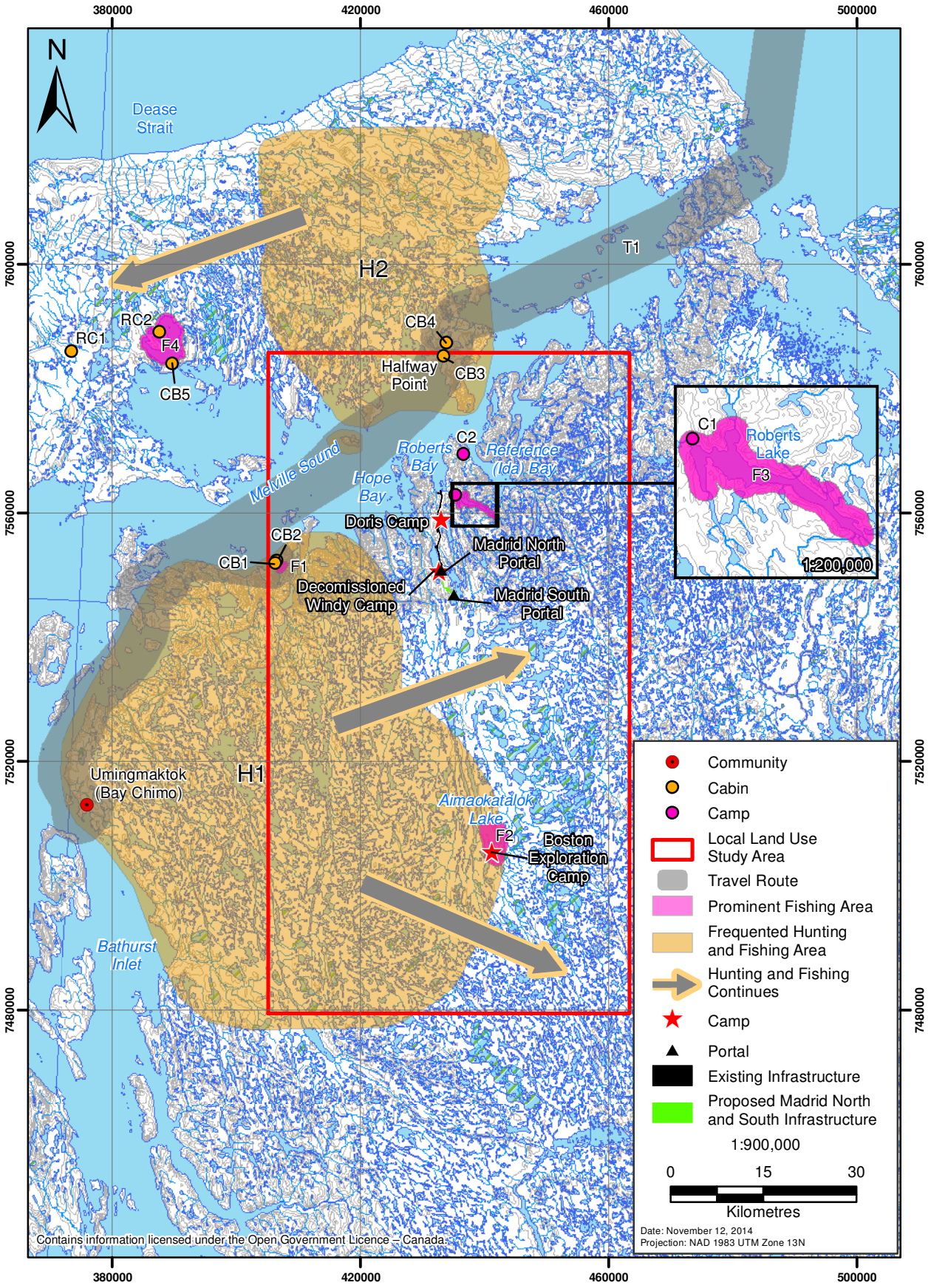
5.5 HARVEST ACTIVITIES

The Nunavut Wildlife Harvest Survey, conducted between 1996 and 2001, remains the most current and comprehensive information source on subsistence harvests in the Kitikmeot Region (NWMB 2004). The survey collected data on non-commercial hunting, trapping, gathering, and fishing of mammals, birds (and their eggs and feathers), fish, and shellfish.

Approximately 17 to 18 hunters were registered annually in Bathurst Inlet; three were classified as intensive land users, four as active, and the remainder reported occasional activity (NWMB 2004). Harvest data indicate that the majority of hunters harvested Caribou, with an annual mean harvest of 93 animals, while Arctic Ground Squirrel, Arctic Fox, Red Fox, Wolverine, Grey Wolf, Arctic Hare, and Seal were also common prey.

Figure 5.4-1

Local Traditional Land Use



Ptarmigan (Willow Ptarmigan and Rock Ptarmigan) were the most commonly hunted bird species, and Seagull eggs were also popular. Fishing activities were practiced by nearly all hunters, with catches including Arctic Char, Cod, Lake Trout, and Whitefish. It is noted that many hunters leave Bathurst Inlet for the winter to live in other centres (e.g., Cambridge Bay, Kugluktuk), returning to the community for the summer months.

In Umingmaktok, the number of hunters decreased from 31 in 1996/97 to only 11 in 2001, which likely reflects an overall decline in the population of the community (NWMB 2004). There were no intensive hunters in any year, while approximately three hunters were classified as active, although actual numbers varied greatly with changes in the population. Caribou was the most-hunted game, with an annual average of 176 kills, and Arctic Ground Squirrel, Grey Wolf, Arctic and Red Fox, Wolverine, and Seal were also common. Canada Goose, Eider Duck, and Ptarmigan were the most popular among birds, as were goose, duck, and seagull eggs. Similar to Bathurst Inlet, fishing activity focused on Arctic Char, Cod, and Lake Trout (Rescan 2012c).

Interview focus group results conducted for the 2012 baseline study confirmed that residents from Bathurst Inlet, Umingmaktok, and Cambridge Bay are known to hunt and fish in areas nearby the Hope Bay Belt area (Figures 5.1-1 and 5.4-1). Residents of Gjoa Haven, Taloyoak, and Kugaaruk do not hunt or fish as far west, typically remaining within an 80 to 100 km range of the community, often only going out on day-trips (Rescan 2012c). The results of interviews conducted for the 2012 baseline study have indicated that the current number of intensive and active hunters in Bathurst Inlet, Umingmaktok, and Cambridge Bay is approximately as reported in the NWMB (2004) survey. Approximately 20 to 25 hunters are reported to be active within and near the Hope Bay Belt area, 10 from Umingmaktok and Bathurst Inlet and 10 to 15 from Cambridge Bay (Rescan 2012c).

5.6 CONSULTATION

In September 2003, a three day Inuit Qaujimajatuqangit[2](IQ) workshop was held in Iqualuktuuttiaq (Cambridge Bay) in an effort to augment documented IQ and respond to the information gaps identified in a preceding literature review and gap analysis. Elders from each of the communities Umingmaktok (Bay Chimo), Kingauk (Bathurst Inlet), Kugluktuk, and Iqualuktuuttiaq nominated workshop participants according to their familiarity with the Hope Bay Belt. To complement the workshop, interviews were held with several IQ experts now living in Iqualuktuuttiaq but formerly of the Bathurst Inlet region and familiar with Hope Bay belt. The interviews were conducted on both an individual and group level in Iqaluktuuttiaq (Golder 2003b). The Kitikmeot Heritage society and Golder associates ltd. Interviewed seven elders from Iqaluktuuttiaq and Umingmaktok (Bay Chimo) to document their knowledge of traditional place names in the area surrounding the Hope Bay Belt (Golder 2003b).

Through the literature review, gap analysis, interviews, and workshop, a variety of IQ was collected that is pertinent to the Hope Bay Belt and Doris North Project. Definitions for IQ and an understanding of climate change, air quality, noise, landscape and terrain, hydrology and water quality, aquatic organisms and habitat, vegetation, terrestrial wildlife and habitats, archaeology, cumulative environmental effects and valued ecosystem components were documented (Golder 2003b).

Workshop participants and interviewees made several recommendations related to the Doris North Project. These included, but were not limited to, the inclusion of Innuinnaqtun place names for rivers, lakes and places (resulting in a traditional place names study), the reduction of noise levels, access to

[2] Inuit Qaujimajatuqangit (IQ) is Traditional Knowledge specific to Inuit.

environmental studies and dissemination of information, and overall respect for the environment (Golder 2003b).

Community-based research detailed in the Socio-Economic and Land Use Baseline Report completed by Rescan (2012c) consisted of site visits and the completion of interviews with key informants from each study community. A focus group session was also held with land users from Umingmaktok, the community closest to the Project location. Community visits to conduct interviews were also conducted in Cambridge Bay, Kugluktuk, Taloyoak, Gjoa Haven, and Kugaaruk, with a second visit to Cambridge Bay in November 2011 (Rescan 2012c).

Key informants included government representatives, service providers, business leaders, and other organization representatives. Representation was provided across a number of areas: local and regional governance, economic development, education and training, health and well-being, housing, safety and protection services, planning and resource management, hunting and trapping, and guide outfitting. The hunter focus group included some Elders (Rescan 2012c). Results of the interviews held with the hunter focus group are discussed in Section 1.5.3.

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Appendix 6

(for Chapter 6, Water Use)

No appendix for this chapter.

Appendix 7

(for Chapter 7, Waste Disposal)

7-A SRK, October 2014 Memo – Hope Bay Project: Madrid Advanced Exploration Bulk Sample: Underground Inflow Estimates

7-B SRK, December 2014 Memo – Hope Bay Project: Madrid Advanced Exploration Project: Water Quality Prediction

Appendix 7-A

SRK, October 2014 Memo – Hope Bay Project: Madrid Advanced Exploration Bulk Sample: Underground Inflow Estimates

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Memo

To:	John Roberts, TMAC	**Client:**	TMAC Resources Inc.
From:	Dan Mackie Gregory Fagerlund	**Project No:**	1CT022.001.410
Cc:	Tom Sharp, SRK Mark Liskowich, SRK	**Date:**	October 31, 2014
Subject:	Hope Bay Project: Madrid Advanced Exploration Project: Underground Inflow Estimates		

1 Introduction and Scope

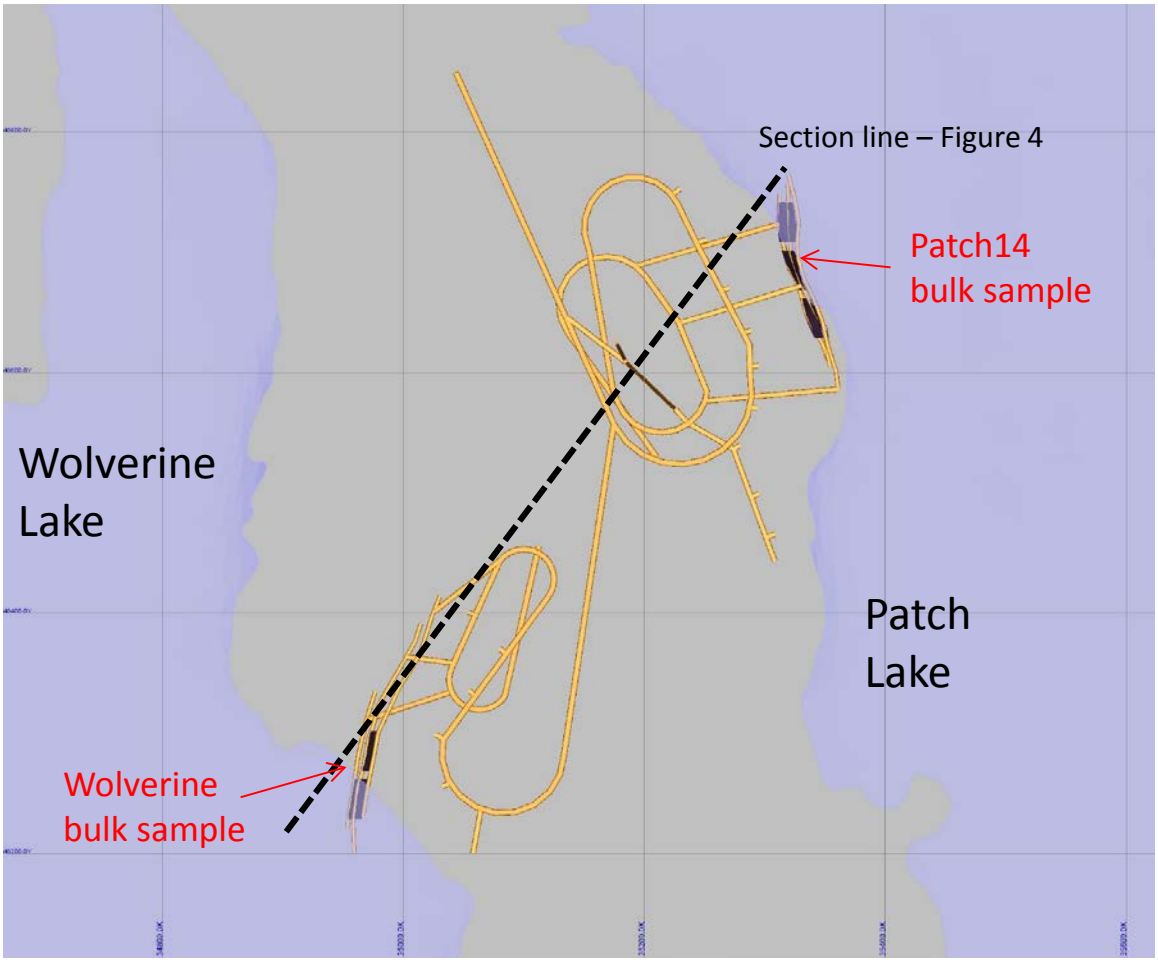
This memo summarizes updated inflow estimates and inflow water quality for the Madrid Advanced Exploration Project. The project consists of bulk samples at Madrid North and Madrid South.

The Madrid North underground bulk sample area is within the Naartok deposit. It has been determined this bulk sample will be within permafrost. As such, ground water inflows are not an issue and will not be discussed below.

The Madrid South underground bulk sample is within the Patch14 and Wolverine deposits. The mining areas are not expected to be completely within permafrost, thus groundwater inflows are possible. This memo presents estimates of groundwater inflow for use with overall mine water management planning, not engineering design.

The scope includes updating inflow estimates based on the current mine plans and existing data. No new data has been collected specifically for this work, but existing data from Madrid South (and across the entire Hope Bay belt) suggests that bedrock is generally competent and inflows to relatively small mine openings should not be excessive. The modeling approach does not attempt to provide rigorous calibration or incorporate a detailed mine plan; an approximation of the major mine openings are used to test the influence of different assumptions about bedrock hydraulic conductivity on inflow. The groundwater flow system around these mine openings is constrained by the more regional concepts for how groundwater moves in permafrost environments and results are sufficient for the purpose of water management planning.

Figure 1 shows the locations of the Madrid South bulk sample areas relative to Patch and Wolverine lakes.



Source: U:\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Madrid South GroundWater\figures for inflow memo_May222014.pptx

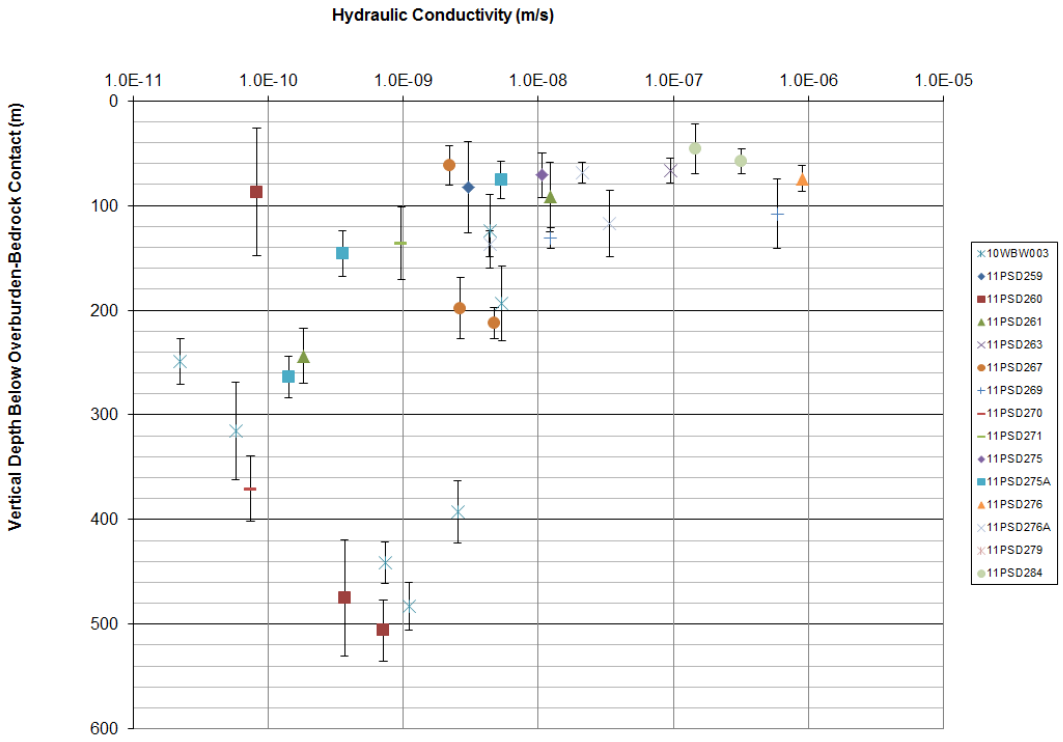
Figure 1: Map of Bulk Sample Locations Relative to Lakes

2 Available Data for Madrid South

2.1 Hydraulic Conductivity

Hydraulic conductivity (K) for the Madrid South area was collected during the 2010 and 2011 field seasons. The hydraulic conductivity (K) was measured through down-hole injection tests during drilling. Figure 3 shows all available data for Madrid South. Figure 4 presents average K by lithologic unit.

Arithmetic mean is provided for average K data because it is considered more appropriate than geometric mean for fractured rock environments. The wide range of K values for a given lithology is typical of the fractured rock environment at Hope Bay. K values are influenced by the presence or absence of discrete, relatively narrow fractures that have higher K than the unfractured bedrock. It is not apparent during drilling what fractures may control water flow (and K), and as a result, the “bulk K” determined by testing over even moderate scale testing intervals (e.g., 25 m) can vary by orders of magnitude.

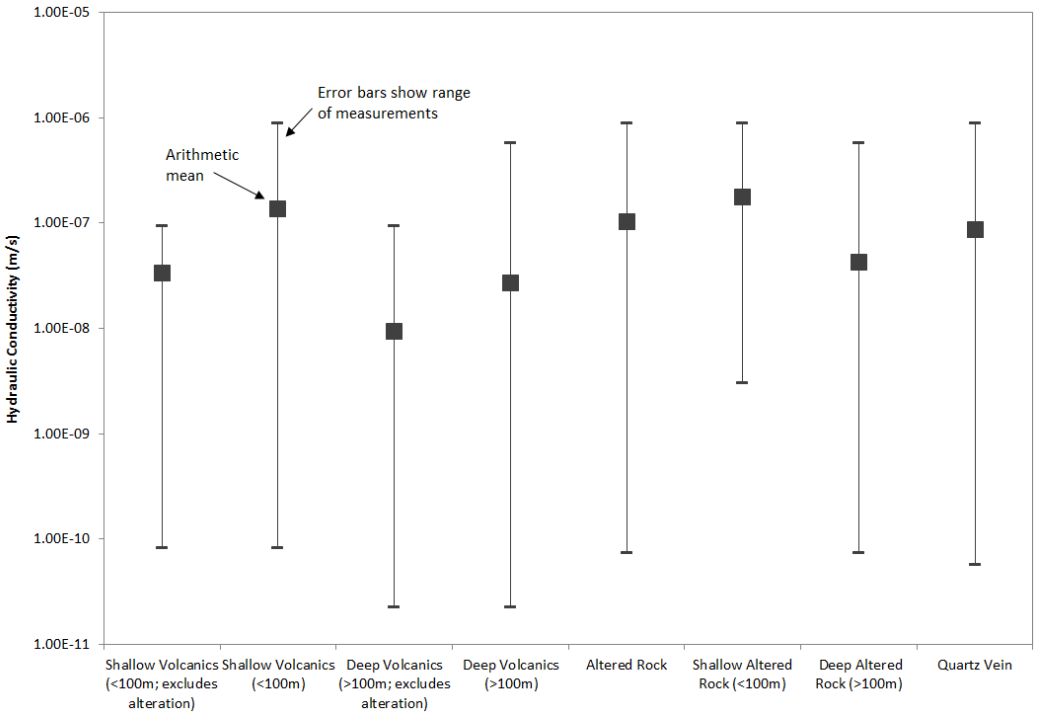


Source: U:\1CH008.054_2011 Stage 2 Geotech-Hydro\020_Project_Data\SRK\!Hydraulic Conductivity\!REVIEWED\Summary Spreadsheets\!HB_MASTER_PackerDataSummary.rev14.ja.20110713_2011FINAL.xls

Notes:

1) Data presented by drill hole.
2) All PSD drill holes are from Madrid South area.
3) 10WBW003 is from the specific Patch 14 area.
4) Error bars indicate the test zone.

Figure 2. Hydraulic Conductivity vs Depth



Source: U:\1CH008.054_2011 Stage 2 Geotech-Hydro\020_Project_Data\SRK\!Hydraulic Conductivity\!REVIEWED\Summary Spreadsheets\HB Madrid K probability distributions.jm.xls

Figure 3. Hydraulic Conductivity by Lithology

2.2 Permafrost

There are a number of deep thermistor strings in place across the Hope Bay belt that provide information on the likely depth of permafrost, including one string at Patch14 that was installed during the summer of 2014. Data from the Patch14 thermistor string was not available for this work. Estimates of the permafrost distribution were developed based on thermal data from the Doris, Madrid North and Boston areas of the Hope Bay Belt and the analytical model of Andersland and Ladanyi (2004).

Groundwater quality data from Hope Bay (and within the broader Canadian Shield in general) indicate elevated total dissolved solids (TDS) can occur at depth and at relatively shallow depths within taliks (refer to section 2.3). The elevated TDS can depress the temperature at which water actually freezes, creating "cryopegs" or areas where temperature is less than 0 degrees Celsius but water is not frozen. The influence of TDS distribution with depth, and the possibility of freezing point depression, has been considered as part of hydrogeological assessments for other mines in the north (e.g., Meliadine, Meadowbank, Diavik). At Hope Bay, potential freezing point depression was estimated based on water quality data collected from the Doris Central Westbay monitoring well using the following equation:

$$\Delta T = i \times K_f \times m$$

$\Delta T = change\ in\ freezing\ point\ from\ 0\ degrees\ Celsius$

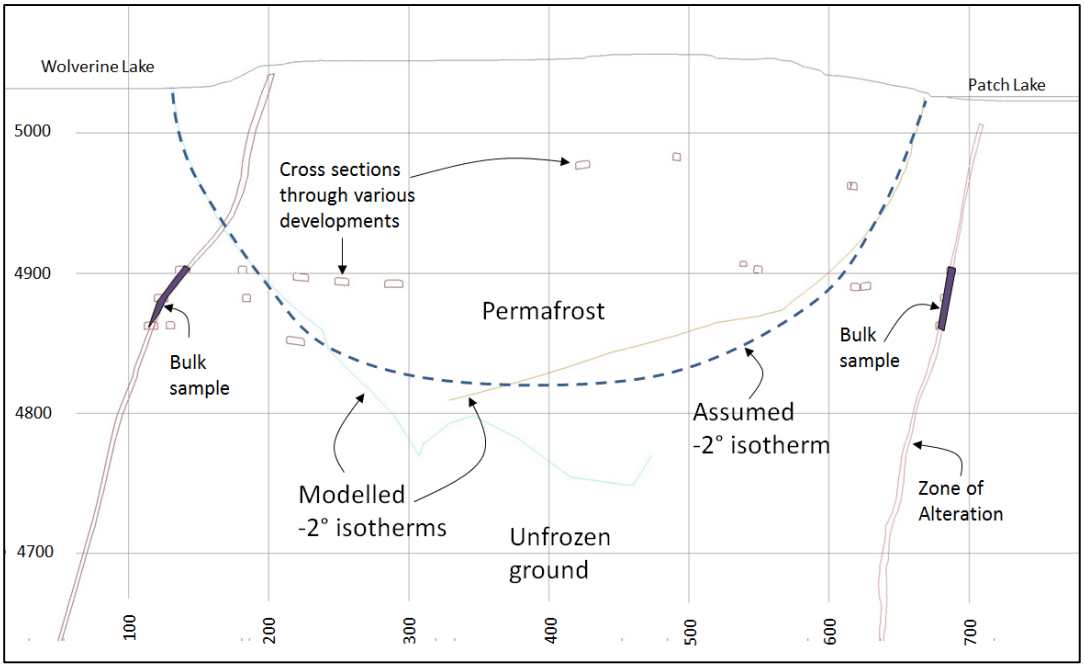
$\mathrm{i} = \mathrm{numberof\ i)\ ions\ in\ a\ molecule\ or\ ii)\ molecular\ compounds}$

$K_f = freezing\ point\ depression\ constant\ for\ water\ (-1.858\ C\ kg/mol)$

$m = molality$

Results suggest a freezing point between about -1 and -2 degree Celsius. Since the water quality at Madrid South is not well constrained, a -2 degree freezing point is assumed.

Figure 4 presents a cross section through the Madrid South Advanced Exploration Bulk Sample showing the -2 degree Celsius isotherm based on results of previous Patch14 thermal modeling (SRK 2010). Permafrost was assumed to start at the shoreline.



Source: U:\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Madrid South GroundWater\figures for inflow memo_May222014.pptx

Figure 4. Cross Section of Bulk Sample areas and -2° Isotherm.

Looking at the map view in Figure 2, a portion of both the Patch14 and Wolverine deposits may be below land and not below the lakebed. In general, a larger portion of the development occuring below land can be assumed to be in permafrost, but the stope areas for the bulk sample are within unfrozen ground.

For Patch14, the deposit is very close to the lake edge and Patch Lake is not particularly deep (about 2 to 3 meters deep to a couple of hundred meters offshore). Under these conditions the lake may freeze to the bottom during winter such that permafrost actually extends under the lake.

2.3 Water Quality

There is no groundwater quality data available for the Madrid South Advanced Exploration Bulk Sample.

Groundwater quality for this area is assumed based on data from Doris and Boston areas. Both areas have saline groundwater at relatively shallow depths in the respective taliks. There is no reason to believe these areas are any different than the Madrid South Bulk Sample. Table 1 presents data from Doris Central that can be used as the assumption for Madrid South Advanced Exploration Bulk Sample groundwater quality.

Table 1. 75th Percentile of Selected Parameters for Hope Bay Waters at Doris Central

		Doris Central		
Parameters	**Units**	**10WBW001 Zone 1 (548 m)**	**10WBW001 Zone 6 (246 m)**	**10WBW001 Zone 10 (63 m)**
pH		7.67	7.65	7.57
TDS	mg/L	44900	37550	38550
Alkalinity	mg/L	2.18	71.6	115
Bicarbonate	mg/L	9.98	56.5	115
Ammonia	mg/L	0.0625	3.44	4.05
Chloride	mg/L	19000	19050	19350
Sulphate	mg/L	976	2025	1853
Calcium	mg/L	4920	1540	1730
Sodium	mg/L	7200	9093	9100
Potassium	mg/L	39	232	258
Magnesium	mg/L	69.5	1480	1310
Dissolved Metals				
Aluminum	mg/L	0.005	0.005	0.005
Arsenic	mg/L	0.002	0.0043	0.002
Cadmium	mg/L	0.00012	0.00007	0.00011
Chromium	mg/L	0.0005	0.0005	0.005
Cobalt	mg/L	0.000059	0.00027	0.00015
Copper	mg/L	0.00083	0.0005	0.0005
Iron	mg/L	0.056	4.5	6.3
Lead	mg/L	0.0003	0.0003	0.0003
Manganese	mg/L	0.73	2.1	1.9
Mercury	mg/L	0.00005	0.00005	0.00005
Molybdenum	mg/L	0.011	0.034	0.013
Nickel	mg/L	0.0016	0.0010	0.00067
Selenium	mg/L	0.002	0.002	0.002
Zinc	mg/L	0.137	0.228	0.0659

Source: \\van-svr0\Projects\01_SITES\Hope.Bay\1CT022.001_2014 Hope Bay Ongoing Support\310_Response to Information Requests\Groundwater Quality 2011

3 Inflow Estimates

Previous estimates for inflows to the Patch14 deposit were developed based on scaling of results from the Doris Central area. When these previous Patch14 estimates were initially completed, there was little K data on which to base any calculations, thus specific modeling was not justified.

Inflow estimates for the Madrid South Advance Exploration Bulk Sample have been updated taking into consideration K data collected since completion of initial results and portions of the bulk sample areas (Patch 14 and Wolverine deposits) that are within the talik zones (as modeled). Revised estimates have been made using a 3D groundwater model.

3.1 3D Numerical Modeling

For the numerical model, the 3D geometry of the Madrid South Advanced Exploration Bulk Sample and the -2 degree Celsius isotherm previously discussed were incorporated into model design. Patch and Wolverine lakes are assigned constant head boundary conditions and the model sides are no flow boundaries. The model is essentially a box with groundwater flow driven by lake levels; this is consistent with the overall hydrogeological conceptual model for the region.

Because the hydraulic conductivity of any given unit is not precisely known, multiple scenarios were assessed. The scenarios represent a reasonable set of hydraulic conductivity distributions that could occur, and provide a range of potential inflows. Table 2 summarizes results.

Further details on the 3D model are provided in Section 4.

Table 2. Inflow Estimates (m^3/d).

Scenario	Best Case	Best Judgement	High Inflow Case 1	High Inflow Case 2
	K of deep volcanic rock = 1x10-10 m/s	K is observed mean for each rock formation	Worst Case K is maximum observed for each rock formation	Reasonable Case K for for deep volcanic or altered rock is maximum observed
Patch14 Deposit	11	60	672	300
Wolverine Deposit	5	35	401	200
Total Inflow	16	95	1073	500

Sources: "case_list&Inflows.xlsx"`

The results from the 3D groundwater model are consistent with previous calculation.

The Best Case scenario demonstrates that inflows to the Patch 14 and Wolverine deposits may not be an issue for the project if K of deep volcanic rock remains low.

The "Best Judgement" case is thought to be a reasonable indication of average inflow conditions that could be observed.

High Inflow Case 1 represents the maximum inflows that may occur if K of the volcanic and altered rock were characterized by the maximum K values reported from observations. This scenario represents extreme conditions that are highly unlikely to occur.

High Inflow Case 2 represents inflows that could occur if K of the deep volcanic rock and alteration zone are represented by the maximum K values observed. This high flow scenario is considered more plausible than Case 1.

For the purposes of water management design it is recommended that results of Case 2 be used. The results from Case 2 represent a reasonable design basis for average inflow *when working in talik areas*.

4 3D Groundwater Model

4.1 Model Geometry

The model domain covers an area of 870,000 m^2. The limit of the domain was defined according to the spatial extent and water elevations of Patch and Wolverine Lakes as well as consideration for potential groundwater flow directions between taliks.

The finite element mesh has 1,831,260 elements with average element dimensions varying gradationally depending on what model elements represent. The mesh is largest in areas outside of the underground developments (average dimensions of about 10 m x 10 m), and smallest at the stopes (average dimensions of about 2 m x 2 m).

The layer thickess is 20 m for the ground surface to 200 m depth and 20 m from 20 m to 400 m depth.

4.2 Model Boundary Conditions

The Patch and Wolverine Lakes are assigned with a constant head node and respectively assigned with head values of 34 m mean annual sea level (masl) and 25 m masl. The stopes are assigned with seepage conditions.

4.3 Model K Values

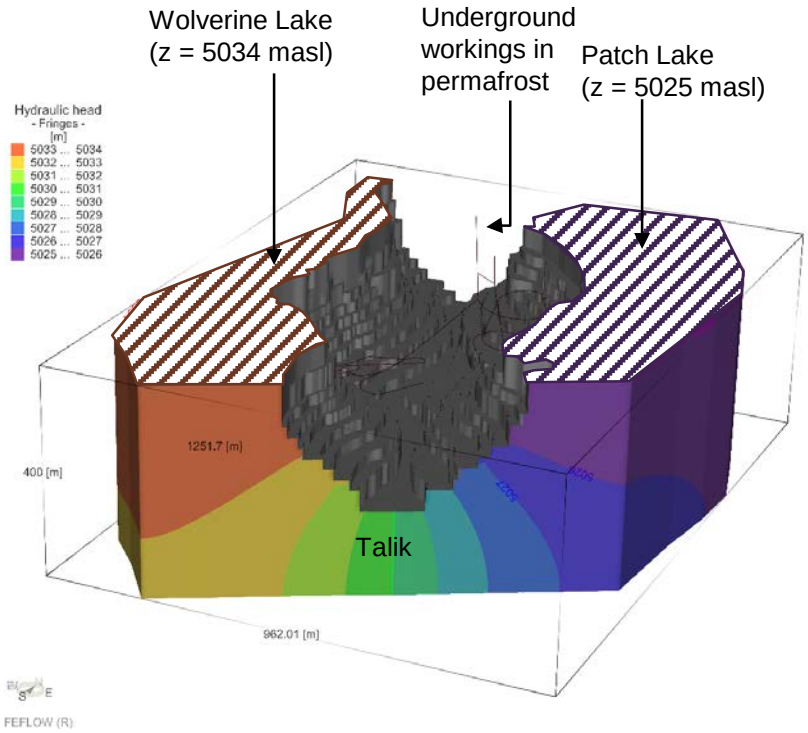
There are four distinct rock formation represented in the Groundwater Model. K for each formation are compiled in Table 3. The spatial distribution of these formations were defined from the Gemcom model.

All simulations were run at steady state; therefore, storage properties are not defined.

Table 3. Hydraulic Conductivity Values.

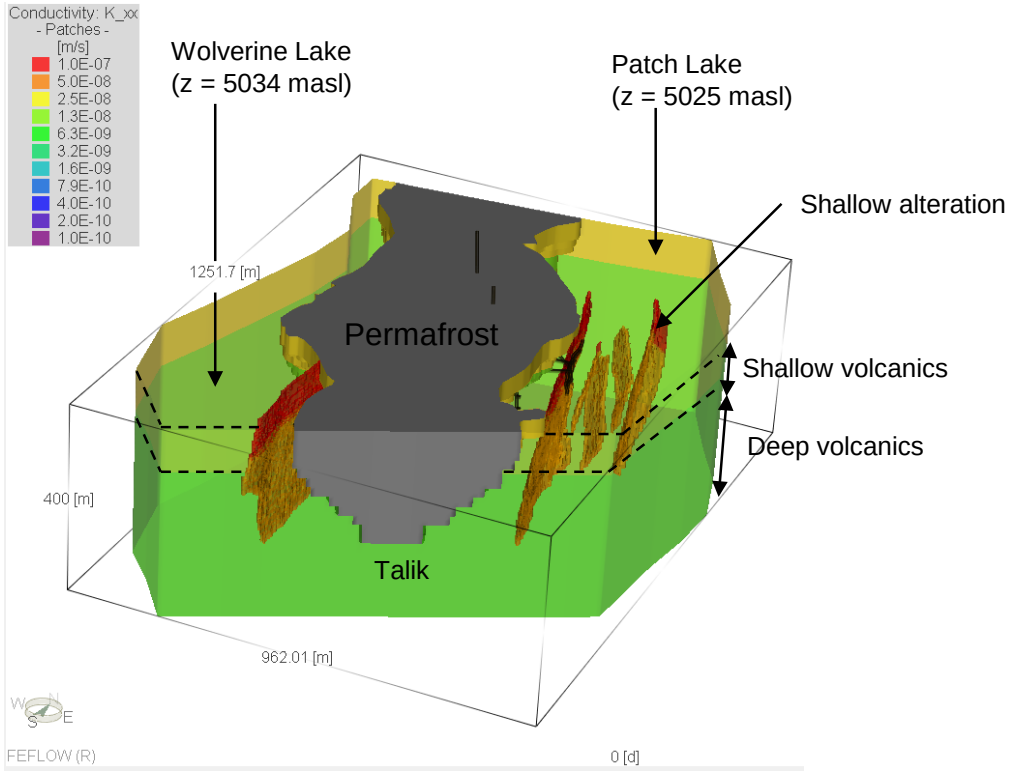
Material	K_{min}	Selected	K_{max}
Shallow Volcanics	$1x10^{-10}$	$3x10^{-08}$	$1x10^{-07}$
Deep Volcanics	$1x10^{-10}$	$9x10^{-09}$	$1x10^{-07}$
Shallow altered	$1x10^{-09}$	$1x10^{-07}$	$1x10^{-06}$
Deep altered	$1x10^{-10}$	$7x10^{-08}$	$1x10^{-06}$

4.4 Model Screenshots



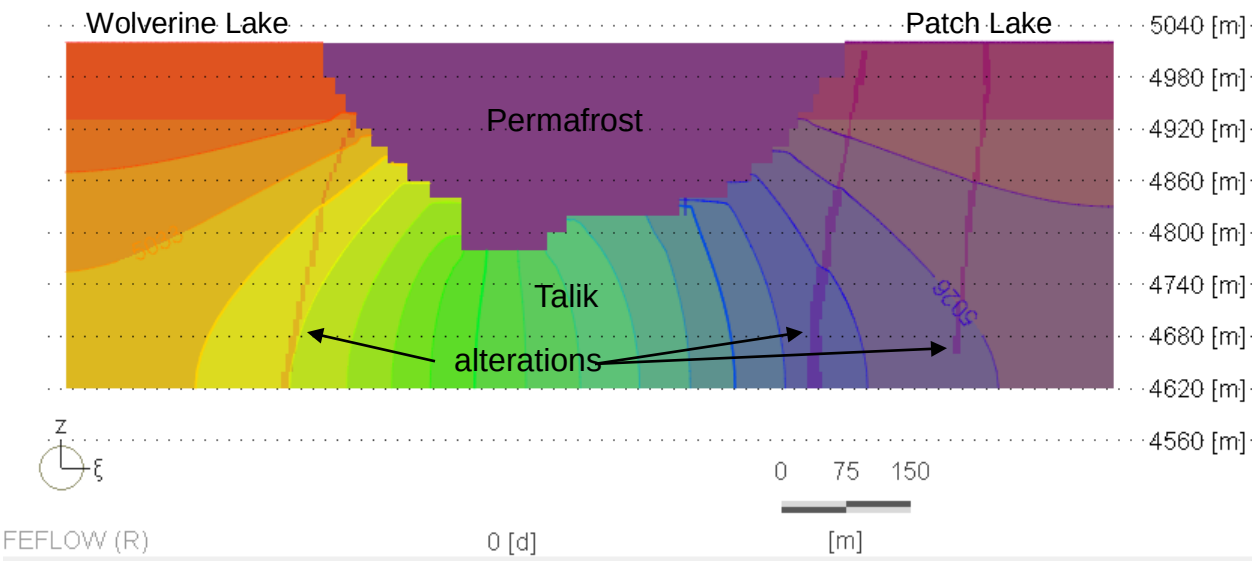
Note: Elevation in mine grid coordinates.

Figure 5: 3D View of the Groundwater Model Showing Hydraulic Head (m).



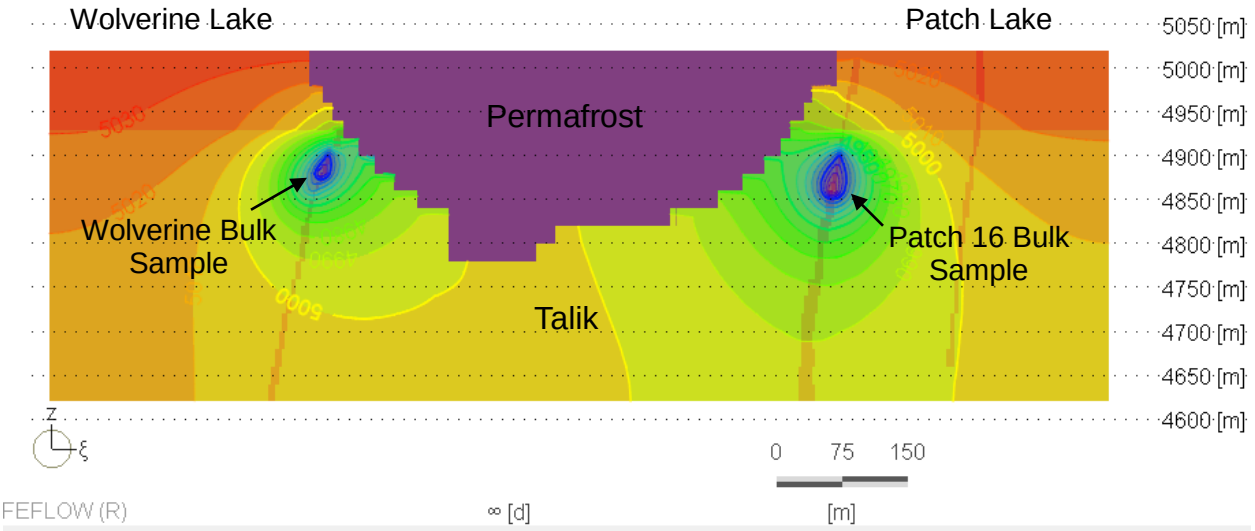
Note: Elevation in mine grid coordinates.

Figure 6: 3D view of the Groundwater Model Showing Conductivity (K m/s)



Note: Elevation in mine grid coordinates.

Figure 7: Cross Section Across the Stopes Showing the Distribution of Hydraulic Head at Time = 0



Note: Elevation in mine grid coordinates.

Figure 8: Cross Section Across the Stopes Showing the Distribution of Hydraulic Head after Bulk Samples are Extracted at time = ∞

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The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

5 References

Andersland and Ladanyi, 2004. Frozen Ground Engineering, Second Edition. ASCE Press and John Wiley & Sons. 363p.

SRK Consulting (Canada) Inc., 2010. Possible Permafrost Conditions at Patch14. Technical Memorandum prepared for Newmont Mining Corporation., Project Number: 1CH008.013. December 1, 2010.

Appendix 7-B

SRK, December 2014 Memo – Hope Bay Project: Madrid Advanced Exploration Project: Water Quality Prediction

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4Memo

To:	John Roberts	**Client:**	TMAC Resources Inc.
From:	Sarah Portelance Tom Sharp	**Project No:**	1CT022.001.410
Cc:	Maritz Rykaart, SRK	**Date:**	December 2, 2014
Subject:	Hope Bay Project: Madrid Advanced Exploration Project Water Quality Prediction		

1 Introduction

TMAC Resources Inc. is currently in the process of constructing their Doris North Project (Project) in the Kitikmeot region of Nunavut, Canada. Mining and processing the Doris North deposit is currently permitted under Nunavut Water Board Water Licence No. 2AM-DOH1323 and Nunavut Impact Review Board Project Certificate No. 3. In addition to the permitted mining activities, TMAC wishes to begin the Madrid Advanced Exploration Project at the Madrid North and Madrid South deposits. This bulk exploration project includes the development of underground workings to access two deposits to collect 50,000 tonne and 55,000 tonne ore samples from Madrid North and Madrid South, respectively. This ore is to be transported to the Doris North mill for processing, with tailings deposited to the Doris North Tailings Impoundment Area (TIA). The underground development work to access these deposits will produce waste rock that will be stored above ground. The ore deposits at Madrid South are located in talik (outside of permafrost) so the underground workings in this area may intercept groundwater. The Madrid North deposit is located in permafrost and the underground workings are not expected to intercept groundwater. Groundwater and contact water from the mining operations and waste rock piles will need to be managed.

SRK (2014a) describes the water management strategy for the Madrid Advanced Exploration Project. Contact water from mine operations, waste rock piles and ore stockpiles will be collected in Pollution Control ponds. Intercepted groundwater at Madrid South will also be collected and contained in the Pollution Control ponds. All contact water that does not meet discharge criteria will be hauled by trucks and disposed of in the Doris North TIA during the Madrid Advanced Exploration Program. When the Madrid Advanced Exploration Program is completed, the waste rock piles will be covered with a geomembrane and capped with a protective layer of crushed rock. The Pollution Control ponds will be breached and site runoff will flow onto the tundra.

This memorandum describes how the discharge of water and milling of the bulk sample from the Madrid Advanced Exploration Project at the Doris North processing facilities may affect the TIA water quality while ore from Doris North (300,000 tonnes) is being processed.

Table 1 summarizes the project milestones used in the water and load balance model. The Madrid Advanced Exploration Program ends in Year 6 when the Madrid South bulk sample milling is complete.

Table 1: Summary of Milestones in the Water and Load Balance Model

Mine Date Description	Start	End
Mill load from Doris North	Year 3 (April)	Year 4 (April)
Madrid North bulk sampling (mining)	Year 3 (April)	Year 4 (November)
Madrid South bulk sampling (mining)	Year 4 (December)	Year 6 (April)
Underground Dewatering (Madrid South)	Year 5 (August)	Year 6 (April)
Madrid North Mill Load	Year 4 (May)	Year 4 (June)
Madrid South Mill Load	Year 6 (February)	Year 6 (April)
Decommissioning of bulk sample sites	Year 6 (May)	Year 7 (April)
Bulk sample site pollution control ponds breached	Year 7 (April)	Year 7 (April)

Source: \\VAN-SVR0\Projects\01_SITES\Hope.Bay\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Water Quality Prediction\Model\Madrid_Doris_SB_SPB_Rev7.gsm

2 Water and Load Balance Description

The water and load balance integrates dissolved constituent concentrations and flow rates to predict water quality during operations and closure. This mass balance predicts water quality in the TIA and in Doris Creek downstream of the TIA discharge point.

Model inputs for Doris North mining and mineral processing were not modified from the existing water and load balance model presented in the Water Quality Model Report (SRK 2011) included in the Doris North Mine Modifications and Related Amendments to Project Certificate No. 003 and Type A Water Licence No. 2AM-DOH1323 (TMAC 2013). The model was run on a monthly time step for a period of 300 months (25 years). A Monte Carlo simulation of 100 realizations was used to stochastically vary annual precipitation to model a range of possible climate and runoff conditions.

2.1 Model Components

The following components are included in the water and load balance to predict water quality in the TIA when the Doris North ore is milled (as permitted by Nunavut Water Board Water Licence No. 2AM-DOH1323 and Nunavut Impact Review Board Project Certificate No. 3) and the bulk samples are collected from Madrid North and Madrid South:

- Tail Lake watershed runoff and direct precipitation to the TIA;
- Runoff from the waste rock piles at Doris North (640,845 tonnes), Madrid South (225,000 tonnes), and Madrid North (285,000 tonnes);
- Runoff from the bulk sample ore stockpiles;
- Doris North, Madrid South and Madrid North contact water from surface infrastructure pads and all-weather roads;

- Treated mill tailings discharged to the TIA for Doris North (300,000 tonnes), Madrid North (50,000 tonnes), and Madrid South (55,000 tonnes) at a milling rate of 800 tpd;
- Treated sewage effluent discharge to the TIA for a Doris North camp of 360 people (includes 70 people for Madrid North and South developed sequentially);
- Saline groundwater inflows (500 m^3/d during the Madrid South Bulk Sample, SRK 2014b);
- Saline drilling fluids (6.7 m^3/d during Doris North, Madrid South and Madrid North underground mining at a rate of 185 kg/m^3 of $CaCl_2$);
- Ammonium nitrate fuel oil (ANFO) residuals on waste rock, quarried rock, ore and mine water (groundwater);
- Salinity release to the TIA from permafrost thawing along shores of the TIA. Incorporated in the model at closure during water level drawdown; and
- Degradation of cyanide destruction products to ammonia.

2.2 Water Balance Summary

Figure 1 illustrates the water balance for Doris North, Madrid South and Madrid North. The preferred option for managing and treating excess contact water at Madrid North and Madrid South is to transport water collected in the Pollution Control ponds to the TIA. Table 2 provides a summary of the total catchment areas included in the water balance model.

Table 2: Catchment Area Summary

Catchment Area		Size (ha)
Upstream Tail Lake Catchment Area		450
Doris North Mine Area[1]		21.2
Madrid North Mine Area (Collection Pond)	Total Area	9.4
	Waste Rock / Ore Stockpile	3.3
	Mine Site Fill	1.3
	Natural Catchment[2]	4.8
Madrid South Mine Area 1 (Collection Pond 1)	Total Area	3.4
	Mine Site Fill	0.8
	Natural Catchment[2]	2.6
Madrid South Mine Area 2 (Collection Pond 2)	Total Area	8.6
	Waste Rock / Ore Stockpile	4.8
	Mine Site Fill	1.3
	Natural Catchment[2]	2.5

Source: \\VAN-SVR0\Projects\01_SITES\Hope.Bay\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Water Quality Prediction\Model\Bulk_Sample_Model_Results.xlsx

Notes:

[1] Includes the total area flowing to the sedimentation pond and pollution control pond with the clean water diversion in place.
[2] Includes pond surface areas.

As described previously, inter-annual climatic variability is modelled using a Monte Carlo simulation. Table 3 summarizes average, wet and dry year runoff for Madrid South and Madrid North. Average runoff volumes are based on the average annual rainfall year (229 mm, SRK 2011). The wet annual runoff volume represents an annual runoff with a 20-year return period interval or a 5% chance of exceeding in a given year. The dry scenario represents the annual runoff with a 20-year return period interval for a 5% chance of not exceeding in a given year.

Table 3: Madrid South and Madrid North Runoff Volumes. Units are m^3/year.

Mine Location	Runoff Source	Dry Year	Average Year	Wet Year
		5th Percentile	50th Percentile	95th Percentile
Madrid North (Collection Pond)	Total Area	16,169	21,384	30,946
	Waste Rock Pile / Ore Stockpile	5,676	7,507	10,864
	Surface Infrastructure Pads and All-Weather Roads	2,236	2,957	4,280
	Undisturbed Ground	8,257	10,920	15,802
Madrid South (Collection Pond 1)	Total Area	3,520	4,655	6,737
	Surface Infrastructure Pads and All-Weather Roads	828	1,095	1,585
	Undisturbed Ground	2,692	3,560	5,152
Madrid South (Collection Pond 2)	Total Area	8,904	11,775	17,040
	Waste Rock Pile / Ore Stockpile	4,969	6,572	9,510
	Surface Infrastructure Pads and All-Weather Roads	1,346	1,780	2,576
	Undisturbed Ground	2,589	3,423	4,954

Source: \\VAN-SVR0\Projects\01_SITES\Hope.Bay\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Water Quality Prediction\Model\Bulk_Sample_Model_Results.xlsx

Contact water collected in the Pollution Control ponds will continuously be hauled to the TIA by trucks with a 50 m^3 capacity. Table 4 provides a summary of peak truck traffic and monthly volumes of water transported to the TIA. The total number of trucks summarized in Table 4 represents the peak daily round trips. Peak traffic will typically occur during freshet (June) where peak traffic during Madrid South mining occurs during the open water season when groundwater is intercepted.

For a wet hydrological condition (95th percentile), the peak truck traffic during Madrid North mining and Madrid South mining (during groundwater inflows) was estimated at 11 and 12 trucks/day respectively.

Table 4: Bulk Sample Water Management Contact Water Volumes for Dry, Average and Wet Hydrologic Conditions.

Phase	Month	Year	Madrid North Bulk Sample			Madrid South Bulk Sample		
			5th	50th	95th	5th	50th	95th
Madrid North Mining	4	3	0	0	0	0	0	0
	5	3	0	0	0	0	0	0
	6	3	8,586	11,546	16,204	0	0	0
	7	3	4,047	5,442	7,638	0	0	0
	8	3	1,254	1,686	2,366	0	0	0
	9	3	1,571	2,113	2,965	0	0	0
	10	3	417	555	779	0	0	0
	11	3	0	0	0	0	0	0
	12	3	0	0	0	0	0	0
	1	4	0	0	0	0	0	0
	2	4	0	0	0	0	0	0
	3	4	0	0	0	0	0	0
	4	4	0	0	0	0	0	0
	5	4	0	0	0	0	0	0
	6	4	8,135	11,592	16,741	0	0	0
	7	4	3,834	5,464	7,891	0	0	0
	8	4	1,188	1,693	2,445	0	0	0
	9	4	1,489	2,121	3,064	0	0	0
	10	4	391	557	805	0	0	0
	11	4	0	0	0	0	0	0
Madrid South Mining	12	4	0	0	0	0	0	0
	1	5	0	0	0	0	0	0
	2	5	0	0	0	0	0	0
	3	5	0	0	0	0	0	0
	4	5	0	0	0	0	0	0
	5	5	0	0	0	0	0	0
	6	5	8,748	11,569	16,741	6,721	8,888	12,863
	7	5	4,123	5,453	7,891	3,168	4,190	6,063
Madrid South Mining in Talik	8	5	1,277	1,689	2,445	16,200	16,517	17,097
	9	5	1,601	2,117	3,064	16,449	16,845	17,573
	10	5	420	556	805	15,542	15,646	15,837
	11	5	0	0	0	15,219	15,219	15,219
	12	5	0	0	0	15219	15,219	15,219
	1	6	0	0	0	15,219	15,219	15,219
	2	6	0	0	0	15,219	15,219	15,219
	3	6	0	0	0	15,219	15,219	1,5219

Phase	Month	Year	Madrid North Bulk Sample			Madrid South Bulk Sample		
			5th	50th	95th	5th	50th	95th
	4	6	0	0	0	15,219	15,219	15,219
Closure	5	6	0	0	0	0	0	0
	6	6	8,667	11,612	16,204	6,659	8,922	12,450
	7	6	4,085	5,473	7,638	3,139	4,205	5,868
	8	6	1,266	1,696	2,366	972.4	1,303	1,818
	9	6	1,586	2,125	2,965	1,219	1,633	2,278
	10	6	417	559	779	320	429	598
	11	6	0	0	0	0	0	0
	12	6	0	0	0	0	0	0
	1	7	0	0	0	0	0	0
	2	7	0	0	0	0	0	0
	3	7	0	0	0	0	0	0
	4	7	0	0	0	0	0	0
Peak Volume (m^3/month)			8,748	11,612	16,741	16,449	16,845	17,573
Peak Daily Truck Traffic (trucks/day)			6	8	11	11	11	12

Source: Z:\01_SITES\Hope.Bay\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Water Quality Prediction\Model\Bulk_Sample_Model_Results.xlsx

2.3 Water Quality Inputs

Constituent loads from waste rock, ore and site rockfill (used in surface infrastructure pad construction) are a function of source terms and the total tonnage. Table 5 summarizes waste rock and site rockfill tonnages used in the load balance. Source terms for waste rock and ore at Madrid North and Madrid South are based on current geochemical testing.

Table 5: Total Waste Rock and Surface Rock Summary

Mine Phase	Total Waste Rock and Ore (tonne)	Total Rock Used to Construct Pads for Infrastructure (tonne)
Doris North	640,845[1]	923,835
Madrid South	225,000	62,806[2]
Madrid North	285,000	37,605[2]

Source: \\VAN-SVR0\Projects\01_SITES\Hope.Bay\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Water Quality Prediction\Model\Madrid_Doris_SB_SPB_Rev7.gsm

Notes:

[1] total Doris North waste rock is 1,095,000 tonne, where 65% of tonnes mined (454,155) backfilled
[2] Assumed an average 1.5 m depth and 1.98 tonne/m^3 density

Mass dependent source terms for Madrid South and Madrid North waste rock and surface infrastructure rockfill are shown in Table 6. A surface area correction factor of 0.3 and a release factor of 40% were used to estimate net release rates (SRK 2011). Leaching of drilling brine and ANFO residue from the waste rock were also included in the model. The rate salt and ANFO residue rinse from waste rock was calculated assuming 40% of the salt and ANFO residue mass present is released from the rock annually. Blast residue volumes are based on data reported in a

study on ammonium nitrate dissolution rates for the Diavik Diamond Mine in Northwest Territories. The method to estimate salinity releases and nitrogen nutrient loading rates is described in the Water Quality Model Report (SRK 2011).

Background concentrations for Doris Creek are based on water quality data obtained in 2004 to 2006 and 2011 to 2013 from compliance monitoring point, TL-2 in Doris Creek. Concentrations for upstream runoff into Tail Lake are based on compliance monitoring point, TL-1, data from 2004 to 2006 before site runoff collected in the Sedimentation and Pollution Control ponds was trucked to Tail Lake. Median monthly concentrations during open water season were used. When results were below the method detection limit, the detection limit was used. Table 7 summarizes background monthly concentrations used in the model during the open water season.

Table 8 provides mill effluent water quality for processed ore from Doris North and Madrid Advanced Exploration Project Bulk Samples. The Madrid North tailings solution chemistry is based on Naartok samples collected and analyzed by Newmont Metallurgical Services. No metallurgical testing of Madrid South ore has been conducted to date. The results of Naartok ore testing were also used for the Madrid South predictions. Further descriptions and other inputs and source terms included in the model are described in the Doris North Mine Modification Report (TMAC 2013).

Table 6: Input Source Terms (mg/kg/week)

Parameter	Mine Area Surface Rock*	Doris North Waste Rock	Madrid South Waste Rock	Madrid North Waste Rock
Sulphate	0.86	23.2	0.8	4.5
Aluminum Al	0.025	0.013	0.015	0.02
Antimony Sb	0.00012	0.02172	0.00033	0.00045
Arsenic As	0.00058	0.00049	0.039	0.067
Barium Ba	0.00008	0.00109	0.00032	0.00022
Beryllium Be	0.000115	0.000543	0.000005	0.000010
Bismuth Bi	0.000115	0.0217218	0.0000023	0.0000083
Boron B	0.006	0.011	0.023	0.022
Cadmium Cd	0.0000288	0.0000002	0.0000023	0.0000034
Calcium Ca	1.5	4.7	2.2	3.0
Chromium Cr	0.000115	0.001086	0.000046	0.000062
Cobalt Co	0.00012	0.00109	0.0005	0.0003
Copper Cu	0.00015	0.00043	0.00026	0.00027
Iron Fe	0.0058	0.0033	0.0014	0.0050
Lead Pb	0.00011500	0.00021722	0.0000225	0.000026
Lithium Li	0.00012	0.00109	0.00026	0.00036
Magnesium Mg	0.15	2.18	1.14	1.30
Manganese Mn	0.0001	0.0029	0.002	0.002
Mercury Hg	0.0000023	0.0000004	0.000001	0.0000039
Molybdenum Mo	0.000001	0.00022	0.00014	0.0002
Nickel Ni	0.00013	0.00217	0.00034	0.0016
Phosphorus P	0.0173	0.0326	0.0018	0.0033
Potassium K	0.04	0.45	0.34	0.29
Selenium Se	0.000115	0.000002	0.000055	0.000076
Silicon Si	0.28	0.18	0.15	0.20
Silver Ag	0.000039	0.000043	0.000002	0.000004
Sodium Na	0.04	0.22	0.29	0.39
Strontium Sr	0.0008	0.0058	0.0064	0.0062
Thallium Tl	0.0000115	0.0000004	0.0000009	0.0000065
Tin Sn	0.00012	0.00326	0.00006	0.00002
Titanium Ti	0.00012	0.00109	0.00023	0.00023
Vanadium V	0.00023	0.00326	0.00017	0.00047
Zinc Zn	0.00058	0.00374	0.00036	0.00033

Source: \\VAN-SVR0\Projects\01_SITES\Hope.Bay\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Water Quality Prediction\Model\Bulk_Sample_Model_Results.xlsx

Note: * Mine fill source terms for Madrid North and Madrid South based on source terms developed for the Doris North source terms (SRK 2011).

Table 7: Background Water Quality Inputs

Parameter	Tail Lake Background Concentrations (TL-1)					Doris Creek Background Concentrations (TL-2)				
	June	July	August	September	October	June	July	August	September	October
TDS	110	80	90	105	105	128.5	145.5	142	154.75	145
TSS	1	1	1.5	2	2	3	3.5	3	3	3
Total_CN	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.003	0.003	0.001
Sulphate	3	3	3	3.25	3.25	3.5	3	2.75	2.84	3
Chloride	30.1	30	37	37	37	49	63	62	62	63
Ammonia_N	0.008	0.008	0.007	0.008	0.008	0.029	0.033	0.031	0.029	0.008
Nitrate_N	0.005	0.006	0.005	0.006	0.006	0.028	0.028	0.028	0.028	0.005
Nitirite_N	0.001	0.001	0.001	0.002	0.002	0.026	0.026	0.026	0.026	0.001
Alkalinity	28	29	30	25	25	26	27	28	28	28
Ortho_P	0.002	0.002	0.002	0.002	0.002	0.0009	0.0009	0.0009	0.0009	0.0008
Phosphate_P	0.008	0.006	0.006	0.004	0.004	0.02	0.023	0.026	0.025	0.027
TOC	6	5	5	5	5	5	5	5	5	5
Hardness	33	34	41	38	38	36	46	46	49	45
Aluminum	0	0	0	0	0.016	0.057	0.055	0.05	0.05	0.048
Antimony	0.00001	0.00001	0.00001	0.00001	0.00001	0.00021	0.00021	0.00021	0.00021	0.00001
Arsenic	0.00024	0.00026	0.00033	0.00023	0.00023	0.00039	0.0004	0.00044	0.00041	0.00042
Barium	0.0021	0.002	0.0031	0.0023	0.0023	0.0031	0.0033	0.003	0.0033	0.003
Boron	0.014	0.015	0.015	0.013	0.013	0.035	0.036	0.036	0.036	0.022
Cadmium	0.000002	0.000003	0.000002	0.000002	0.000002	0.000006	0.000006	0.000006	0.000006	0.000002
Calcium	6.09	6.13	7.58	6.54	6.54	6.33	8.32	7.74	7.95	7.35
Chromium	0.000248	0.000158	0.00025	0.0002215	0.0002215	0.00066	0.00062	0.00065	0.0006	0.00019
Cobalt	0.00002	0.00005	0.00008	0.00006	0.00006	0.001	0.001	0.001	0.001	0.0001
Copper	0.0009	0.0008	0.0007	0.0007	0.0007	0.0014	0.0015	0.0014	0.0015	0.0014
Iron	0.042	0.089	0.404	0.068	0.068	0.093	0.14	0.094	0.123	0.09
Lead	0.00003	0.00005	0.00006	0.00001	0.00001	0.000073	0.000078	0.000109	0.000068	0.000035
Magnesium	4.63	4.63	5.59	4.59	4.59	4.84	6.15	6.11	6.13	6.37
Manganese	0.001	0.002	0.008	0.002	0.002	0.013	0.021	0.017	0.021	0.01

Parameter	Tail Lake Background Concentrations (TL-1)					Doris Creek Background Concentrations (TL-2)				
	June	July	August	September	October	June	July	August	September	October
Molybdenum	0.0001	0.00007	0.00007	0.00007	0.00007	0.00256	0.00257	0.00257	0.00257	0.00014
Nickel	0.00052	0.00051	0.00051	0.00043	0.00043	0.0012	0.0013	0.0012	0.0012	0.0004
Potassium	1.58	1.35	1.48	1.84	1.84	1.91	2.28	2.11	2.26	2.34
Selenium	0.0004	0.00042	0.00062	0.00046	0.00046	0.00059	0.00061	0.00062	0.00076	0.00076
Silver	0.000001	0.000002	0.000001	0.000001	0.000001	0.000011	0.00001	0.00001	0.00001	0.000001
Sodium	15.7	16	18.6	18.1	18.1	24	30.75	29.98	30.47	32.13
Strontium	0.025	0.027	0.034	0.029	0.029	0.035	0.039	0.039	0.04	0.04
Thallium	0.000006	0.000014	0.000002	0.000002	0.000002	0.000059	0.000061	0.000055	0.000052	0.000003
Tin	0.00003	0.00004	0.00004	0.00003	0.00003	0.02502	0.02506	0.02502	0.02502	0.00003
Uranium	0.00001	0.00001	0.00001	0.00001	0.00001	0.000064	0.000066	0.000068	0.000066	0.000032
Vanadium	0.0004	0.0001	0.00008	0.00001	0.00001	0.00079	0.00056	0.00057	0.00056	0.00012
Zinc	0.0054	0.0021	0.0026	0.0024	0.0024	0.0027	0.0028	0.0034	0.003	0.0017

Table 8: Mill Effluent Water Quality Concentrations (mg/L)

Parameter	Doris North	Maximum (North/Central/Connector)	Madrid Bulk Samples* (Naartok)
Nitrate as N	0.23	0.74	0.28
Nitrite as N	0.09	0.28	3.85
Sulphate	137	137	55
Aluminum Al	0.12	0.59	0.05
Antimony Sb	0.08	0.08	0.04
Arsenic As	0.007	0.007	0.404
Barium Ba	0.008	0.13	0.01
Beryllium Be	0.001	0.001	0.01
Bismuth Bi	0.00	0.00	0.00
Boron B	0.194	0.27	0.66
Cadmium Cd	0.00015	0.0007	0.0000
Calcium Ca	400	400	400
Chromium Cr	0.020	0.024	0.001
Cobalt Co	0.095	0.10	0.36
Copper Cu	0.023	0.64	0.07
Iron Fe	1.51	2.79	1.06
Lead Pb	0.0002	0.01	0.00
Lithium Li	0.013	0.01	0.00
Magnesium Mg	7.4	35.3	46.3
Manganese Mn	0.009	0.14	0.04
Mercury Hg	0.0001	0.0001	0.00
Molybdenum Mo	0.045	0.12	0.16
Nickel Ni	0.243	0.24	0.03
Phosphorus P	0.97	1.20	0.27
Potassium K	54	54	42
Selenium Se	0.011	0.025	0.064
Silicon Si	3.90	3.90	2.48
Silver Ag	0.0011	0.0474	0.0002
Sodium Na	1918	1918	437
Strontium Sr	0.204	0.30	0.29
Thallium Tl	0.0004	0.0004	0.0001
Tin Sn	0.050	0.05	0.05
Titanium Ti	0.099	0.099	0.05
Vanadium V	0.006	0.006	0.023
Zinc Zn	0.50	0.50	0.50

Source: \\VAN-SVR0\Projects\01_SITES\Hope.Bay\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Water Quality Prediction\Model\Mill Effluent WQ.xlsx

Note: * Mill effluent for Madrid Bulk Samples based on Naartok samples (Croall and Bucknam 2011).

2.4 Water Management Constraints

The Madrid Advanced Exploration Project water management plan defines the water management strategy used in the water quality model (SRK 2014a).

The following key components were applied to the water management strategy during operations and closure:

- The TIA will discharge seasonally to Doris Creek until end of closure.
- The maximum discharge from the TIA to Doris Creek is limited to 10% of background flow in Doris Creek.
- Discharge from the TIA must meet the water quality objectives in the water licence.
- Doris Creek downstream of the discharge must meet water quality objectives in the water licence.
- The maximum water elevation during operations is 32.5 m when concentrations in the TIA meet discharge objectives and is 33.5 m when concentrations exceed discharge objectives.
- The minimum depth of water cover is 4 m above the surface of tailings during operations and closure to prevent re-suspension of sediments.

3 Water Quality Predictions

The median and 95th percentiles of maximum concentrations for discharge water quality of the TIA during operations and closure were predicted. The 95th percentile of concentrations represent the maximum concentration expected in the TIA based on 100 realizations for a range of hydrological conditions.

A monthly discharge timing window (June to October) during open water season was applied to ensure modelled TIA discharges met water quality targets during operations and closure as specified in the Water Licence for the Doris North Project (NWB No. 2AM-DOH1323). As described in the Water Licence Part G, Items 28 and 30, all water discharged from the TIA (end-of-pipe) cannot exceed specified effluent quality limits and during periods of discharge, water quality in Doris Creek cannot exceed the greater of the background water quality at the time of discharge or specified limits.

Enough water must be stored in the TIA to dilute the chloride load from Madrid South groundwater. Discharge from the TIA to Doris Creek can only start when mining progresses into the Madrid South talik. If water is discharged prior to this, there is insufficient dilution in the TIA for the discharge to meet water quality guidelines in Doris Creek. The maximum water quality predictions for Madrid North and Madrid South and guidelines for parameters of concern during operations and closure are presented in Table 9.

Table 9: Water Quality Results

Parameter	Effluent Limits Item 28	Max TIA Discharge Concentration		Doris Creek Limits Item 30	Doris Creek Concentration	
		Median	95th Percentile		Median	95th Percentile
TDS		1800	1900		290	310
Free_CN		0.000005	0.000005	0.005	0.002	0.002
Total_CN	1	0.0001	0.0001	0.01	0.003	0.003
WAD_CN		0.0003	0.0003		0.002	0.002
SCN		14	15		1	1
Sulphate		82	89		10	11
Chloride		790	860	150	130	140
Ammonia_N		0.2	0.2	1.5	0.05	0.05
Nitrate_N		1.8	1.9	2.9	0.2	0.2
Nitirite_N		0.2	0.2	0.06	0.04	0.04
Alkalinity		71	76		32	32
Hardness		400	430		78	80
Aluminum		0.2	0.3	0.1	0.07	0.07
Antimony		0.03	0.03		0.002	0.003
Arsenic	0.5	0.05	0.05	0.005	0.005	0.005
Barium		0.008	0.008		0.004	0.004
Beryllium		0.0009	0.001		0.0005	0.0005
Boron		0.1	0.2		0.04	0.05
Cadmium		0.0001	0.0001	0.00002	0.00001	0.00001
Calcium		300	330		34	36
Chromium		0.003	0.003	0.001	0.0008	0.0008
Cobalt		0.01	0.01		0.002	0.002
Copper	0.3	0.004	0.005	0.002	0.002	0.002
Iron		0.4	0.4	0.3	0.2	0.2
Lead	0.2	0.0006	0.0006	0.001	0.0001	0.0001
Manganese		0.05	0.06		0.02	0.02
Mercury		0.00002	0.00003	0.00003	0.00001	0.00001
Molybdenum		0.006	0.007	0.07	0.003	0.003
Nickel	0.5	0.02	0.02	0.03	0.003	0.003
Selenium		0.002	0.003	0.001	0.0009	0.0009
Silver		0.0002	0.0002	0.0001	0.00003	0.00003
Thallium		0.00006	0.00007	0.0008	0.00006	0.00006
Uranium		0.0003	0.0003		0.00008	0.00008
Zinc	0.5	0.05	0.05	0.0350	0.007	0.007

Source: \\VAN-SVR0\Projects\01_SITES\Hope.Bay\1CT022.001_2014 Hope Bay Ongoing Support\410_Preparation of Submission (Patch 14, Wolverine & Madrid)\Water Quality Prediction\Model\Mill Effluent WQ.xlsx

The water and load balance model predicts that by restricting discharges until the start of underground mining in Madrid South (August Year 5), predicted water quality meets discharge limits.

Figure 2 illustrates the predicted maximum (95th percentile) and minimum (5th percentile) water levels in the TIA during operations and closure. As noted above, water is not released during operations to provide additional dilution in the TIA prior to discharging to Doris Creek. The maximum (95th percentile) elevation modelled during operations was determined to be approximately 32.40 m amsl. The water elevation at closure is the natural Tail Lake elevation of 28.3 masl and provides a minimum water cover of 4.0 m above the deposited tailings (321,961m^3, 24.36 m amsl).

Arsenic levels in the TIA discharge determine the number of years required for water quality in the TIA to meet water licence limits to directly discharge to Doris Creek. Figure 3 illustrates that it would take approximately 15 years after the end of Madrid South bulk sampling (modelled month 250) before the 95th percentile arsenic levels in the TIA decrease below 0.005 mg/L during open water season (June to October). This is assuming that arsenic concentrations in the Bulk Sample Mill effluent are similar to Naartok metallurgical testing.

Additional metallurgical testing is underway to verify the concentrations in the tailings slurry. The model will be updated with these results as they become available. If the initial results significantly differ from the results used for these predictions, TMAC will prepare a contingency plan to address managing mill effluent.

4 Conclusion

The effect of managing and discharging excess collected contact water in the Madrid South and Madrid North Pollution Control ponds to the Doris North Project TIA was evaluated. Water balance and water quality modelling indicate that the water level in the TIA and water quality objectives in the water licence (2AM-DOH1323) can be met for the Madrid Advanced Exploration Project.

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The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

5 References

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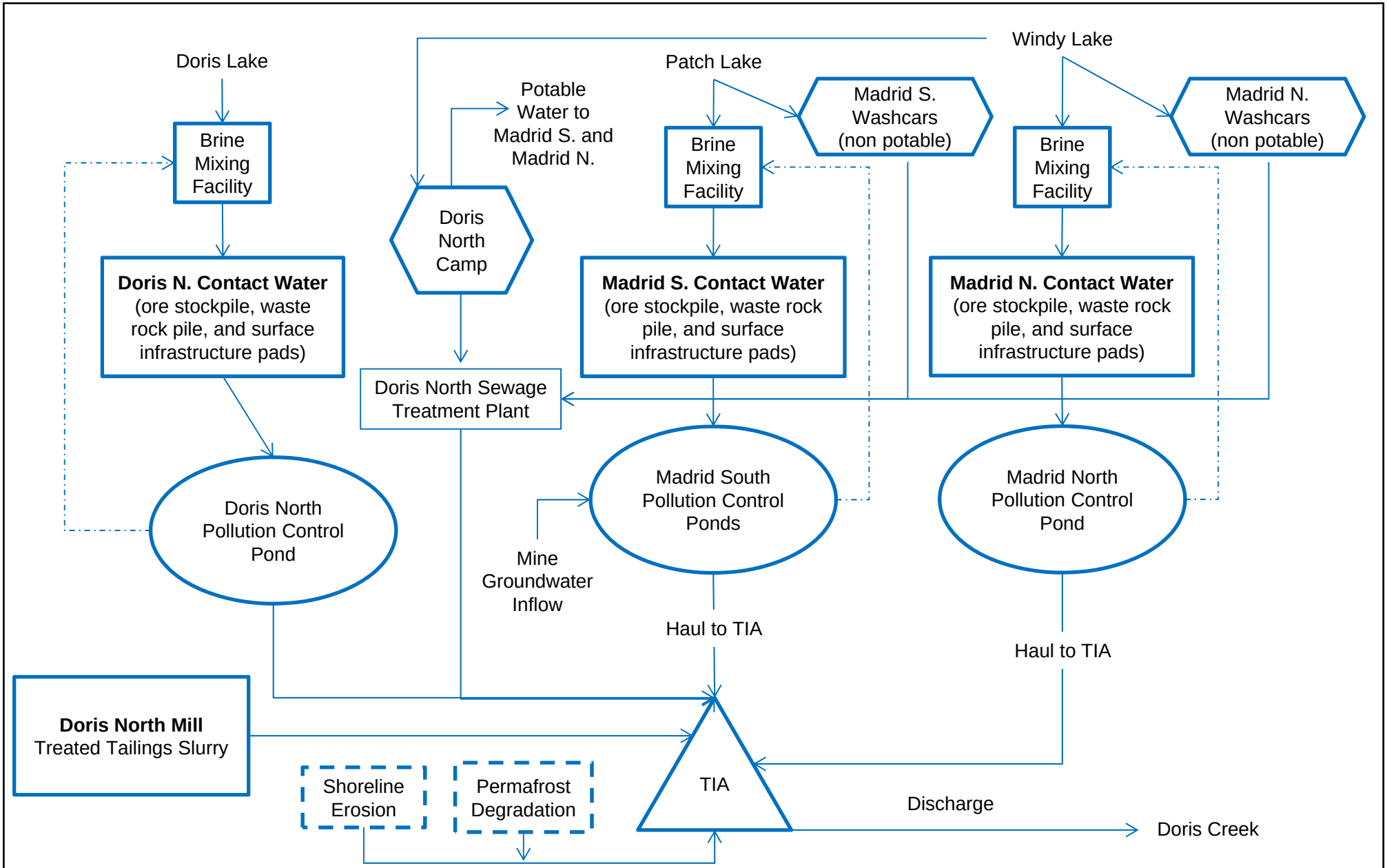
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Figures



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TMAC RESOURCES

Madrid Advanced Exploration Project
Water Quality Prediction

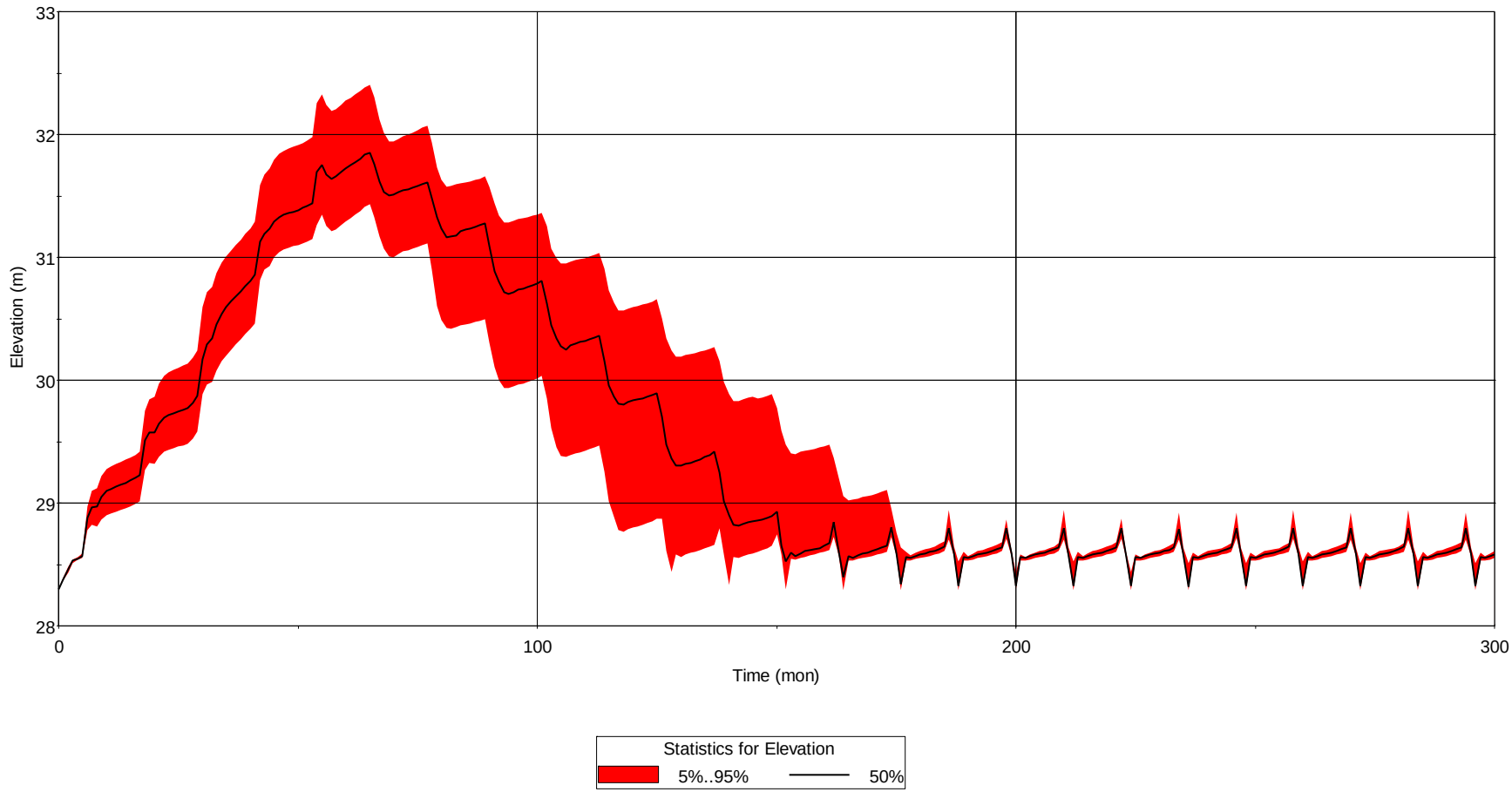
Water Management Schematic

Job No: 1CT022.000.410

Filename: Figure 1 Water Balance Schematic_SPB_lw.pptxx

Hope Bay Project

Date:	Approved:	Figure:
November 2014	SPB	1



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Madrid Advanced Exploration Project
Water Quality Prediction

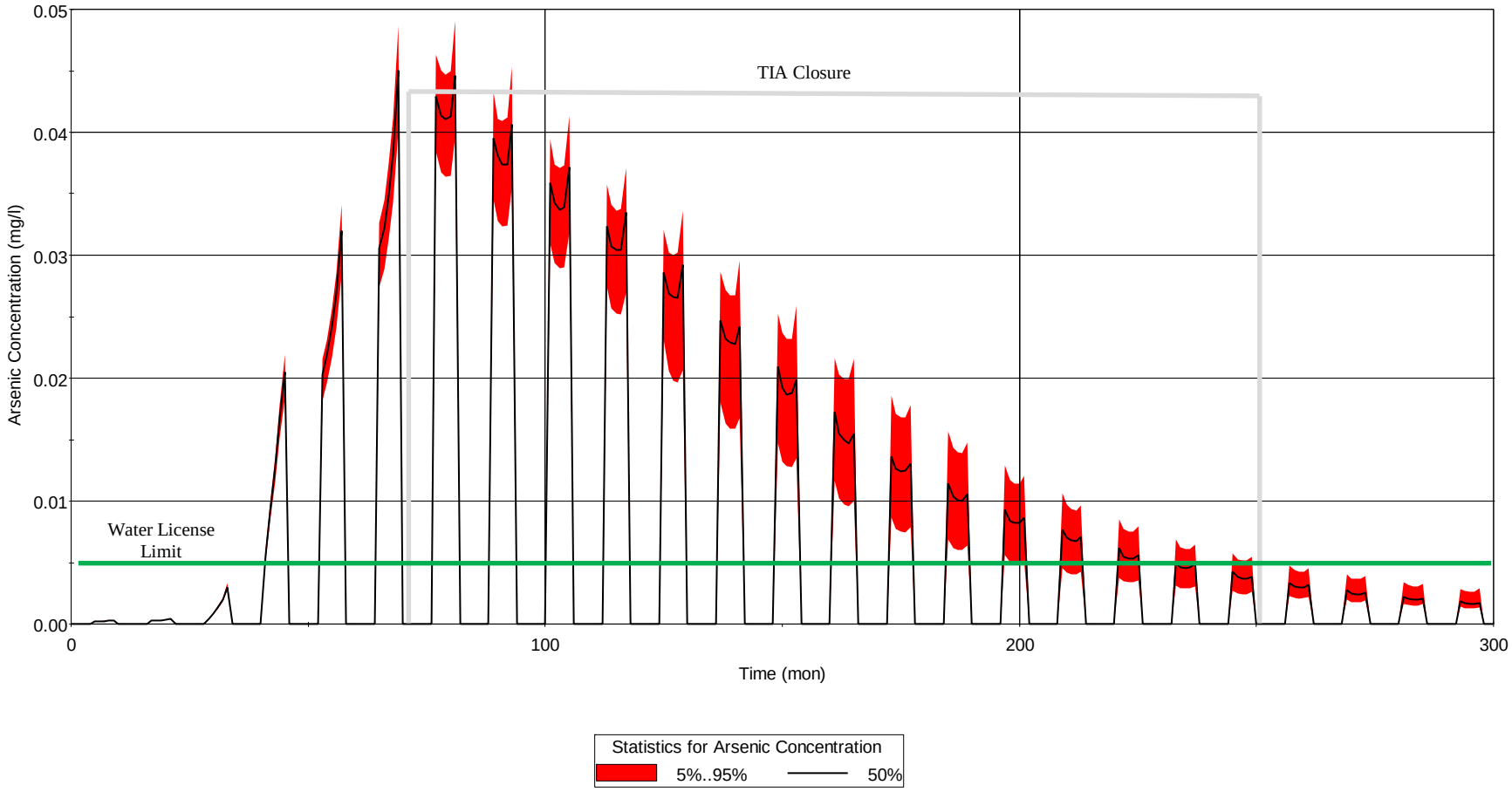
Tail Lake Water Elevation

Job No: 1CT022.000.410

Filename: Figure 2 Tail Lake Water Elevation.pptx

Hope Bay Project

Date:	Approved:	Figure:
November 2014	SPB	**2**



srk consulting	MAC RESOURCES	Madrid Advanced Exploration Project Water Quality Prediction
		Tail Lake Arsenic Concentration
Job No: 1CT022.000.410 Filename: Figure 3 Arsenic Concentration.pptx	Hope Bay Project	Date: November 2014 / Approved: SPB / Figure: **3**

Appendix 8

(for Chapter 8, Management Plans)

8-A SRK, December 2014 Memo – Water Management Plan: Madrid Advanced Exploration Program, North and South Bulk Samples

8-B SRK, December 2014 Memo – Overview of Madrid North and South Bulk Sample ML/ARD Characterization Programs and Conceptual Waste Rock Management Plans

8-C SRK, December 2014 – Hope Bay Project Quarry Management and Monitoring Plan - Revision 02

Appendix 8-A

SRK, December 2014 Memo – Water Management Plan: Madrid Advanced Exploration Program, North and South Bulk Samples

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Memo

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From:	Mark Liskowich	**Project No:**	1CT022.001.410
Cc:	Maritz Rykaart, SRK	**Date:**	December 1, 2014
Subject:	Water Management Plan: Madrid Advanced Exploration Program, North and South Bulk Samples		

1 Introduction

This plan is intended primarily for TMAC Resources Inc. staff and their contractors with the objective to ensure that best practices are employed throughout all water management activities associated with the operation and closure of the Madrid Advanced Exploration Program, Madrid North and South bulk samples, thus ensuring minimal potential environmental impacts.

There are no camp facilities at Madrid North or South bulk sample locations; therefore, potable water is limited to daily usage by the work force which will be transported to site from the Doris Camp on an as needed basis. All remaining water use will be limited to that needed to support mining the bulk samples. Water is needed to prepare brine for drilling in the underground workings. The goal of the water management system is to use intercepted contact water in preference to lake water for make-up water, and to maximize the mine contact water reuse within the underground workings.

This plan has been written in a manner allowing it to be appended to the Hope Bay Water Management Plan, following regulatory approval to proceed with the Madrid North and South bulk samples. This plan involves the collection and transportation of all excess water from the bulk samples via truck to Tail Lake Tailings Impoundment Area (TIA).

This plan does not include management of any water used or consumed as part of the surface exploration drill program which is covered under the standard terms and conditions of exploration licences issued by the Nunavut Water Board (NWB).

2 Background

From beginning to end, the bulk samples will require approximately 590 days or 20 months for the Madrid North bulk sample and approximately 520 days or 18 months for the Madrid South bulk sample.

In the case of the Madrid North bulk sample all waste and ore mining will be completed outside of the talik zone resulting with the production of relatively low volumes of mine water.

The Madrid South bulk sample will initially require approximately 260 days of development mining (waste rock) in order to reach the area of interest. Once the ore zone is reached, a combination of ore and waste mining will be carried out for an additional 260 days to the completion of the bulk sample. This latter phase of the Madrid South bulk sample is assumed to be in the talik zone and therefore is expected to generate the highest volumes of mine water.

3 Responsibilities

The overall responsibility for the implementation of this Water Management Plan rests with TMAC's General Manager of Operations. The general manager will be responsible to ensure that all necessary resources and personnel are made available to ensure that components of the water management plan such as pipelines, diversion berms, lined ponds, holding tanks are ready for operation prior to initiating the bulk sample mining activities.

Day-to-day operational responsibilities will be in accordance with those outlined in the Doris North Water Management Plan; however, it is expected the following will also apply.

The Manager of Environmental Compliance and the Environmental Coordinator will be responsible for reporting requirements related to all monitoring associated with all components of this plan, such as pond water volumes, as well as coordination with the surface foreman responsible for transporting water from the bulk sample sites to the TIA.

4 Infrastructure

Both the Madrid North and Madrid South bulk samples will occur at undeveloped sites with no existing infrastructure. An all-weather road will be constructed in order to access both sites. The following infrastructure will be required and constructed at both the Madrid North and Madrid South bulk sample sites:

- 1 Pollution Control Pond (Madrid North bulk sample site), 2 Pollution Control Ponds (Madrid South bulk sample site);
- Waste rock pile;
- Bulk sample ore stockpile;
- Laydown area, infrastructure pads and vent raise;
- Fuel storage area; and
- Mine portal.

The locations of these facilities are shown on Figures 1 and 2 for the Madrid North and Madrid South bulk sample sites, respectively.

4.1 Pollution Control Ponds

All water interacting with the above infrastructure will be collected in the Pollution Control Pond or ponds in the case of the Madrid South bulk sample and managed as described in Section 5.

The ponds at both bulk sample locations will be lined with a geomembrane and will act as sedimentation basins facilitating the settling of suspended solids. The runoff water captured by these ponds will either be used within the Brine Mixing Facilities (BMF) or transferred to the TIA.

4.1.1 Madrid North Bulk Sample

The single pond at the Madrid North bulk sample site will be located downstream of the portal, ore and waste rock pile pads as shown in Figure 1. The pond will be contained by a 6 m wide berm. This berm has been designed to allow for light vehicle access around the pond for regular inspection; to assist in accommodating any required maintenance; and to allow for a vacuum truck to remove any retained water. The surface area of the Pollution Control Pond is 13,900 m^2 and its maximum depth is 2.8 m.

The Pollution Control Pond will have the capacity to contain flow from the overall drainage area plus 25% of the annual snow coverage combined with a 100-year, 24-hour storm event or an approximate 14,940 m^3 in total. However, it is expected that this pond will always be operated in a manner allowing pumping to commence as soon as the containment volume is large enough for one continuous hour of pumping.

The run-off water captured by this pond will be used within the BMF or transferred to the TIA.

4.1.2 Madrid South Bulk Sample

The primary Pollution Control Pond will be constructed downstream of the waste rock and ore stockpiles and will be contained by an 8-m wide berm which will double as a roadway and allow for access around the pond and to the waste rock storage location as shown in Figure 2. The surface area of the primary Pollution Control Pond will be 12,300 m^2 and will have the capacity to contain flow from the overall drainage area plus 25% of annual snow coverage combined with a 100-year, 24-hour storm event (approximately 15,000 m^3 in total).

The secondary Pollution Control Pond will be contained by a 6-m wide berm located next to the Madrid South portal and the BMF. The berm was designed to allow for light vehicle access around the pond for regular inspection and to assist in accommodating any required maintenance. The secondary Pollution Control Pond will have the capacity to contain flow from the overall drainage area plus 25% of the annual snow coverage for an approximate total of 900 m^3. However, it is expected that this pond will always be operated in a manner allowing pumping to commence as soon as the containment volume is large enough for one continuous hour of pumping.

Operation of both primary and secondary ponds will be done in a manner that both ponds are maintained in a 90% empty state.

The run-off water captured by these ponds will be used within the BMF or transferred to the TIA.

4.2 Waste Rock Piles

As shown in Figures 1 and 2, the waste rock piles at each bulk sample sites will be located adjacent to the Pollution Control Ponds.

The Madrid North bulk sample waste rock pile has a base area of 21,530 m^2 and is designed to hold 285,000 m^3 of waste rock. The Madrid South bulk sample waste rock pile has a base area of 31,230 m^2 and is designed to hold a volume of 276,000 m^3 of waste rock.

All water coming into contact with the waste rock piles will be collected in the Pollution Control Ponds and managed in accordance with Section 5.

4.3 Bulk Sample Ore Stockpiles

The bulk sample ore stockpiles will be constructed adjacent to the waste rock piles (Figures 1 and 2). The Madrid North bulk sample ore stockpile is designed with a base of 5,560 m^2 and the ability to hold 28,000 m^3 (50,000 tonnes) of ore and the Madrid South bulk sample ore stockpile is designed with a base area of 12,200 m^2 and the capacity to hold 31,000 m^3 (55,000 tonnes) of ore.

All water coming into contact with the bulk sample stockpiles will be collected in the Pollution Control Ponds and managed in accordance with Section 5.

4.4 Laydown Area and Infrastructure Pads

4.4.1 Madrid North Bulk Sample

The Madrid North laydown area is located on the Portal Upper Pad (Figure 1). The Portal Pad provides a base for the Shop, Laydown Area, office trailers, the BMF and the storage of calcium chloride. The Vent Raise Pad provides a base for the vent raise, air heating facility and fuel containment.

Each of these facilities will be constructed and graded at 0.5% to collect and route all contact water to the Pollution Control Pond for collection, reuse and/or management as discussed in Section 5.

4.4.2 Madrid South Bulk Sample

The laydown area and infrastructure pads consist of the infrastructure pad, the portal pad, the upper portal pad and the vent raise pad. The infrastructure pad provides a base for the shop, fuel transfer station, laydown area and office trailers. The vent raise pad provides a base for the vent raise, air heating facility and associated fuel storage tank. The Upper Portal Pad provides a base

for the water tank. The Madrid South Portal Pad provides a base for the BMF and the storage of calcium chloride ($CaCl_2$) (Figure 2).

Each of these facilities will be constructed to collect and route all contact water to either the Primary or Secondary Pollution Control Pond for collection, reuse and/or management as discussed in Section 5.

4.5 Fuel Storage Area

At both the Madrid North and South Bulk Sample sites, fuel will be stored in two separate locations. One 75,000 L double-walled tank will be located adjacent to the Portal Pad Haul Road (Figure 1) at the Madrid North bulk sample site and one 75,000 L double-walled tank will be located on the infrastructure pad at the Madrid South bulk sample site (Figure 2). A second storage tank with a capacity of 60,000 L will be located on the vent raise pads associated with both the Madrid North and Madrid South bulk sample sites. These tanks will be placed in lined containment designed to hold 100% of the tank volume plus 10% of the fuel transport truck as well as 25% of annual snow cover combined with a 1-in-100 year 24-hour storm event.

A sump will be installed in one corner of each tank's containment to allow for collection and removal of runoff and snow melt that accumulates inside the containment. If seasonal accumulation of water meets discharge criteria it may be discharged to the tundra in the area of the fuel storage and/or used in activities, such as dust suppression if said approval is pre-approved.

4.6 Mine Portal

The mine portals will provide access to the underground workings and be used to recover all mine water from both bulk sample sites. The portal is located on Figures 1 and 2. All brine needed for drilling will be transported via pipeline from the BMF to the underground drilling equipment. Following settlement of suspended solids in the underground sumps the clarified water will be directly recycled from the sumps to the underground equipment and/or pumped to the BMF water supply tank which supplies raw water to the BMF for re-use in the underground workings. All runoff entering the mine portal will report to the underground sumps.

5 Water Management

Runoff from the waste rock piles, ore stockpiles and the site infrastructure pads will be collected in Pollution Control ponds and transferred to the 50,000 L water supply tank located at each bulk sample site. Supply water for the BMF will be drawn from this tank to create a brine to be used in underground operations. Additional freshwater for the BMF should only be needed when water already being used for drilling can no longer be recycled. When make-up water cannot be drawn from the Pollution Control ponds it will be drawn from Windy Lake in the case of the Madrid North bulk sample, and from Patch Lake in the case of the Madrid South bulk sample. All excess water collected in the Pollution Control ponds will be transported to the TIA.

5.1 Water Management during Operations

The sources of water during operations are runoff from site infrastructure pads, waste rock piles and ore stockpiles (collected in the Pollution Control ponds) and fresh make-up water drawn from either Windy or Patch Lake.

Water will be stored in a 50,000 L water supply tank located near the BMF.

During operations, the underground mine water demand will be supplied from three sources, as shown in Figures 3 and 4 and listed by priority of use below:

1. Reuse mine water collected in underground settling sumps;
2. Contact water from waste rock and ore stockpiles, collected in the Pollution Control ponds and directed to the 50,000 L tank as needed; and
3. Freshwater as make-up water from Windy Lake or Patch Lake.

It is estimated that there will be four underground drilling rigs used for the bulk sampling at the Madrid North and Madrid South bulk sample sites resulting in the use of 34 m^3 of water daily per site. Of this 34 m^3/d an estimated 6.7 m^3/d will be consumed and 27 m^3/d will be recycled. Water will initially be drawn from Windy Lake (in the case of the Madrid North bulk sample) and from Patch Lake (in the case of the Madrid South bulk sample) to make brine for drilling. Brine used underground will be reused to the maximum extent possible by settling solids in sumps underground. Some of the drilling brine will be lost in waste rock and ore, and additional make-up water will be required.

Contact water runoff from the pads, waste rock piles and ore stockpiles will be collected in the Pollution Control ponds. Once the ponds have filled to a 10% capacity the water will be pumped from the Pollution Control ponds to the 50,000 L water supply tank for the BMF at each of the bulk sample sites.

Water will be pumped from the supply tank through the BMF, and will be stored in a secondary containment structure within the BMF. This additional brine will be pumped underground and used by the underground drilling as needed.

If the Pollution Control ponds and underground settling sumps cannot meet the demand for brine, additional make-up water will be drawn from Windy Lake for the Madrid North bulk sample or from Patch Lake for the Madrid South bulk sample. When necessary the freshwater pumped from either lake will be done so utilizing a water truck. All intakes will be screened in accordance with guidelines published by DFO (1995).

Potable water will be limited to that used for drinking water. This water will be provisioned to each site from the Doris North water treatment facility on an as-needed basis. Water for washroom facilities and the emergency shower located at each of the bulk sample sites will be sourced from Windy Lake for the Madrid North bulk sample or from Patch Lake for the Madrid South bulk sample and will be provisioned by truck.

All grey water and sewage will be transported via truck from the bulk sample locations to Doris North for disposal in the Doris North Sewage Treatment Facility.

5.2 Excess Water Management

Excess water from the underground workings or the Pollution Control ponds will be managed in the following manner and as shown schematically on Figures 3 and 4.

Excess water accumulating in the Pollution Control ponds above 10% of the pond holding capacity that is not required as supply water for the BMF, will be transferred to trucks and hauled to the TIA.

The volume of water that will need to be transported to the TIA will vary depending on the season and the climatic conditions of the season (i.e., dry, average or wet year) and what point in the mining schedule each bulk sample is at.

5.2.1 Madrid North Bulk Sample

In the case of the Madrid North bulk sample the entire bulk sample should be completed without intersecting the talik zone therefore the major fluctuations in mine contact water volumes should be climate dependent. Table 1 provides anticipated monthly volumes and estimated water truck trips on an annual basis while mining the bulk sample under different climatic conditions.

Table 1: Bulk Sample Water Management Contact Water Volumes for Dry, Average and Wet Hydrologic Conditions (SRK 2014).

Phase	Month	Year	Madrid North Bulk Sample			Madrid South Bulk Sample		
			5th	50th	95th	5th	50th	95th
Madrid North Mining	4	3	0	0	0	0	0	0
	5	3	0	0	0	0	0	0
	6	3	8,586	11,546	16,204	0	0	0
	7	3	4,047	5,442	7,638	0	0	0
	8	3	1,254	1,686	2,366	0	0	0
	9	3	1,571	2,113	2,965	0	0	0
	10	3	417	555	779	0	0	0
	11	3	0	0	0	0	0	0
	12	3	0	0	0	0	0	0
	1	4	0	0	0	0	0	0
	2	4	0	0	0	0	0	0
	3	4	0	0	0	0	0	0
	4	4	0	0	0	0	0	0
	5	4	0	0	0	0	0	0
	6	4	8,135	11,592	16,741	0	0	0
	7	4	3,834	5,464	7,891	0	0	0
	8	4	1,188	1,693	2,445	0	0	0

Phase	Month	Year	Madrid North Bulk Sample			Madrid South Bulk Sample		
			5th	50th	95th	5th	50th	95th
	9	4	1,489	2,121	3,064	0	0	0
	10	4	391	557	805	0	0	0
	11	4	0	0	0	0	0	0
Madrid South Mining	12	4	0	0	0	0	0	0
	1	5	0	0	0	0	0	0
	2	5	0	0	0	0	0	0
	3	5	0	0	0	0	0	0
	4	5	0	0	0	0	0	0
	5	5	0	0	0	0	0	0
	6	5	8,748	11,569	16,741	6,721	8,888	12,863
	7	5	4,123	5,453	7,891	3,168	4,190	6,063
Madrid South Mining in Talik	8	5	1,277	1,689	2,445	16,200	16,517	17,097
	9	5	1,601	2,117	3,064	16,449	16,845	17,573
	10	5	420	556	805	15,542	15,646	15,837
	11	5	0	0	0	15,219	15,219	15,219
	12	5	0	0	0	15219	15,219	15,219
	1	6	0	0	0	15,219	15,219	15,219
	2	6	0	0	0	15,219	15,219	15,219
	3	6	0	0	0	15,219	15,219	1,5219
	4	6	0	0	0	15,219	15,219	15,219
Closure	5	6	0	0	0	0	0	0
	6	6	8,667	11,612	16,204	6,659	8,922	12,450
	7	6	4,085	5,473	7,638	3,139	4,205	5,868
	8	6	1,266	1,696	2,366	972.4	1,303	1,818
	9	6	1,586	2,125	2,965	1,219	1,633	2,278
	10	6	417	559	779	320	429	598
	11	6	0	0	0	0	0	0
	12	6	0	0	0	0	0	0
	1	7	0	0	0	0	0	0
	2	7	0	0	0	0	0	0
	3	7	0	0	0	0	0	0
	4	7	0	0	0	0	0	0
Peak Volume (m^3/month)			8,748	11,612	16,741	16,449	16,845	17,573
Peak Daily Truck Traffic (trucks/day)			6	8	11	11	11	12

5.2.2 Madrid South Bulk Sample

It is anticipated that much of the waste and ore mining at the Madrid South bulk sample will occur in the talik zone. The initial ±260 days of mining will be developed in waste rock which is anticipated to be outside of the talik zone and therefore be relatively dry. The final ±260 days of mining is expected to be within the talik and therefore responsible for the production of the majority of the groundwater encountered during the Madrid South bulk sample program. Table 1 provides anticipated monthly volumes and estimated water truck trips on an annual basis while mining in the different zones (with or without groundwater) and under different climatic conditions.

5.3 Water Management at Closure and Temporary Closure

In the case of temporary mine shut down, or permanent closure, mine contact water will be managed as excess water described in Section 5.2. Any remaining waste rock or ore remaining on the stockpiles will either be transported to the Doris North Project or covered in place with a HDPE liner to eliminate contact, or some combination of both management approaches.

Runoff from the site infrastructure pads, waste rock piles and ore stockpiles will be collected in the Pollution Control ponds for settling. The water collected in the ponds will be tested and if it meets discharge criteria it will be discharged to the tundra. Water not meeting the discharge guidelines will be transported via truck to the TIA as described in Section 5.2 (Figure 5).

Subsequent to the water quality meeting all discharge limits, the site infrastructure will be decommissioned and reclaimed as described in the Madrid Advanced Exploration Program: Conceptual Closure and Reclamation Plan (SRK 2014).

6 Inspections

Daily visual inspections of all pads and dykes located throughout the bulk sample infrastructure areas will be completed by operations or environmental staff. These inspections will look for the following types of issues:

- Drainage channels have not been inadvertently blocked or re-routed in a manner that could alter the intended routing of the runoff to the Pollution Control ponds.
- Signs of erosion, occurring during high flow periods.
- Volumes of water in the Pollution Control ponds.
- Any irregularities identified during the visual inspections will be recorded in field books and immediately relayed to the General Manager of Operations and/or the Engineering, Procurement and Construction (EPC) Manager in order to ensure immediate corrective action can be implemented.

7 Monitoring

The Pollution Control ponds will be constructed with permanent staff gauges to allow for visual monitoring of incoming flows to each pond. Daily volumes will be recorded in a dedicated log book for each pond. These log books should be maintained by the operations or environmental staff. The volume of all water transferred from the Pollution Control ponds either to the BMF or to the TIA will be monitored with a flow meter or tracked by truckload as appropriate during the transfers.

Pond water quality in the Pollution Control ponds will be monitored in accordance with the Water Licence.

The Site General Manager and operations are responsible for monitoring.

All sampling procedures and QA/QC activities will follow those documented in the SNP requirements stipulated in the Water Licence.

8 Reporting

In accordance with the approval to proceed with the Madrid North and Madrid South bulk samples, a construction monitoring report will be prepared documenting the construction of all infrastructure at each site.

The report will include, but not necessarily be limited to the following:

- A summary of all inspections conducted during construction, and
- Updated “As-built” drawings of the constructed infrastructure.

All inspection and monitoring data will be compiled, documented and incorporated into the existing monthly and annual monitoring reports submitted to the Board. These reports will include, but not be limited to:

- An assessment of data to identify areas of non-compliance; and
- A site water balance incorporating water volumes transferred from the Pollution Control Ponds to the BMF and/or volumes trucked to the Doris North TIA.

Disclaimer—SRK Consulting (Canada) Inc. has prepared this document for TMAC Resources Inc.. Any use or decisions by which a third party makes of this document are the responsibility of such third parties. In no circumstance does SRK accept any consequential liability arising from commercial decisions or actions resulting from the use of this report by a third party.

The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

9 References

DFO 1995, Freshwater Intake End-Of-Pipe Fish Screen Guideline, DFO / 5080, March 1995.

SNC-Lavalin, 2009. Hope Bay Mining Limited. Doris North Infrastructure Project. Fresh Water Supply Pipeline (Permanent) Plan, Profile & Section. As-Built Drawings Prepared for Newmont Mining Corporation. Project Number 334499, January 26, 2009.

SRK Consulting (Canada) Inc. 2014, Hope Bay Project: Madrid Advanced Exploration Program: Conceptual Closure and Reclamation Plan. Technical Memorandum prepared for TMAC Resources Inc., Project No.: 1CT022.001.410. October 31 2014.

SRK Consulting (Canada) Inc. 2014b. Hope Bay Project: Madrid Advanced Exploration Project Water Quality Prediction. Technical Memorandum prepared for TMAC Resources Inc., Project No.: 1CT022.001.410. November 5, 2014.

Figures

Dam Height ~3m

Berm Crest el. 60.8m tied into rock face creates a pond (el. 60.5m) with a volume of 15,100 cu.m.
Required Containment Volume = 14,940 cu.m.

Pollution Control Pond Surface Area = 13,900 m 2
Max. Depth = 2.8m

Waste Rock Pile
3H:1V Reslope Footprint

Waste Rock Pile Crest at el. 77m (Base at ~64m)
Design Capacity = 285,000 t (158,500 m 3)
Available Capacity = 427,500 t (240,000 m 3)

Watershed Divide

Ore Stock Pile Crest at el. 76.0m placed on a 1m pad (pile ~11m high)
Design Capacity = 50,000 t (28,000 m 3)
Available Capacity = 75,000 t (41,700 m 3)

Fuel Storage Facility Pad at 69.8m Elevation

Fuel Storage Facility
(See Dwg MNP-06)

Culverts
(See Detail 6 on Dwg MNP-11)

Doris-Windy
All-Weather Road

Doris Camp

Windy Camp

Pond at El. 60.5m

Lined Pond Area

Waste Rock Pad
(1m min.)

Surface Water
Runoff

1000 sq.m.
Laydown Area

Portal Pad Haul Road
(9.5m width)

Contact
Water Runoff

Pond Access Road

Portal Upper Pad
at El. 67m

Shop (15x30m)

Compressor Building (5x5m)

Emergency Trailer (3x10m)
ATCO Office Trailer (3x10m)

Diesel Generator (Seacan)

50,000L Water Storage Tank with Containment

$CaCl_2$ Laydown

Brine Mixing Facility

Portal Lower Pad
at El. 65m

Portal

Windy
Lake

-4.6%
-3.0%
-0.5%
-0.5%

0+448
0+400
0+350
0+300
0+250
0+200
0+150
0+100
0+050
0+000
0+101
0+150
0+200
0+243
0+050
0+000
8+400
8+410

432500 E
432600 E
432700 E
432800 E
432900 E
433000 E
433100 E

7551100 N
7551000 N
7550900 N
7550800 N

67.5
75.0
55.0
60.0
61.0
62.0
62.5
63.0
63.5
68.5
69.0
68.0

A MNP-09
B MNP-09

N

NOTES

1. All dimensions in metres unless noted otherwise.
2. Notes in this drawing apply to all other active drawings.

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Scale in Metres

srk consulting

SRK JOB NO.: 1CH022.001
FILE NAME: 1CT022.001_MNP-Figure1.dwg

TMAC RESOURCES

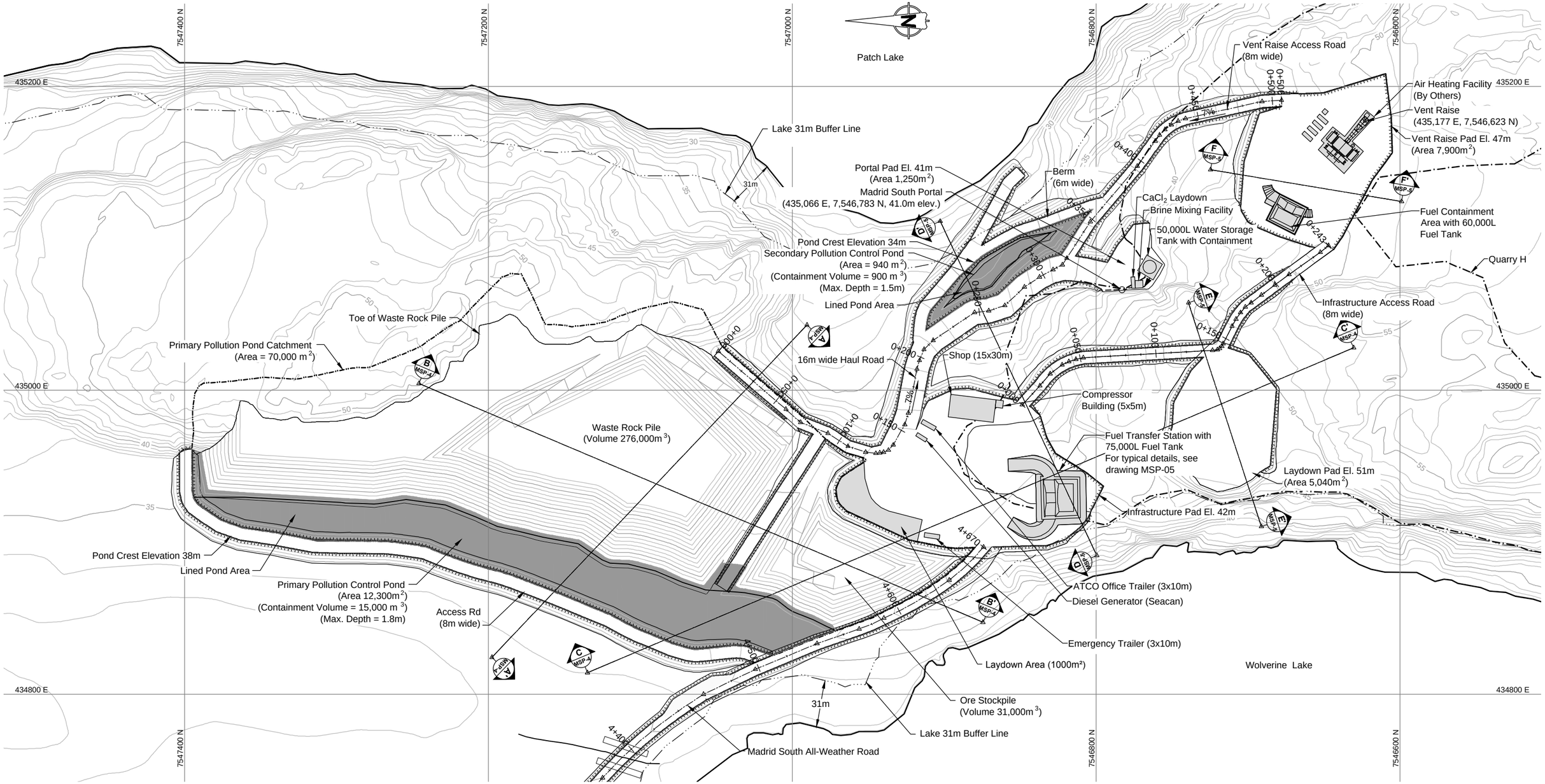
HOPE BAY PROJECT

Surface Water Management

Madrid North Site Layout Portal

DATE:	APPROVED:	FIGURE:
Oct. 2014	ML	1

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LEGEND

- Proposed Quarry Boundary
- Water Line
- Pollution Pond Catchment

NOTES

1. The design of the Madrid South Portal and Vent Raise is based on topographic contour information provided by HBML and is derived by 2007 aerial photography.
2. Contours are shown in 1m intervals.
3. The co-ordinate system is UTM NAD 83, Zone 13.
4. All dimensions are in metric units, unless specifically mentioned.
5. Notes in this drawing apply to all other active drawings.

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Scale in Metres

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SRK JOB NO.: 1CH022.001
FILE NAME: 1CT022.001_MSP_Fig1.dwg

TMAC RESOURCES

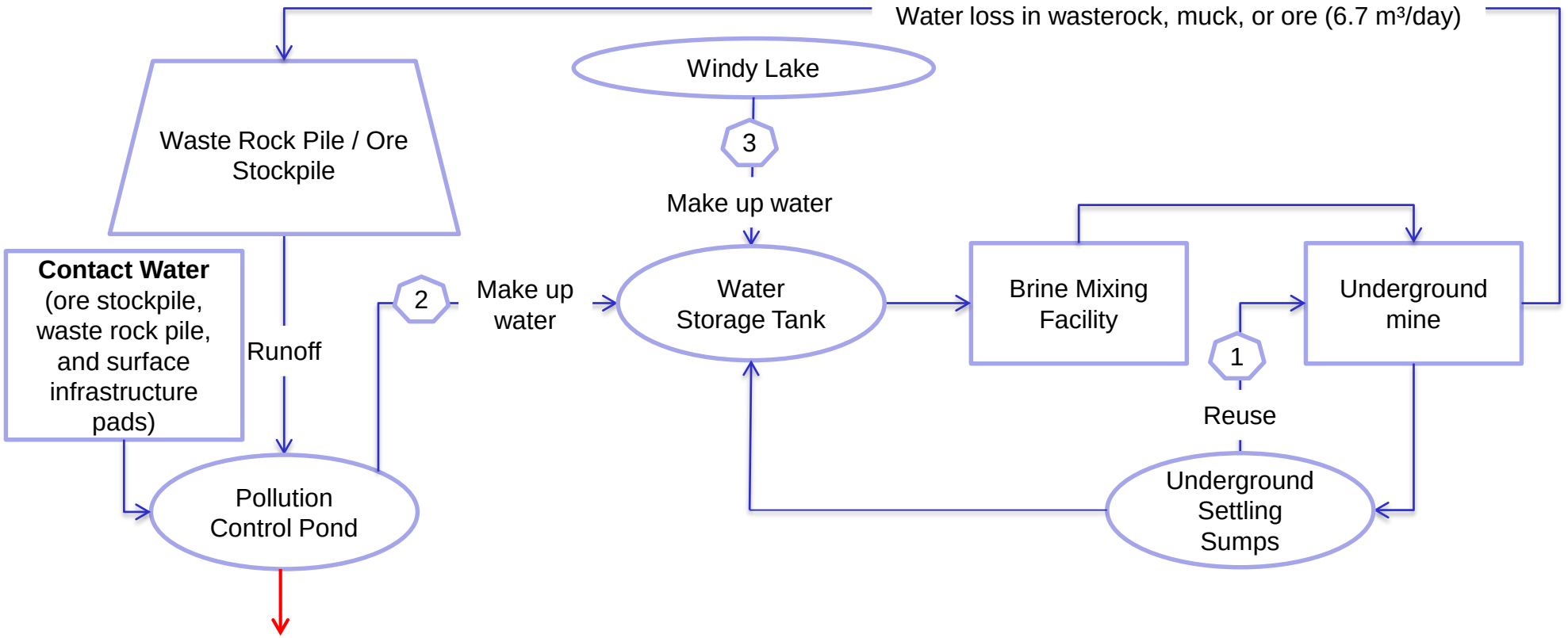
HOPE BAY PROJECT

Surface Water Management

Madrid South Site Layout

DATE:	APPROVED:	FIGURE:
Oct. 2014	ML	2

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Water Source Priority

Excess Water Flow Path

Mine Water Loss

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Madrid Advanced Exploration Project
Water Management Plan

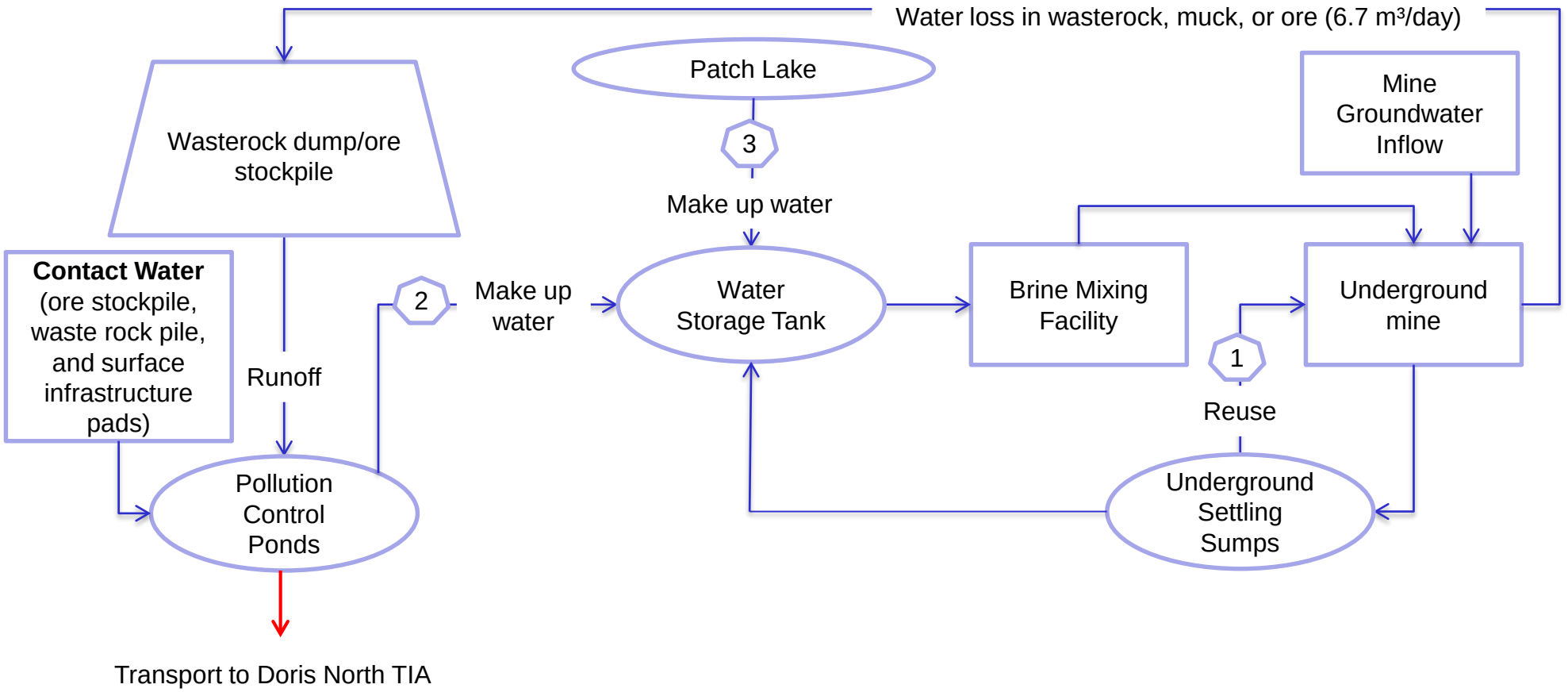
Operations Water Management Schematic Madrid North

Job No: 1CT022.001

Filename: Water_Management_Schematic_1CT022_MWL_North_and_South_rev9.pptx

Hope Bay Project

Date:	Approved:	Figure:
October 2014	TRS	3



Water Source Priority

Excess Water Flow Path

Mine Water Loss

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Job No: 1CT022.001

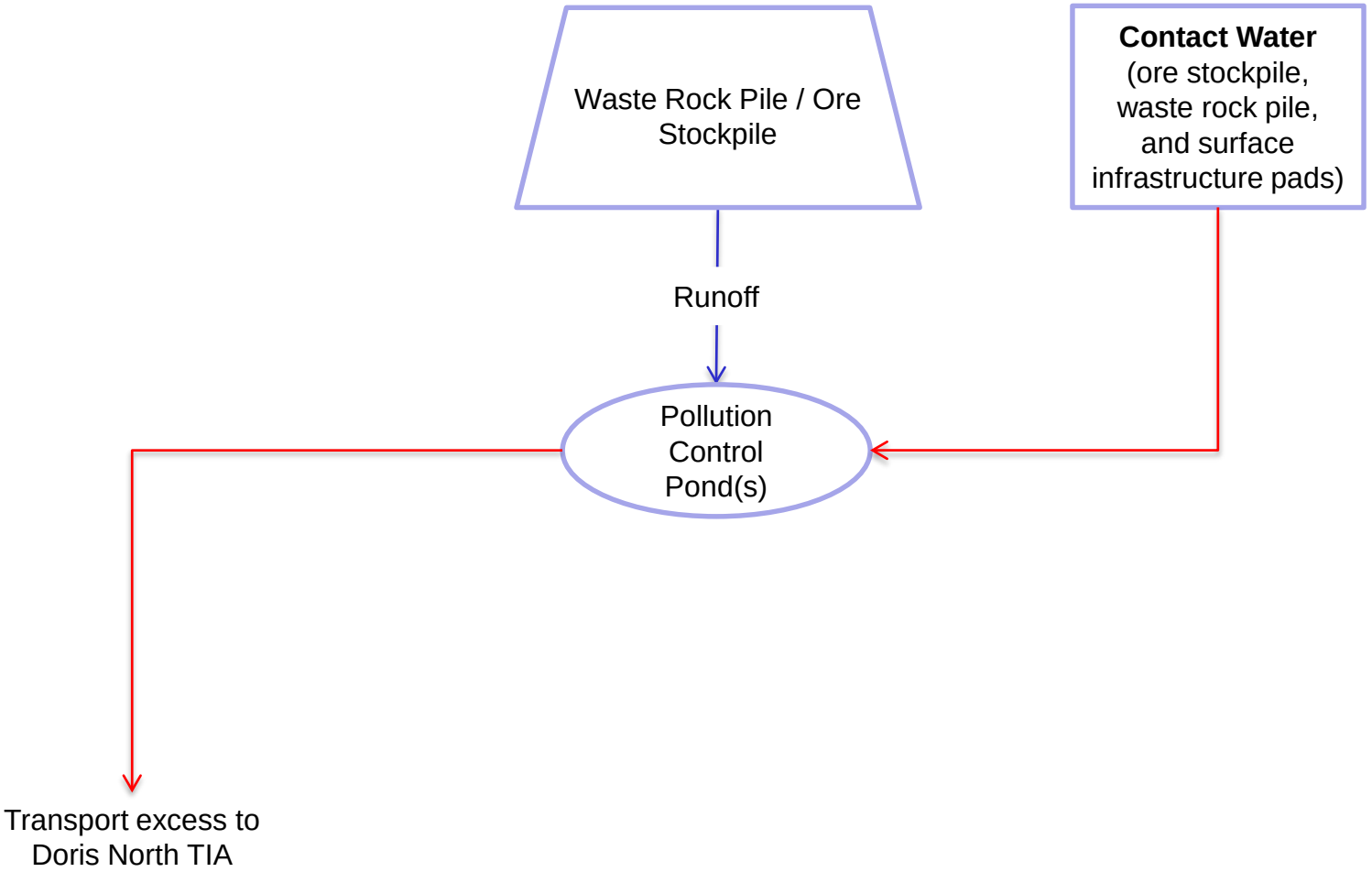
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Hope Bay Project

Madrid Advanced Exploration Project
Water Management Plan

Operations Water Management Schematic Madrid South

Date:	Approved:	Figure:
October 2014	TRS	**4**



Excess Water Flow Path

Mine Water Loss

srk consulting

MAC RESOURCES

Job No: 1CT022.001

Filename: Water_Management_Schematic_1CT022_MWL_North_and_South_rev9.pptx

Hope Bay Project

Madrid Advanced Exploration Project
Water Management Plan

Closure or Temporary Closure Water Management Schematic Madrid North and South

Date:	Approved:	Figure:
October 2014	TRS	**5**

Appendix 8-B

SRK, December 2014 Memo – Overview of Madrid North and South Bulk Sample ML/ARD Characterization Programs and Conceptual Waste Rock Management Plans

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Memo

To:	John Roberts	**Client:**	TMAC Resources
From:	Lisa Barazzuol	**Project No:**	1CT022.001.400
Cc:	Dave King, TMAC Paul Christman, TMAC Kelly Sexsmith, SRK	**Date:**	December 11, 2014
Subject:	Overview of Madrid North and Madrid South Bulk Sample ML/ARD Characterization Programs and Conceptual Waste Rock Management Plans		

1 Introduction

TMAC Resources Inc. is advancing exploration and development on a number of gold deposits in the Hope Bay belt, Nunavut, Canada (Figure 1), including those at the Madrid Advanced Exploration Project, which includes the Madrid North (Naartok) and Madrid South (Patch 14/Wolverine) deposits. TMAC is planning a bulk sample program from Madrid North and Madrid South and will require a Type B water license for this activity. In support of both the engineering studies and the water licence application, SRK Consulting (Canada) Inc. was asked to compile all of the relevant geochemical information on these deposits and to provide input towards the waste and water management plans.

The purpose of this memorandum is to provide a conceptual waste rock management plan for the Madrid Advanced Exploration Project. The conceptual waste rock management plans are based on the results for the Madrid North and Madrid South geochemical testing program (SRK 2012 and 2014a) and the mine plans provided by TMAC for the bulk sample, which will be accessed by underground workings (Figure 2 and Figure 3).

This memorandum presents an overview of the geochemical findings for waste rock and ore that would be produced as part of the proposed bulk sample underground activities at Madrid North (SRK 2014a) and Madrid South (SRK 2012). A conceptual waste rock management plan for each of the Madrid North and Madrid South bulk sample programs is also presented.

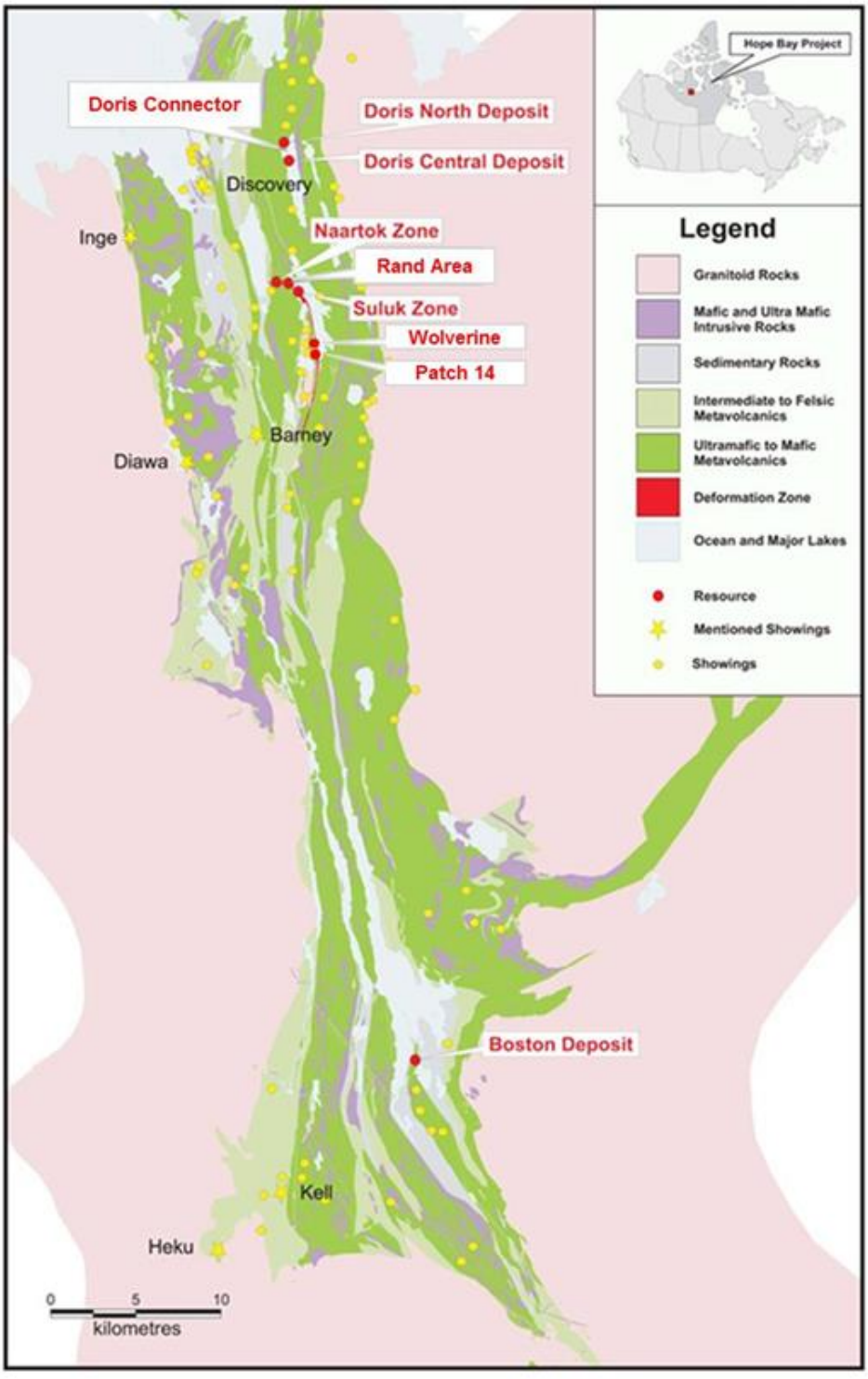


Figure 1: Geology of the Hope Bay Belt and Location of the Main Deposits. The location of the Madrid North bulk sample is labelled as Naartok Zone.

551000.0Y

550800.0Y

550600.0Y

550400.0Y

32800.0X

33000.0X

33200.0X

33400.0X

33600.0X

33800.0X

Madrid North Portal Area

08PMD669

06PMD484

07PMD610

08PMD670

12c

11c

05PMD310

PMD165

PMD144

PMD114

PMD143

05PMD293

PMD146

06PMD470

08PMD668

PMD117

PMD097

PMD093

PMD147

05PMD291

04PMD272

PMD125

PMD129

05PMD352

PMD135

PMD138

PMD119

PMD126

05PMD301

PMD123

PMD094

PMD096

Note: For figure clarity, only drill holes with ABA samples are shown.

Legend

Rock Types (LCODE)

- 1
- 1 (mixed)
- 5
- 5 (mixed
- 2
- 7a
- 7a (mixed)
- 11c
- 12c
- 13a

09PSD209 ARD Sample Interval

Drillhole collar

Non ARD Interval

UG Design

0 20 40 60 80 100

Scale in Metres

srk consulting

SRK JOB NO.: 1CT022.001.400.10

FILE NAME: MadridNorthBulkSampleGeochemPlan.dwg

TMAC RESOURCES

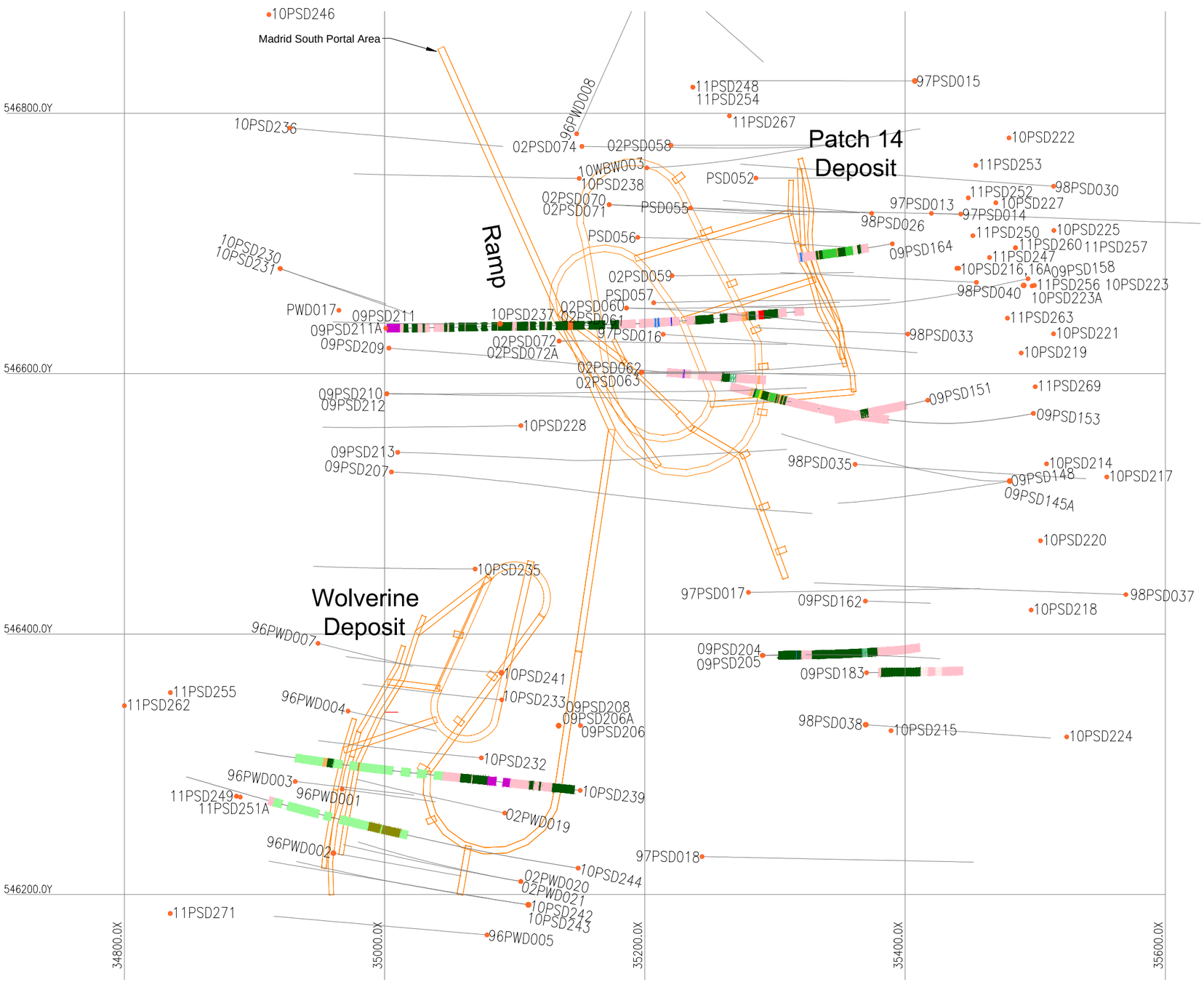
HOPE BAY PROJECT

Geochemical Characterization of Waste Rock, Madrid North Bulk Sample Application, Hope Bay

Madrid North Mine Plan for Bulk Sample and Distribution of Geochemistry Data Set

DATE:	APPROVED:	FIGURE:
June 2014	LNB	2

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Legend

Rock Types (LCODE)

- 1
- 1 (mixed)
- 1 w. 12q
- 2
- 3
- 7a
- 7ac (mixed)
- 9
- 9 w. 12q
- 10a
- 10b
- 12c
- 12q
- 12q (mixed)
- 13a

09PSD209 ARD Sample Interval

Drillhole collar

Non ARD Interval

UG Design

0 20 40 60 80 100
Scale in Metres

srk consulting

SRK JOB NO.: 1CT022.001.400.10

FILE NAME: BulkSampleGeochemPlan.dwg

MAC RESOURCES

HOPE BAY PROJECT

Geochemical Characterization of Waste Rock, Madrid South Bulk Sample Application, Hope Bay

Madrid South Mine Plan for Bulk Sample and Distribution of Geochemistry Data Set

DATE:	APPROVED:	FIGURE:
June 2014	LNB	3

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2 Overview of ARD/ML Characterization Programs

2.1 Madrid North

SRK (2014a) provided an assessment of the acid rock drainage and metal leaching (ARD/ML) potential of waste rock and ore that would be produced as part of the proposed bulk sample underground activities at Madrid North. The characterization program was conducted on behalf of Hope Bay Mining Ltd. (HBML) and was designed based on an open pit concept. SRK has reassessed the relevance of the existing Madrid North geochemical database with respect to TMAC's bulk sample mine plan and determined that the sample set provides sufficient coverage (both spatially and geologically) of TMAC's mine plan. Accordingly, the sample set formed the basis of the geochemical interpretations and conclusions presented in SRK (2014a), and the waste rock management plan presented herein. This section presents an overview of the geochemical characterization program.

2.1.1 Testing Programs

The Madrid North geochemical sample set consists of 186 samples (Table 1). The distribution of the sample set relative to TMAC's proposed underground workings for the bulk sample is presented in Figure 2. All 186 samples were characterized for acid-base accounting (ABA) and trace element content and 166 samples were analyzed for mineralogy (by XRD). The geochemical database also included 18 humidity cell tests and six barrel tests relevant to the Madrid North bulk sample. Further details about the sample set, selection rationale and analytical methods are provided in SRK (2014a).

Based on the mine plan, the most volumetrically significant waste rock type is mafic metavolcanics (1). The ore is also hosted in the mafic metavolcanics (1). Sedimentary units (5), early gabbro (7a) and diabase (11c) are volumetrically less significant waste lithologies that are projected to be intersected by the mine workings based on the geological logging. Similarly, it is expected that there would be minimal amounts of waste rock from the deformation zone (13a), which is located adjacent to some of the stopes. The other rock types listed in Table 1 are less prevalent in the deposit (and sample set). Similarly, the sample sets for sedimentary units (5), early gabbro (7a), diabase (11c) and defomation zone (13a) have fewer than ten samples. All data are presented though interpretations will focus on the rock types most relevant to the mine plan.

Table 1: Distribution of ABA Sample Set According to Rock Type

Description	Category	Lithology Code	Preliminary Economic Classification	No. of Samples
Ultramafic to Mafic Metavolcanic Rocks	1	1a, 1pv, 1p, 1u	Waste	96
			Ore	22
			Waste/Ore	7
Mixed Ultramafic to Mafic Metavolcanic Rocks	1 mixed	1a, 1pv, 1p, 5a, 7a, 9, 13a	Various[1]	20
Intermediate Metavolcanic Rocks	2	2p	Waste	3
Sedimentary Units (Argillite)	5	5a	Waste	5
	5 mixed	5a, 1a, 1pv	Various[2]	3
Early Gabbro	7a	7a	Various[3]	6
	7a mixed	7a, 5a, 1pv	Waste	2
Diabase	11c	11c	Waste	1
Carbonate Vein	12c mixed	12c, 1a	Waste	1
Deformation Zone	13a	13a	Waste	20
Total				186

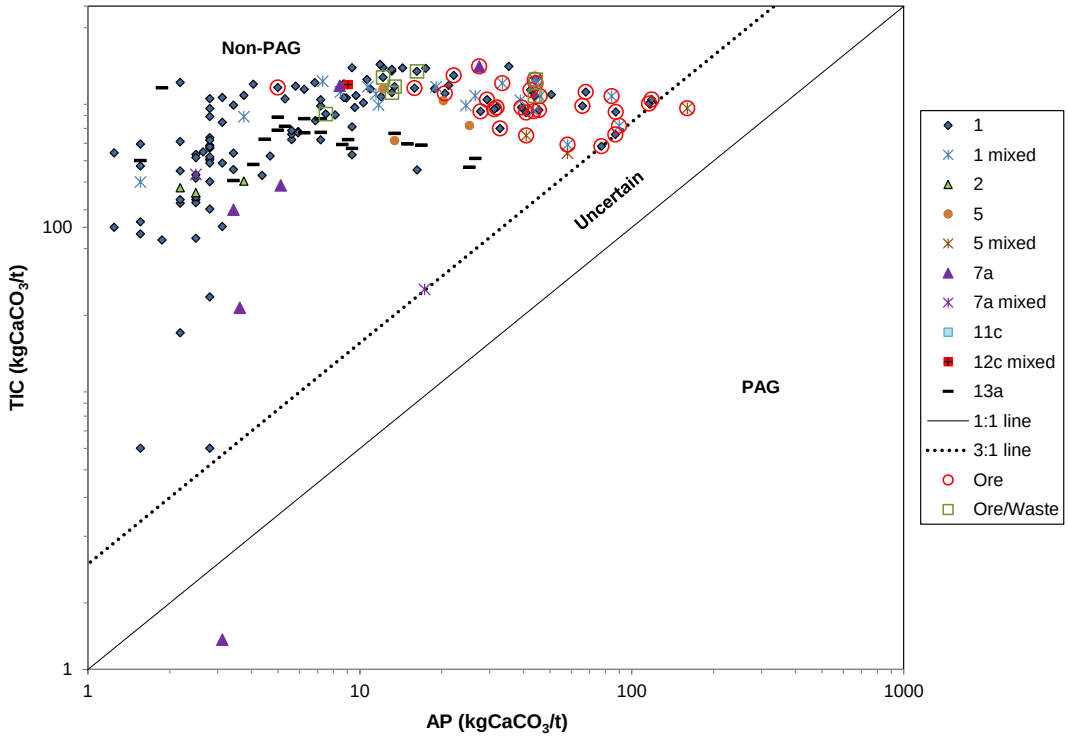
Source:\\van-svr0\projects\01_SITES\Hope.Bay\1CH008.005_Geochemistry (Doris, Madrid, Boston)\3.ABA data\201404_NaartokReport_TypeB_WL\Working File\[Hope Bay MASTER Geochemical Spreadsheet_Rev33_Naartok.xlsx]

Note:

[1] Category 1 mixed is comprised of samples classified as waste (n=8), ore (n=8) and ore/waste (n=4).
[2] Category 5 mixed is comprised of samples classified as waste (n=1) and ore (n=2)
[3] Category 7 is comprised of samples classified as waste (n=5) and ore (n=1).

2.1.2 Static Test Results and Mineralogy

The potential for acid rock drainage is considered to be low for the majority of the waste rock from the Madrid North bulk sample. The waste rock sample set was typically characterized by low sulphur levels where 90% of samples have total sulphur levels less than 0.5%. The ABA data indicate that the waste rock is primarily classified as non-PAG due to nearly ubiquitously high carbonate content. Early gabbro (7a) with low amounts of both sulphide and neutralization potential has the potential to be PAG (Figure 4). Also based on the humidity cell test samples, the static test data indicated the sedimentary units (5) with high sulphide content was classified as uncertain potential for ARD (Table 2). Volumetrically, both rock types are projected to be relatively minor - approximately 8% based on the distribution of these samples in the ABA sample set, which is assumed to be reasonably representative of the rock intersected by the bulk sample. In the event localized ARD is produced from sedimentary units and/or early gabbro, it is anticipated that the high carbonate content in the overall waste rock stockpile would provide sufficient buffering capacity, and that the overall drainage from the stockpile would remain neutral to alkaline.



P:\01_SITES\Hope.Bay\1CH008.005_Geochemistry (Doris, Madrid, Boston)\3.ABA data\201404_NaartokReport_TypeB_WL\Working File\[Hope Bay MASTER Geochemical Spreadsheet_Rev33_Naartok.xlsx]

Figure 4: Comparison of TIC and AP, Madrid North

In general, ferroan dolomite was the most abundant carbonate mineral (median concentrations ranging from below detection to 45%). Calcite, magnesite, magnesite-siderite and siderite occurred less frequently and were present in significantly lower levels as compared with ferroan dolomite.

All the significant rock types contained samples with elevated solid-phase arsenic. Overall highest arsenic levels were exhibited for samples of sedimentary units (median levels greater than 400 ppm). Samples of mafic volcanics and early gabbro contained median arsenic levels of approximately 35 ppm, while median levels for diabase and deformation zones samples were 3 ppm and 74 ppm, respectively. Compared to other Hope Bay deposits, the arsenic content of mafic volcanics from Madrid North is lower than samples from Boston but higher than samples from Madrid South and Doris.

2.1.3 Kinetic Test Results

Selected geochemical attributes of the eighteen humidity cell tests relevant to the Madrid North bulk sample are presented in Table 2. At the time of sample selection, an open pit mine was proposed for the Naartok, Rand and Suluk areas (SRK 2014a). Accordingly, sample selection included all of the aforementioned areas. TMAC's current Madrid North bulk sample mine plan focusses on an underground development of Naartok only. On the basis of geology and static testing results, kinetic tests (e.g., humidity cell tests) from each of the aforementioned deposit areas are assumed to be representative of all areas for the purpose of water quality predictions.

All humidity cell tests had leachates with neutral pH. Sulphate concentrations were initially high and decreased rapidly, with the exception of HC-26 and HC-28 (both mafic volcanic, ore) and HC-21 (sedimentary unit). HC-26 and HC-21 are both "high" sulphide[1] samples whereas HC-28 is a "typical" sulphide sample. For these three samples, after an initial decrease, sulphate levels trended upward before levelling out to approximately 20 mg/L (HC-28), 50 mg/L (HC-21) and 80 mg/L (HC-26).

Arsenic and nickel were the only elements that exhibited noteworthy trends in concentrations and leaching rates. Stable sulphate, arsenic and nickel release rates are presented in Table 2. The humidity cell arsenic stable[2] release rates were variable with values varying over four orders of magnitude (Table 2). The highest arsenic leaching rates (0.2 to 0.3 mg/kg/week) were observed in HC-20 (sedimentary unit) and HC-41 (early gabbro) HC-27 (mafic metavolcanic, waste) and HC-24 (mafic volcanic, ore), but release rates were less than 0.01 mg/kg/week in most other samples. High levels of arsenic leaching appeared to be related to the occurrence of the trace mineral gersdorffite ((Fe,Co,Ni)AsS). Those humidity cell samples containing detectable levels of the trace mineral gersdorffite tended to have the highest stable arsenic release rates (Table 2) suggesting a possible relationship.

As with arsenic, nickel stable release rates were variable. Samples HC-20 (sedimentary unit) and HC-26 (mafic metavolcanics, ore) exhibited the highest rates of stable nickel release (0.02 and 0.002 mg/kg/week, respectively). Samples containing the mineral gersdorffite tended to have higher nickel release suggesting that nickel leaching may be related to the presence of gersdorffite.

There are six barrel tests relevant to the Madrid North bulk sample. Three of the barrels contained mafic metavolcanics (1) and there was one each with a mixture of sedimentary units mixed with mafic metavolcanics (5+1), mixed early gabbro (7a mixed) and deformation zone (13a).

The pHs for the barrel tests were alkaline, with field and lab values typically between 8 and 8.5. Antimony, arsenic, cobalt and nickel release rates were higher for the sample containing sedimentary units (5+1) and to a lesser degree deformation zone (13a).

The kinetic test results suggest that arsenic and nickel leaching under neutral pH conditions is expected from materials containing the trace mineral gersdorffite. As there is no practical means of identifying gersdorffite during mining, waste rock cannot be segregated and managed according to arsenic and nickel leaching characteristics.

[1] Assessed based on the assessment of the stability of sulphate release.

Table 2: Selected Humidity Cell Test Results Relevant to the Madrid North Bulk Sample

Humidity Cell #	Rock Type[1]	Total Sulpur	Preliminary Economic Classification	Static Test Results								Kinetic Test Results				
				Total	NP	TIC	NP/AP	TIC/AP	Arsenic	Nickel	Gersdorffite (Fe,Co,Ni)AsS	pH		Stable Release Rates		
														SO_4	As	Ni
		% Rank[2]			kg $CaCO_3$/t				ppm		%	min	max	mg/kg/week		
HC-3	1	62%	W	0.17	146	165	27.5	31.0	6.7	68	--	7.5	9.1	0.7	0.0008	0.00005
	1	58%	W	0.12	145	148	38.3	39.1	4.1	75	--					
HC-9	1	19%	W	0.07	131	146	59.9	66.6	2.6	65	bd	7.9	9.3	0.7	0.0002	0.00006
HC-27	1	61%	W	0.15	244	310	52.1	66.1	122	141	0.01	8.5	9.5	1.3	0.2	0.0006
HC-25	1	91%	W	0.40	239	321	19.2	25.7	108	145	0.01	7.8	9.5	2.1	0.07	0.0008
HC-8	1	11%	mixed	0.26	250	335	30.7	41.2	115	479	0.01	7.5	9.5	2.2	0.01	0.0001
	1	12%	mixed	0.35	270	303	24.9	27.9	93	493	--					
HC-28	1	57%	O	1.31	262	330	6.4	8.1	433	131	0.02	8.1	9.3	10	0.08	0.00090
HC-26	1	>100%	O	3.93	294	367	2.4	3.0	628	394	0.02	7.3	8.8	25	0.007	0.002
HC-24	1	76%	O	2.17	337	409	5.0	6.0	630	264	0.03	7.7	9.1	3.1	0.2	0.001
HC-20	5	>100%	W	3.30	214	246	2.1	2.4	1070*	651*	0.09	7.4	8.9	3	0.3	0.02
HC-21	5	>100%	W	3.45	143	195	1.3	1.8	86.0	76	bd	7.5	8.3	41	0.0002	0.0002
HC-40	7a	25%	W	0.11	114	120	33.3	34.9	7.1	115	bd	7.7	9.9	1.1	0.002	0.00003
HC-41	7a	100%	W	0.27	321	437	38.0	51.7	273	183	0.03	8.1	9.2	2	0.3	0.0009
HC-22	11c	100%	W	0.02	22	11	35.3	17.4	3.1	25	bd	7.5	10.0	2.2	0.0006	0.0001
HC-23	11c	>100%	W	0.07	33	35	14.9	16.0	27	52	bd	8.1	9.9	1.5	0.001	0.00002
HC-5	13a	24%	W	0.16	215	242	42.9	48.4	73	45	<0.01	7.5	9.1	0.9	0.04	0.0002
	13a	60%	W	0.24	203	269	27.4	36.4	93	49	--					
HC-29	13a	39%	W	0.19	316	403	53.2	67.9	77	122	0.01	7.9	9.7	1.0	0.06	0.0005
HC-39	13a	94%	W	0.54	191	235	11.3	13.9	64	24	<0.01	7.3	9.1	2	0.003	0.0003
HC-30	13a	94%	W	0.55	300	419	17.5	24.4	2.0	306	--	8.0	9.2	4	0.0002	0.00003

Source: P:\01_SITES\Hope.Bay\1CH008.005_Geochemistry (Doris, Madrid, Boston)\3.ABA data\201404_NaartokReport_TypeB_WL\Working File\[HB_WR_Outcomes.mc.REV14_MadridNorth_Rev02.xlsx]

Notes:
[1] Rock codes: 1 = mafic volcanics; 5 = sedimentary rocks; 7a = early gabbro; 11c = diabase; 13a = deformation zone.
[2] Rank relative to rock type and economic classification for Madrid North sample set.
* Value as determined on humidity cell sample residue because residue levels were higher than initial values determined on ABA sample.
-- denotes data not available
bd denotes mineral below detection

2.2 Madrid South

SRK (2012) provides an assessment of the acid rock drainage and metal leaching (ARD/ML) potential of waste rock and ore that would be produced as part of the proposed bulk sample underground activities at Madrid South. The report was prepared for Hope Bay Mining Ltd. (HBML). TMAC's proposed mine plan for the Madrid South bulk sample (Figure 2) is a modification of the HBML mine plan that was evaluated in SRK (2012). SRK has reassessed the relevance of the Madrid South geochemical database with respect to TMAC's bulk sample mine plan and determined that the sample set provides sufficient coverage (both spatially and geologically) of TMAC's mine plan. Accordingly, the interpretations and conclusions in SRK (2012) are an appropriate basis for the waste rock management plan presented herein. This section presents an overview of the geochemical characterization program.

2.2.1 Testing Programs

The Madrid South geochemical sample set consists of 261 samples (Table 3). The distribution of the sample set relative to TMAC's proposed underground workings for the bulk sample is presented in Figure 3. All 261 samples were characterized for mineralogy (by XRD), acid-base accounting (ABA) and trace element content. Furthermore, the geochemical database included five humidity cell tests and two barrel tests. Details about the sample set, selection rationale and analytical methods are outlined in SRK (2012).

The dominant rock types for the Madrid South deposit include mafic metavolcanics (unit 1) and porphyry granitoids (unit 9), with lesser amounts of intermediate volcanics (2). As shown in Table 1, the bulk of the ABA samples are for these aforementioned rock types. Less significant rock types characterized include quartz veining (unit 12q), which is associated with gold mineralization, intermediate to felsic volcanic (unit 3ao), early gabbro intrusives (unit 7a), late gabbro intrusives (10a), late mafic dykes (10b), and carbonate veins (12c).

Table 3: Distribution of ABA Sample Set According to Rock Type

Lithological Description	No. of Samples
Mafic to ultramafic metavolcanics (1a, 1p, 1pd)	92
Mafic to ultramafic metavolcanics (1) mixed with Quartz Vein (12q) only	2
Mixed mafic to ultramafic metavolcanics (1)	4
Intermediate volcanics (2a, 2p, 2pd)	28
Intermediate to felsic volcanics (3ao)	6
Early gabbro intrusives (7a)	5
Mixed early gabbro (melangabbro) intrusives (7ac)	1
Late porphyry granitoids (9p, 9pf, 9pq)	97
Late porphyry granitoids mixed with quartz vein (9 w. 12q)	4
Late gabbro intrusives (10a)	1
Late mafic dyke (10b)	4
Quartz vein (12q)	12
Mixed quartz veins (12q w. 1a)	1
Carbonate vein (12c)	3
Madrid deformation zone (13a)	1
Total	**261**

2.2.2 Static Test Results and Mineralogy

The samples were characterized by low sulphur content, with 95% of samples containing less than 0.50% total sulphur (Figure 5). Sulphur levels for the deposit rock types were low, with the highest levels observed for samples of quartz vein (12q, median level of 0.46%). Median levels were below 0.10% for mafic metavolcanics (1), intermediate volcanics (unit 2) and late porphyry granitoids (9). Levels of NP and TIC were high (median values for all rock types greater than 75 $kgCaCO_3$ eq/t). All samples were classified as non-potentially acid generating (non-PAG).

In general, ferroan dolomite was the most abundant carbonate mineral (median concentrations ranging from below detection to 38%). Calcite was also present at median levels greater than 5% in selected rock types. The occurrence of magnesite and magnesium siderite was overall less significant, both in quantity and occurrence.

All the significant rock types contained samples with elevated solid-phase arsenic. Overall highest arsenic levels were exhibited for samples of quartz vein (median levels greater than 100 ppm) while samples of mafic volcanics, intermediate volcanics and late porphyry granitoids contained median levels of less than 10 ppm. Compared to other Hope Bay deposits, arsenic content for mafic volcanics from Madrid South was lower than Boston, Madrid North (Naartok, Rand and Suluk), and generally similar to Doris.

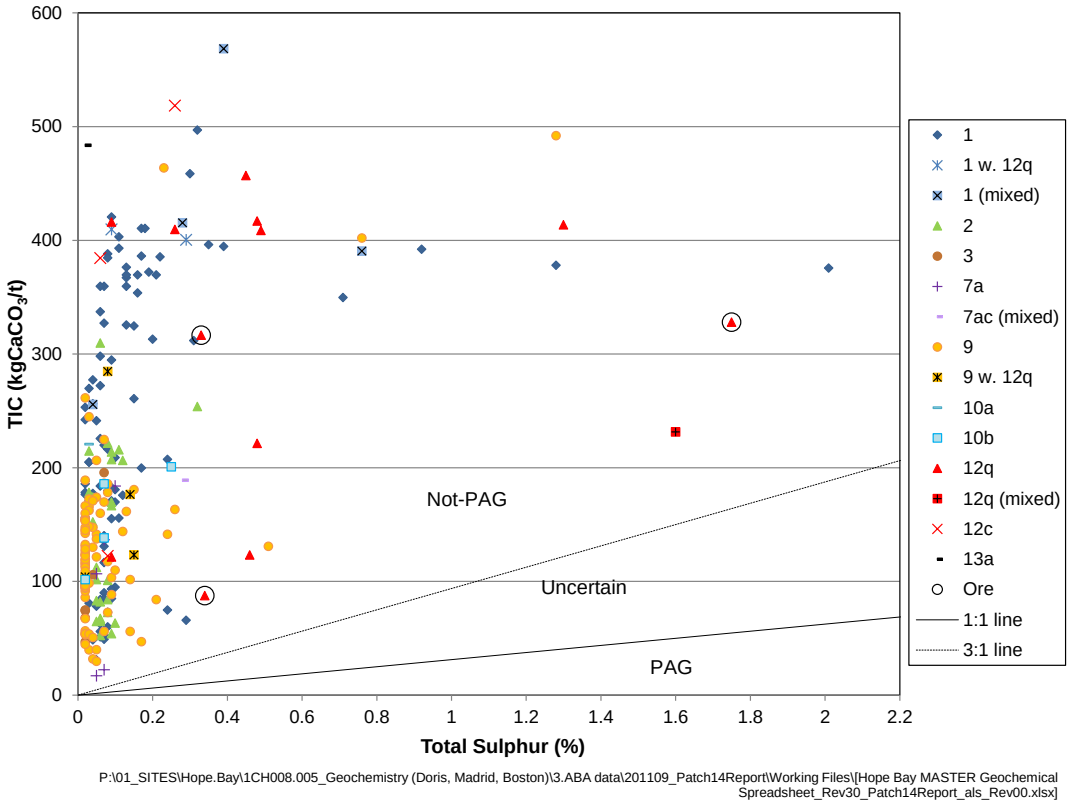


Figure 5: Comparison of TIC and Total Sulphur, Madrid South

2.2.3 Kinetic Test Results

Selected geochemical attributes of the five humidity cell tests of Madrid South waste rock are presented in Table 2. All tests had leachates with neutral pH. Sulphate release rates were low (maximum 1 mg/kg/week) for the mafic metavolcanic and late porphyry granitoid samples, indicating low rates of sulphide oxidation. Stable sulphate leaching rates for the sample of mixed early gabbro were higher (23 mg/kg/week), however this likely reflects the leaching of primary sulphate minerals in the sample rather than sulphide oxidation.

For each of the mafic metavolcanics and late porphyry granitoids humidity cell test samples, there are samples with lower and higher sulphide content, as denoted by the %rank value in Table 2. Arsenic, cobalt and nickel leaching rates were appreciably higher in the samples with high sulphide content, i.e., HC-61 and HC-64. Sulphate release rates for HC-61 and HC-61 were uniformly low (1 mg/kg/week) and were equivalent to the lower sulphide samples (HC-63 and HC-60).

The pHs for the two barrel of Madrid South waste rock (mafic volcanic and late porphyry granitoid) are circumneutral. The database for the barrels is limited due to the absence of or low volumes of leachate.

Table 4: Selected Humidity Cell Test Results for Mafic Metavolcanic and Late Porphyry Granitoid Samples

HCT #	Rock Type[1]	Sulphide	Static Test Results					HCT Stable Release Rates			
			Sulphide	NP	TIC	NP/AP	TIC/AP	SO_4	As	Co	Ni
		% Rank[2]	%S	$kgCaCO_3/t$				mg/kg/week			
HC-63	1	77	0.16	299	383	60	77	0.6	0.0005	0.00001	0.00003
HC-61	1	97	0.83	281	388	11	15	1	0.06	0.001	0.0006
HC-62*	7ac mixed	0	<0.02	169	189	27	30	23	0.0005	0.00002	0.00005
HC-60	9	0 to 51	0.02	102	137	164	219	0.5	0.003	0.00003	0.00003
HC-64	9	97	0.27	348	473	41	56	1	0.1	0.0009	0.0007

Source: P:\01_SITES\Hope.Bay\1CH008.005_Geochemistry (Doris, Madrid, Boston)\3.ABA data\201406_MadridSouthWRMP_TypeB_WL\Table\[HCT Rates table.xlsx]

Notes:
[1] Rock codes as follows: 1 = mafic volcanics; 7ac = early gabbro; 9 = late porphyry granitoids
[2] For HC-62, percent rank of sulphide determined by comparion with early gabbro samples (7a, mixed and unmixed)

3 Conceptual Waste Rock Management Plan

This section presents a conceptual waste rock management plan. A comprehensive waste rock management plan will be developed and submitted six months after receipt of the Type B water license. The framework of the waste rock management plan would be parallel to the approved plan for Doris North (SRK 2010), and would address details such as waste rock and seepage monitoring; water management; management of residual explosives; spill prevention and dust management.

The geochemical characterization programs for the Madrid Advanced Exploration Project indicated that there are no practical methods for segregating PAG from non-PAG waste rock. Accordingly, a waste rock pile at Madrid North and at Madrid South would be placed on a minimum of 1m thick pad, constructed from Run-of-Quarry (ROQ) material placed over the original ground.

The drainage from each waste rock pile would be captured by a Pollution Control Pond (PCP). The PCP's would be fully lined, with a geosynthetic liner and contained by a 6 m wide berm, constructed from ROQ material (SRK 2014b and SRK 2014c). The berms have been designed to allow for light vehicle access around the pond for regular inspection; to assist in accommodating any required maintenance; and to allow for a vacuum truck to remove any retained water.

Water collected in each of the PCPs will be transferred to the 50,000 L supply tank located at each respective location. Supply water for the Brine Mixing Facility (BMF) will be drawn from this tank to create a Brine to be used in underground operations. Any excess water from the PCPs would be transported to the Tailings Impoundment Area.

Water collected in the PCP and any seeps flowing directly from waste rock would be monitored in accordance with the water licence and to monitor metal leaching from the stockpile. The objective

of monitoring is to assess the magnitude of arsenic and nickel concentrations to inform waste management practices and adjust closure planning, if results determine this is appropriate.

Operational monitoring of solids would follow the general methodology used at Doris North. However, monitoring would be less frequent, because unlike Doris North, the waste rock from the Madrid Advanced Exploration Project will not be segregated. Monitoring of waste rock during mining would include a geological inspection and collection of confirmatory samples from either blasted rock, either from within the mine, or immediately following placement in the waste rock pile. Sampling frequency would be approximately one sample per 5,000 tonnes of rock. A minimum of one in five samples would be submitted for full ABA tests. The other four samples would be submitted for total sulphur and TIC only.

Three samples from the first six months of mining and then one in ten samples from the confirmatory testing (representing approximately one sample per 50,000 tonnes of rock) will be subjected to shake flask extractions to assess the amount of soluble salt, nutrients and metals present in the rock.

At closure, the Madrid Advanced Exploration Project waste rock piles will be reshaped to prevent the ponding of water with the final slopes of 3H:1V, and covered with an HPDE liner with a 0.3 m thick protective layer of crushed rock.

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The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

4 References

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SRK Consulting (Canada) Inc., 2014c. Hope Bay Project: Madrid South Bulk Sample: Portal and Vent Raise. Technical Memorandum prepared for TMAC Resources Inc. by SRK Consulting (Canada) Inc. Project Number 1CT022.001.410. May 9, 2014.

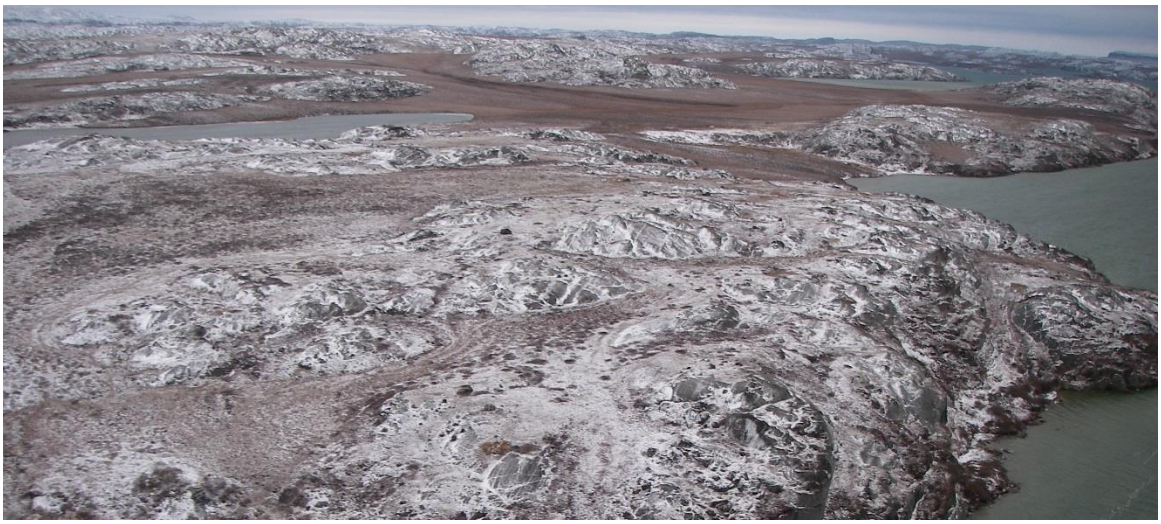
Appendix 8-C

SRK, December 2014 – Hope Bay Project Quarry Management and Monitoring Plan - Revision 02

Hope Bay Project
Quarry Management and Monitoring Plan – Revision 02

Prepared for

TMAC Resources Inc.



Prepared by

SRK Consulting (Canada) Inc.
1CT022.001
December 2014

Hope Bay Project
Quarry Management and Monitoring Plan – Revision 02

December 2014

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File Name: Quarry_ManagementPlan_Report_1CT022.001_LNB_KSS_20141211.docx

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1 Introduction

TMAC Resources Inc. is conducting advanced exploration and developing the infrastructure at the Hope Bay Mining Project in the Hope Bay Belt, Nunavut, Canada. The Project site is located on Inuit Owned Land (IOL) in the West Kitikmeot region of Nunavut approximately 125 km southwest of Cambridge Bay and 75 km northeast of Umingmaktok.

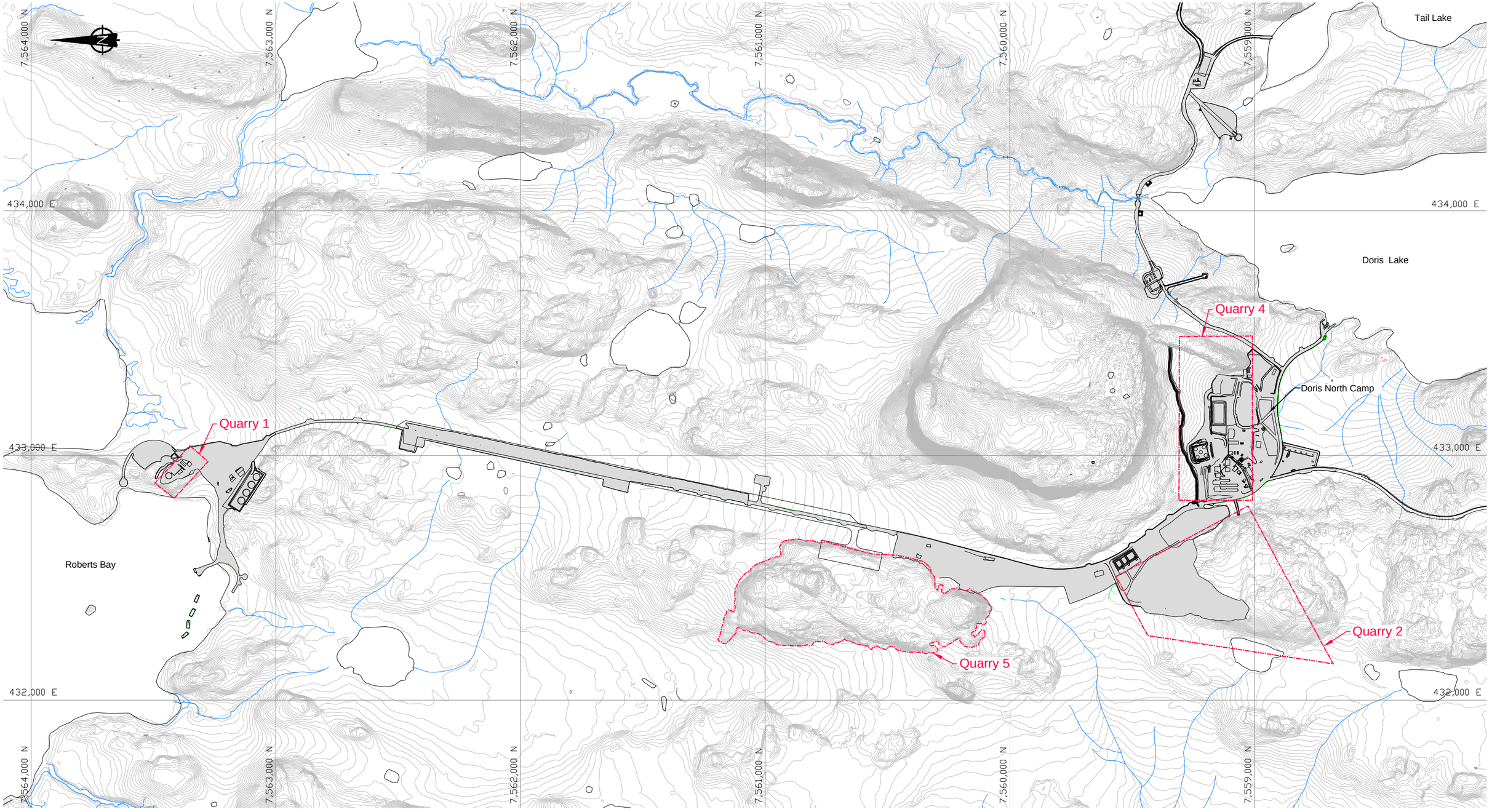
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Construction of many of the facilities associated with the advanced exploration and infrastructure development program at the Hope Bay Project site has made use of or will continue to require rock from various quarries developed or approved for development at the site, including Quarry 1, 2, 3 and 4 (Figure 1), and Quarry A, B, and D (Figure 2). The proposed construction and development at Madrid South, including the Madrid South Road that connects to the existing Doris-Windy Road (TMAC 2014), would make use of rock from Quarry G and H (Figure 3). The proposed expansion of the Doris deposit will also require a small quarry (Quarry I) in the Doris Central area (Figure 2), (TMAC 2013).

This *Hope Bay Project Quarry Management and Monitoring Plan – Revision 02* has been prepared by TMAC in accordance with Quarry Permit Agreements KTP307Q010 and KTP308Q010, issued by the Kitikmeot Inuit Association, and Water Licences 2BE-HOP1222 and 2AM-DOH1323 issued by the Nunavut Water Board (NWB). The plan was originally prepared to address the management requirements for Quarry A, B and D, but has been expanded to include three new Quarries (G, H and I) which have been proposed to support expanded mining activities in the Doris area (TMAC in preparation), and exploration activities for Madrid South (TMAC in preparation). Additionally, the plan addresses ongoing management requirements for Quarry 2 and 3 in the Doris area.



LEGEND

Permitted Quarry Boundary

NOTES

1. Topographic contour data for the terrain model were provided by Hope Bay Mining, and is based on 2007 Aerial Photography. Contour intervals are 1m.
2. The co-ordinate system is UTM NAD 83, Zone 13.
3. All dimensions are in metric units, unless specifically mentioned.

0 100 200 300 400 500
Scale in Metres

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FILE NAME: 1CT022.001_Rob Bay-Doris.dwg

TMAC RESOURCES

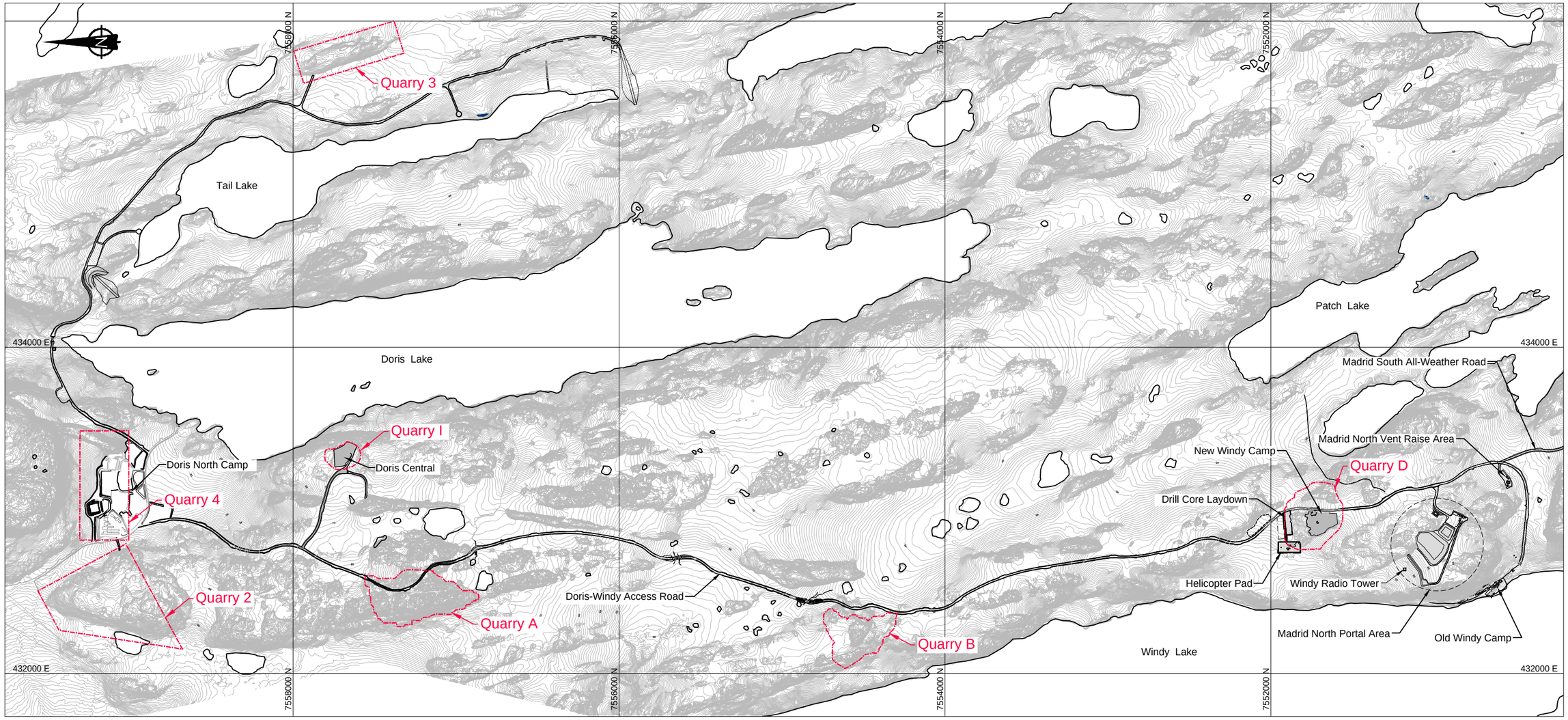
HOPE BAY PROJECT

Quarry Management Plan

Quarry 1 ,2, 4, and 5 Locations

DATE:	APPROVED:	FIGURE:
June 2014	LW	1

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LEGEND

Permitted Quarry Boundary

NOTES

1. Topographic contour data for the terrain model were provided by Hope Bay Mining, and is based on 2007 Aerial Photography. Contour intervals are 0.5m.
2. The co-ordinate system is UTM NAD 83, Zone 13.
3. All dimensions are in metric units, unless specifically mentioned.

0 200 400 600 800 1000
Scale in Metres

srk consulting

SRK JOB NO.: 1CH022.001
FILE NAME: 1CT022.001_Doris-Windy.dwg

TMAC RESOURCES

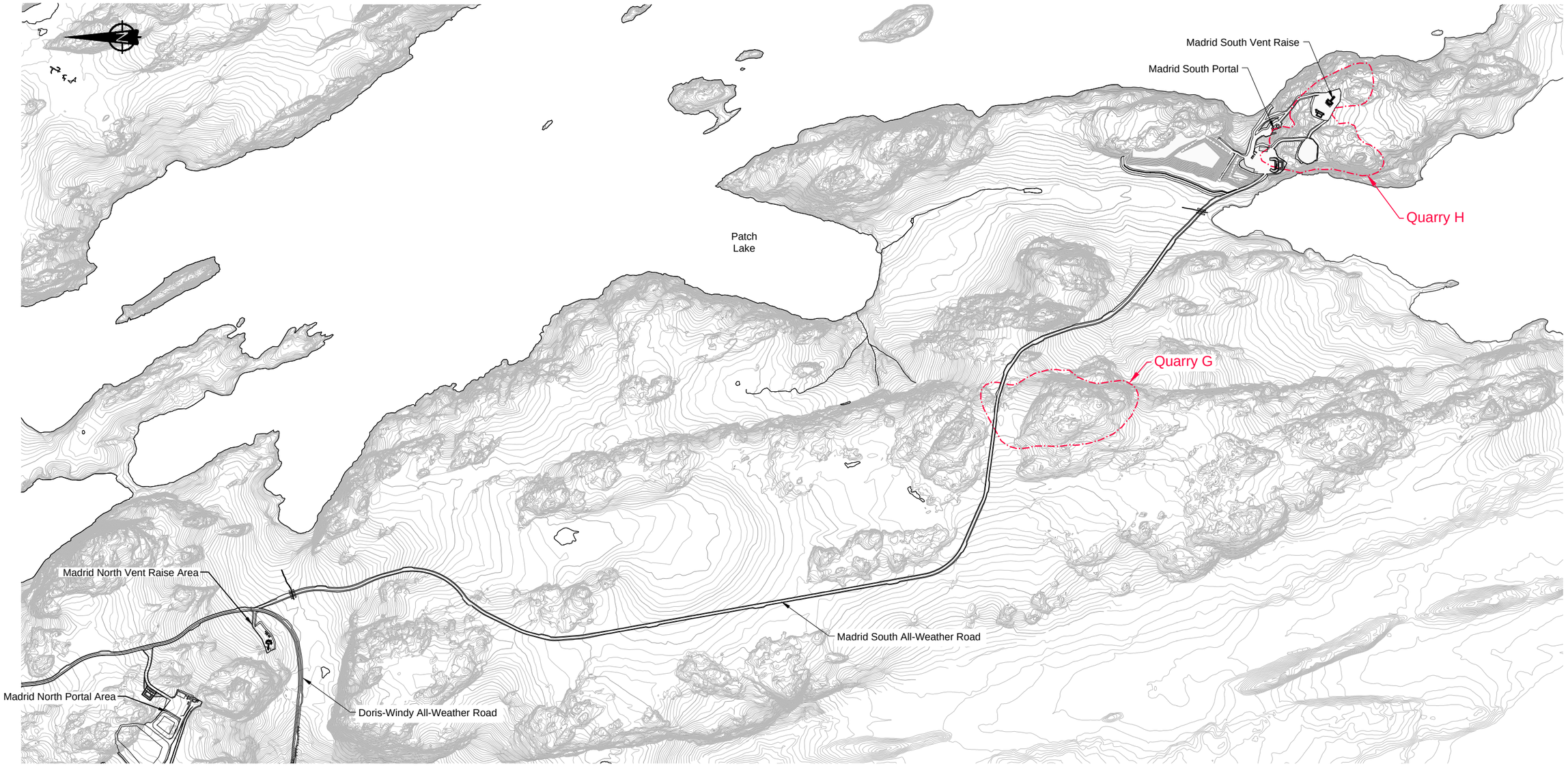
HOPE BAY PROJECT

Quarry Management Plan

Quarry 2, 3, 4 ,A, B, D, and I Locations

DATE:	APPROVED:	FIGURE:
June 2014	LW	2

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LEGEND

Permitted Quarry Boundary

NOTES

1. Topographic contour data for the terrain model were provided by Hope Bay Mining, and is based on 2007 Aerial Photography. Contour intervals are 0.5m.
2. The co-ordinate system is UTM NAD 83, Zone 13.
3. All dimensions are in metric units, unless specifically mentioned.

0 100 200 300 400 500
Scale in Metres

srk consulting

SRK JOB NO.: 1CH022.001
FILE NAME: 1CT022.001_Windy–Madrid South.dwg

TMAC RESOURCES

HOPE BAY PROJECT

Quarry Management Plan

Quarry G and H Locations

DATE:	APPROVED:	FIGURE:
June 2014	LW	3

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2 Background

2.1 Regulatory Approvals

Pursuant to the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada*, the Nunavut Water Board issued:

- Nunavut Water Board Type B Water Licence No. 2BE-HOP1222 to the Hope Bay Regional Exploration Project – Windy Camp; and
- Nunavut Water Board Type A Water Licence 2AM-DOH1323 to the Doris North Project.

Quarry operations also require approval by the Kitikmeot Inuit Association (KIA) to access Inuit Owned Lands (IOL). For example, Quarries A, B, and D are authorized by Quarry Permit Agreement KTP308Q010 and Quarries 2, 3, and 4 are authorized by Quarry Permit Agreement KTP307Q010.

TMAC are planning to submit applications to the Nunavut Water Board to amend the Type A water licence 2AM-DOH1323, and to obtain a Type B water licence for the Madrid North and South deposits, and applications to the Kitikmeot Inuit Association for quarry permit agreements for Quarry G, H, and I.

The existing licences and permits contain a number of specific conditions which apply to quarrying, infrastructure construction, management and monitoring. To ensure that the highest regulatory requirements for management of construction rock are uniformly applied throughout the Hope Bay Belt, the previous owner, HBML opted to implement Part D and Schedule D – Conditions Applying to Construction related to quarrying and placement of rock from the Type A Doris Water Licence 2AM-DOH0713 (renewed as 2AM-DOH1323) in their management plan for Quarry A, B and D (SRK 2010). TMAC have adopted this same approach in expanding the scope of the quarry management plan to include all of the quarries and has opted to implement Part D – Conditions Applying to Waste Disposal related to quarry drainage discharge from Type B Hope Bay Regional Exploration Project Water Licence 2BE-HOP1222 in their management plan. The relevant sections from 2AM-DOH1323 are Part D Items 9, 10, 20 and 21 and Schedule D a, b, c, f, k and n and from 2BE-HOP1222 are Part D Item 18 and Part J Items 5, 6 and 20.

This *Hope Bay Project Quarry Management and Monitoring Plan - Revision 02* has been prepared on behalf of TMAC to address the management and monitoring requirements related to quarrying, infrastructure and road construction – as specified in the aforementioned licences, and the applications that are currently under review.

2.2 Quarry Development and All-Season Road Construction

Figures 1 through 3 show the locations of all of the Quarries that have been developed, approved for development, or proposed at Hope Bay. The status of each of these quarries, including a description, and the approximate size is provided in Table 1.

In general, the amount of quarry rock that will be required from these areas is only a small proportion of the rock that could be extracted. Therefore, the actual size of most of these quarries is expected to be much smaller than indicated in Table 1.

The quarrying, infrastructure and road construction activities consist of drilling, blasting, mucking crushing, haulage to usage locations (e.g. the advancing road limit), end dump and levelling. Detailed design and/or as-built drawings for approved quarries have been issued in various submissions to NWB.

Table 1: Location and Status of Hope Bay Quarries

Quarry	Status	Description	Approximate Size
1	closed	Site is currently used for the Fuel Tank Farm.	21,000 m^2
2	active	Located west of the Doris camp.	308,000 m^2
3	approved but not yet developed	Located east of Tail Lake. Material will be required for construction of the South Dam.	133,000 m^2
4	closed	Doris Camp is located on the former quarry site.	201,000 m^2
5	proposed	Located at the south apron of the Doris North Airstrip Expansion.	352,000 m^2
A	not active	Located at the northern end of the Doris Windy Road. Site is currently used for storage of explosives.	155,000 m^2
B	not active	Located on the Doris Windy Road. Site has been proposed for storage of explosives.	98,000 m^2
D	not active	Site has been approved for construction of a new camp.	117,000 m^2
G	proposed	Located on the proposed Madrid South All-weather Road.	125,000 m^2
H	proposed	Located on the proposed Madrid South All-weather Road at the Madrid South Portal.	106,400 m^2
I	proposed	Located at Proposed Doris Central Vent Raise.	27,000 m^2

3 Quarry Management

3.1 Pre-Development

3.1.1 Quarry Material Characterization

Geochemical characterization studies of all potential quarry sites for the Hope Bay Project have been carried out by AMEC (2005), and SRK (2007, 2008, 2011, and 2014).

The 2002-2007 characterization programs (AMEC 2005, SRK 2007) included over 90 samples from Quarries 1 to 4. The samples were subjected to acid-base accounting (ABA), elemental analyses, and shake flask extraction tests. Humidity cell tests (HCTs) and mineralogical analyses were also completed on three sample composites.

The 2008 characterization program included a total of 120 samples from Quarries A, B and D. The samples were subjected to ABA and elemental analysis. Eight (8) samples were subjected to shake flask extraction to assess mineral weathering and nine (9) samples were subjected to quantitative mineralogy by Rietveld-XRD in order to investigate carbonate composition.

The 2010 characterization program for Quarry G, H, and I made use of a backpack-type drill. Shallow drill core samples were obtained across the strike of the geology with the objective of examining geochemical variability according to lithology and/or sample location. Additionally, for Quarry H, two drillholes (SRK-GC-10-A2 and SRK-GC-10-A5) were located in overburden to determine the recessive geology. The program included a total of 36 samples, which were subjected to ABA analyses including paste pH, total sulphur, sulphate sulphur, TIC, and modified NP, and elemental analysis by aqua regia digestion with ICP-MS finish.

Based on these geochemical characterization programs, the material from all of the quarries is considered to have a low potential for acid rock drainage (ARD) generation based on NP/AP ratios and low sulphur content. Accordingly, material from these quarries is suitable to be used as construction material.

3.1.2 Archaeology Survey

Archaeological surveys of the quarries and the Doris-Windy and Madrid South all-weather road routes were conducted. Based on the results of the survey, buffers were established to ensure that the development of Quarry A, B, D, G, H, and I and the Doris-Windy and Madrid South all-weather roads do not impact any archaeological sites.

TMAC provides training on “chance-find” procedures to relevant field staff to ensure that any archaeological sites that were not identified during pre-development surveys are recognized and treated in an appropriate manner (i.e. SOP for Archaeological Site Protection, and Hope Bay Archaeology Awareness for Field Workers).

3.1.3 Notification of Intent to Enter Quarry Lands

Article 27 of the Quarry Permit Agreement KTP307Q010 issued by the Kitikmeot Inuit Association (KIA) for Quarry 2, 3 and 4, and Quarry Permit Agreement KTP308Q010 for Quarry A, B, and D, requires that the KIA be notified of intent to enter the lands defined in the licence at least ten (10) business days prior to the commencement of activities. For Quarry G, H and I, TMAC will adhere to the same notification process outlined in Article 27. TMAC will give the KIA notice of its intent to enter upon the lands defined in the licence at least ten (10) business days prior to the commencement of activities.

3.2 Operations

3.2.1 Residual Explosives

The majority of the rock fill will be blasted using a bulk form of Ammonium Nitrate (AN) and fuel oil mixture to make the blasting product ANFO. ANFO is soluble in water and nutrient rich in environmental terms. From a blasting perspective, ANFO is only ideally suited for dry hole application. In the event that ANFO is loaded into a wet borehole inadvertently, an incomplete detonation of the product may occur. In such instances, residual ammonium nitrate may remain in the rock fill and be inadvertently transferred with the infrastructure or road construction material, causing nutrient loadings to the receiving environment.

The potential for wet-holes in the quarries is considered to be low due to the land-based nature of the quarry sites and the presence of permafrost below the outcrops. However, even though the quarry area is assumed to be dry, a contingency will be available. The potential for wet holes will be assessed at the time of drilling and without fail at the time of loading each blast hole. The blaster responsible for loading and firing the drilled pattern begins the loading process by walking the entire pattern and checking the actual drilled depth of each hole versus the plan and noting any conditions such as water in each hole. This information is recorded on the blast pattern record sheet required by regulation to determine the amount and type of explosive required in each hole including the delay detonators used. The presence of water in any drill hole requires one of several approaches to be taken to ensure proper and complete explosive detonation. One way is to attempt to dewater the hole using a down hole dewatering pump and truck so that a poly borehole liner can be lowered into the hole and ANFO poured inside the bag.

In the event that an incomplete detonation of the product occurs, it is likely that an orange colour smoke plume would be observed rising from the affected area. The blaster is required by the regulations to make an inspection of the blasted area, make note of blast holes that may have experienced incomplete detonation and mark those locations with flagging.

Information from the blaster's inspection will be noted in the blast pattern log and the daily operations shift log communicated to all field supervision personnel. The flagged off area will remain until the excavation equipment advances up to within half the hole spacing distance at which time the suspect material would be more closely inspected for the presence of ANFO.

Contingency - Identification of Un-detonated or High ANFO Residue Areas

Material considered un-detonated or high in ANFO residue, which will contain potentially elevated level of nutrients (primarily ammonia) will be selectively excavated and hauled to an established waste rock management area with any runoff from the area reporting to Pollution Control Ponds for ultimate disposal in the Tailings Impoundment Area (TIA).

Contingency - Spill of ANFO

In the unlikely event that a spill of the ANFO occurs during the charging of the holes for blasting, all activities within the quarry will be suspended until the clean-up is complete. The clean-up of the spilled material will be initiated immediately and the material disposed of in accordance with the Explosives Management Plan.

3.2.2 Blast Management

The quarry sites have been deemed suitable for use providing that the archaeological site buffer zone is kept intact; therefore, due care will be taken in order to maintain the integrity of these sites. The blasts will be designed to shoot away from the archaeological sites. Prior to any blast, the rock face will be cleaned to minimize the potential of fly rock.

The following blasting method will be applied for a 10 m bench using a 115 mm diameter borehole:

- Powder factor - 1.40 kg/m^3
- Stemming – 2.3 m (with 3/8” crushed rock)
- Pattern - 2.3 m x 2.3 m
- Delays - Single hole delay with offset timing, of 12 ms, will be used in order to limit the blasting to one hole at a time which will reduce the vibration to a minimum.

Single hole delays will also be used for maximum shot placement away from any identified archaeological sites and row timing will be increased to prevent back break and ensure all rock is moving in a forward motion away from the archaeological sites.

As an additional precaution, the blast limits will be set 60 m from the recommended 30 m buffers zones located in the quarries. This extra buffer will offer further protection from any possible disturbance to archaeological sites.

3.2.3 Precipitation/Snow Melt Water Management

The development of each quarry will proceed in a manner that, to the extent possible, ensures that all water entering the quarry as a result of precipitation or snow melt is retained within the quarry boundaries. Generally, this will be accomplished by ensuring that the quarry floors are sloped toward a natural low area of the quarry and, if required, the creation of a quarry sump to collect the waters and settle out suspended solids.

In the event that the quarry sump requires pumping, a sample of the ponded water will be collected, preserved in the appropriate manner, and submitted to an accredited laboratory for the analysis of specified parameters. These parameters are outlined in Part D Item 18 and Part J Item 6 of Water Licence 2BE-HOP1222 and the quarry effluent quality limits for these aforementioned parameters are listed at Part D Item 18 (reproduced herein as Table 2). Monitoring results will be reported as part of the monthly monitoring reporting.

Additionally, notification will be provided to the Inspector, at least fifteen (15) days prior to the planned pumping. The notification will include the volume proposed for discharge and the discharge location. Following receipt of the laboratory results, water meeting the discharge requirements will be discharged. As the governing permits for Quarry G, H and I are not presently defined, the discharge requirements are assumed to be the same as those outlined in Table 2.

Table 2: Quarry Effluent Quality Limits[1] (Part D Item 18 of Water Licence 2BE-HOP1222)

Parameter	Maximum Average Concentration	Maximum Concentration in Any Grab Sample
pH	6.0 to 9.0	9.0
Electrical Conductivity	500 µS/cm	500 µS/cm
Total Ammonia	2 mg/L	4 mg/L
Total Suspended Solids	15 mg/L	30 mg/L
Oil and Grease	5 mg/L and no visible sheen	10 mg/L and no visible sheen
Total Aluminum	1.0 mg/L	2.0 mg/L
Total Arsenic	0.05 mg/L	0.10 mg/L
Total Copper	0.02 mg/L	0.04 mg/L
Total Iron	0.30 mg/L	0.60 mg/L
Total Lead	0.01 mg/L	0.02 mg/L
Total Nickel	0.05 mg/L	0.10 mg/L
Total Zinc	0.01 mg/L	0.02 mg/L

Care will be taken not to disturb settled solids in the bottom of the sump and pumping of the sump will only take place when conditions are suitable. Care will also be taken to ensure that discharged water does not enter fish bearing waters and that the pump discharge is positioned in a manner that minimizes erosion and siltation of the area downstream of the discharge.

Contingency - Sump Water Requires Special Handling

In the event that the quarry water does not meet the discharge criteria, an inquiry of the cause of the noted exceedance will be conducted, and appropriate mitigation developed. Any non-compliant water that needs to be discharged would be transported to Pollution Control Ponds for management and/or transported directly to the Doris North TIA for disposal.

In previous versions of the Quarry Management Plan, the option of using the Pollution Control Ponds and/or the Doris North TIA to manage non-complaint water was not available. Therefore,

there was a requirement in the licence for investigating and reporting non-compliant quarry water to the Inspector. However, now that these alternatives are available, TMAC believes that this specific reporting requirement should be removed from the licence. Any non-compliant water that needs to be discharged from a quarry would be transported to Pollution Control Ponds for management and/or transported directly to the TIA. All compliant and non-compliant monitoring results are summarized in the monthly SNP reports to the NWB and a copy is provided to the Inspector. This monthly report would include details of the disposal of any non-complaint water.

3.2.4 Dust Management

The major source of dust generation during the operations of the quarries will be in the vicinity of the crusher while it is operating. Dust suppression, where required, will consist of using water as permitted by licences 2AM-DOH1323 and 2BE-HOP1222. A record of the volume of water used for this purpose will be maintained.

3.2.5 Materials Quarried and Removed

Article 25 of IOL Quarry Permit Agreement KTP308Q010 issued by the KIA for Quarry A, B, and D and Quarry Permit Agreement KTP307Q010 issued by the KIA for Quarry 2, 3, and 4, requires that a record of the quantity of granular materials quarried and the quantity of granular materials removed from each quarry will be maintained. It is assumed the reporting requirements for Quarry G, H and I will be the same as for the other quarries. TMAC will adhere to the same process outlined in Article 25 of KTP308Q010 and KTP307Q010 unless otherwise required by the quarry permit issued for Quarry G, H, and I.

3.2.6 Equipment Re-fuelling

In the event that re-fuelling of mobile equipment is required in one of the active quarries, it will be conducted in a location and at a time that will ensure that any spill of fuel or lubricants is effectively contained within the quarry area and clean-up is easily accomplished. During this activity, all re-fuelling equipment will be equipped with a Spill Kit suitable for the materials being handled and a functioning fire extinguisher suitable for the materials being transferred.

Contingency - Spill during Re-fuelling

In the unlikely event that a spill does occur during re-fuelling activities, clean-up of the spilled material will be initiated immediately and all activities within the quarry suspended until the clean-up is complete. The material will be disposed of in an appropriate manner as per the requirements specified in the Hope Bay Project Spill Contingency Plan.

3.3 Post-Operations

Once quarrying activities in each individual quarry are completed, all equipment, materials and supplies will be removed for appropriate reuse or disposal. Vertical walls within the mined out quarry will be inspected to ensure that they do not pose an unreasonable safety risk and, if required, remediation activities undertaken to address residual safety concerns.

The quarries may be used for laydown areas or for the development of other infrastructure components. In the event that a particular mined out quarry is to be re-commissioned or employed in a new role, appropriate applications will be made to the respective regulatory authorities.

4 Operational Inspections and Monitoring

4.1 Quarry Operations

4.1.1 Quarry Visual Inspections

During quarrying operations, a visual inspection of the quarry face to verify the geological characteristics of the rock will be conducted by a qualified field geologist or geochemist at least once per week. The purpose of the inspection will be to confirm the presence of the expected rock types and that disseminated sulphides only (e.g. not veins) are being exposed and therefore used in construction. A secondary objective of the inspection will be to confirm the absence of any fibrous forms of actinolite in the quarry material.

Prior to the inspections, site personnel will develop a traffic control plan to ensure that it is safe to work within the quarry and will inform any vehicle operators as to the location and timing of the inspection work.

The inspectors will walk from one side of the quarry around to the other side examining both the surface and the exposed bedding material along the side of the quarry for any anomalous rock types or significant amounts of sulphide. If present, these materials will be examined, described, and located on a map. In addition, at regular 100 metre intervals, the inspector will stop and complete a close inspection of the rocks, breaking open several rock clasts and describing what they see. The results of each inspection will be recorded on data sheets, and reported in the Construction Monitoring Report submitted by March 31 of the year following construction.

Contingency - Identification of Inappropriate Quarry Rock

In the unlikely event that the visual inspection identifies potentially acid generating rock, the geologist will “tag” the material for avoidance or removal. If the material is excavated, it will be hauled back to one of the previously mined-out quarries. The rock fill will then be placed within the quarry and covered with a minimum of 2 metres of the more typical Mg-theolite basalt that was approved for construction use or temporarily stored in an appropriate manner prior to eventual disposal underground. In the quarry stored rock, permafrost is expected to slowly aggrade into the rock fill, slowing the rates of sulphide oxidation substantially, and eventually shutting off seepage pathways. The clean rock cover would act as a thermal blanket to keep the active freeze/thaw zone away from the more reactive rock.

In the unlikely event that the visual inspection identifies fibrous actinolite, the geologist will “tag” the material for avoidance or removal. If the material is excavated, it would be hauled back to one of the previously mined-out quarries and covered with a 1.0 m layer of benign rock and a record of the location maintained.

4.1.2 Quarry Rock Sampling

During quarrying activities blast material from each quarry will be collected at two different stages of quarry development and samples will be submitted to an accredited external lab for sulphur analysis. Two samples of the same material will be collected: a whole rock sample and a sample

sieved to pass a -2 mm screen. This sampling method and frequency will result in up to 4 samples from each quarry. The sample locations will be pre-determined to ensure that they reflect a random selection of the rock fill material used in road construction. In the event that the results return a sulphur value of greater than (>) 0.1 % sulphur, the samples will be subjected to ABA and other confirmatory test work including shake flask extraction tests on a representative subset of samples.

The objective of this program will be to confirm previous rock characterization results and to assess the ARD potential of the fine fraction, which tends to concentrate sulphide minerals.

The following information will be recorded for each sample collected:

- Location of sample point;
- GPS coordinates of the sample point;
- Name of the quarry from which the rock fill originated;
- The name of the person who performed the sampling;
- Date and time of sampling;
- Date of analysis;
- Name of person who performed the analysis;
- Analytical method or techniques used; and
- Results of analysis.

The results of the analysis will be reported in the Waste Rock and Quarry Monitoring Report (which is referenced in the Construction Monitoring Report) and submitted by March 31 of the year following construction. The report will include a discussion and interpretation of the geochemical data collected.

4.1.3 Quarry Sump Monitoring

The development of each quarry will proceed in a manner that, to the extent possible, ensures that all water generated as a result of precipitation or snow melt is retained within the quarry boundaries. Generally this will be accomplished by ensuring that the quarry floors are sloped toward the centre and, if required the creation of a quarry sump to collect the waters and settle out suspended solids.

After significant precipitation events, the quarry area will be inspected and the water level in the quarry sump assessed. In the event that the quarry sump requires pumping, the procedures or contingencies outlined in Section 3.2.3 of this plan will be followed.

4.1.4 Blast Vibration Monitoring

Shock waves from blasting in close proximity to fish bearing water can lead to potential for causing detrimental shock wave effects on fish. Guidelines for the use of explosives in or near Canadian fisheries waters (Wright and Hopky 1998) indicate that "*no explosive shall be detonated in or near fish habitat that produces, or is likely to produce, an instantaneous pressure change (i.e., overpressure) greater than 100 kPa (14.5 psi) in the swimbladder of a fish*". The guidelines also provide specific methods for calculating the setback distance required to stay below this threshold based on different amounts of explosive and the type of substrate. To ensure that there are no detrimental effects on fish from quarry activities, these guidelines will be used to establish final setback distances for each of the quarries. Additionally, blast vibration monitoring will be undertaken to avoid potential effects when detonation distances approach the recommended setbacks to ensure appropriate vibration thresholds that are protective of fish and vulnerable life stages of fish are maintained.

4.1.5 Dust

The major source of dust generation during the operations of the quarries will be from the crusher when it is operating. Passive (observation) dust monitoring after blasting in all quarries and during operations of the crusher will be limited to an assessment conducted during the other regularly scheduled visual inspections of operations (i.e. the pre-blast inspection, the post blast inspection, and regular environmental personnel inspections). The results will be recorded by the site personnel. Dust suppression will be limited to the application of clean water to affected areas and a record of the volume of water used for this purpose will be maintained.

4.2 Infrastructure and All-Weather Roads

4.2.1 Visual Inspection

During all construction activities a visual inspection by site personnel will be conducted of the quarries, equipment storage and re-fuelling areas, construction areas and the advancing area of road construction activity at least once per week. The inspection will focus on identification and removal of foreign and/or spilled materials, assessing the extent of erosion and sedimentation resulting from rock placement (particularly during periods of precipitation), the extent of dusting and the transport of dust onto the surrounding tundra.

In addition, an inspection of each watercourse crossing along the all-weather roads throughout the annual ice-free period will be conducted in order to confirm structural integrity, confirm soil and permafrost stability in the immediate area and to confirm that the crossings have been located adequately with respect to the watercourses.

A record of the time, place and results of each inspection will be maintained as will a photographic record of "items of interest" (i.e. dusting, wildlife encounters, spilled material, etc.) identified during the inspection.

5 Post-Construction Inspections and Monitoring

5.1 Quarry

A visual inspection of each mined out quarry will be completed at least once per year in order to ensure that the site remains safe and no environmental or public health and safety concerns have developed. In the event that potentially acid generating waste rock has been placed in one or more of the mined-out quarries, the area will be inspected to ensure that the 2 metre cover remains intact and that seeps from the material are not in evidence.

In the event that the inspection identifies ponded water within the mined out quarry in sufficient volume to require pumping, the procedures or contingencies outlined in Section 3.2.3 of this plan will be followed.

Records of the inspections and findings of each will be maintained and reported in the appropriate manner.

5.2 Infrastructure and All-Weather Roads

5.2.1 Road Seep Survey and Sampling

During the spring freshet in the year following completion of the construction of the road and pad areas, an inspection will be conducted by a qualified field geologist or geochemist in order to characterize the rock used in construction and to identify and sample ephemeral seeps occurring through the road construction material. The objective of this program will be to confirm that an environmentally-significant level of metal leaching (ML) is not occurring from the road materials.

Seeps will be located by walking along the downstream side of the roads and looking and listening for signs of flowing water. In low lying areas where the direction of surface water flow is not evident, both sides of the structure will be inspected. Where surface flows are identified, the upstream side will be inspected to determine whether the flow originates from the upstream side or whether it is likely to originate from within the rock fill material. Most samples will target the latter, more ideal type of seep. However, a modest number (maximum of one location for every two km of road) will be collected at locations where there is moderate upstream flow component. In these cases, samples will be collected from both upstream and downstream of the roads.

A survey stake will be installed to mark the location of each seep sampled and the following information recorded:

- Description of the seep location;
- GPS location of the seep;
- A photographic record of the seep;
- A description of the flow pattern and magnitude of flow;
- Field pH, EC, Eh and temperature readings; and

- Field pH, EC, Eh and temperature measurements at a reference site located away from the influence of the road or other mine related activities.

At a minimum, a water sample will be collected from 10% of the identified ephemeral seeps (regardless of the field measurement values) appropriately preserved and submitted for laboratory analysis. The following information will be recorded:

- The name of the person who performed the sampling;
- Date and time of sampling;
- Date of analysis;
- Name of person who performed the analysis;
- Analytical method or techniques used; and
- Results of analysis.

All of the samples collected will be preserved in an appropriate manner, labelled and submitted to an accredited laboratory for analysis of pH, TDS, acidity and/or alkalinity, sulphate, total ammonia, nitrate, and a full suite of dissolved metals by ICP-MS. The results of the seep survey will be reported in the Waste Rock and Quarry Monitoring Report (which is referenced in the Construction Monitoring Report) and submitted by March 31 of the year following construction. The Addendum will include a discussion of the interpretation of the geochemical data collected.

5.2.2 Road Material Sampling

Once the construction of the road and pad areas is complete, an inspection of these facilities will be conducted by a qualified field geologist or geochemist to characterize the rock used in construction. That inspection will include collection of in situ rock fill from pre-determined points along the road route (approximately 1 sample per 0.5 kilometres of road, and five samples from each of the pad areas). At each sample location, a whole rock sample will be collected as well as a -2 mm sieved sample when available. The sample locations will be pre-determined to ensure that they reflect a random selection of a representative sample of the in situ rock fill from each quarry used to construct the road and pad areas.

All of the samples will be submitted to an accredited external lab for sulphur analysis. In the event that the results return a sulphur value of greater than (>) 0.1 % sulphur, the samples will be subject to ABA and shake flask extraction tests on a representative subset of samples. Testing will be completed on both the fines and the whole sample.

The objective of this program is to confirm previous rock characterization results and assess the ARD potential of the fine fraction, which tends to concentrate sulphide minerals.

The following information will be recorded for each sample collected:

- Description of the sample point;

- GPS Coordinates of sample point;
- An estimate of which quarry the rock fill originated from;
- The name of the person who performed the sampling;
- Date and time of sampling;
- Date of analysis;
- Name of person who performed the analysis;
- Analytical method or techniques used; and
- Results of analysis.

The results will be reported in the Waste Rock and Quarry Monitoring Report (which is referenced in the Construction Monitoring Report) and will include a discussion and interpretation of the geochemical data collected.

5.2.3 Infrastructure Seep Survey and Sampling

In the event that clean quarry rock from any of the quarries is used in the construction of any other infrastructure, the area in which the rock is used will be incorporated in the ongoing seep and rock sampling program currently established for the project. This includes, at a minimum, incorporating the requirements specified in Part D and Schedule D - Conditions Applying to Construction in the Type A Water Licence 2AM-DOH1323 related to quarrying and placement of rock. The monitoring and sampling will be completed in order to ensure that the highest regulated requirement for the management of construction rock is uniformly applied throughout the Hope Bay Belt.

5.2.4 Contingency - Inappropriate Construction Material Identified

In the unlikely event that the results of the seep monitoring/sampling program or the road material sampling program indicate the presence of potential ML or ARD further investigations will be undertaken to define the extent and assess the potential impacts of the material. If warranted, and after discussion with the appropriate regulatory agencies, the material will be excavated and hauled to one of the previously mined-out quarries or temporarily stored in an appropriate manner prior to eventual disposal underground. The quarry stored rock fill will be placed within the quarry and covered with a minimum of 2 m of the more typical Mg theolite basalt. Permafrost is expected to slowly aggrade into the rock fill, slowing the rates of sulphide oxidation substantially, and eventually shutting off seepage pathways. The clean rock cover will also act as a thermal blanket to keep the active freeze/thaw zone away from the more reactive rock.

5.3 Summary of Inspections and Monitoring

Table 3 provides a summary of the monitoring required during and after quarry mining and construction of the new roads or infrastructure areas.

Table 3: Hope Bay Quarry & All-Weather Road Monitoring Summary

Aspect	Monitoring Activity	Monitoring Type	Data Management & Reporting
Pre-development	Geochemical characterization of quarry material.	Sample and analysis of rock.	Complete (see summary in Section 3.1).
	Archaeological survey.	Field inspections and establishment of buffers.	Survey report kept on file.
Quarry Operations	Pre-blast inspection.	Identify "wet holes" and clean spilled ANFO	Maintain field notes.
	Post-blast inspection.	Confirm ANFO consumption (minimal misfires).	Maintain field notes.
	Weekly visual inspection by field geologist or geochemist.	Confirm rock types (no fibrous actinolite) and presence of disseminated sulfides (not veins).	Maintain field notes. Report results in subsequent Waste Rock and Quarry Monitoring Report.
	Representative samples of blast material (two from each quarry) during quarry operations (whole rock and screened), sampled twice during quarry development.	Sulphur analysis and, if required, ABA and shake flask extraction analysis of representative subset of samples.	Maintain field notes. Report results in subsequent Waste Rock and Quarry Monitoring Report.
	Weekly inspection by site personnel.	Visual inspection	Maintain field notes on inspection time and results.
	Amount of material quarried and amount removed.	Amount of material quarried in m^3. Amount of material removed in m^3.	Maintain record and monthly reporting to Kitikmeot Inuit Association.
Post-precipitation Event	Inspect quarry for ponded water (sump).	If ponded water is present and in quantities requiring discharge, collect sample for discharge criteria screening.	Maintain field notes. Report results in monthly monitoring reports.
	Prior to pumping and discharge of sumps.	Water sample collected for analysis of parameters outlined in Table 2 (pH, EC, Eh, Total Suspended Solids, Total Sulphate, Total Ammonia, Nitrate, Alkalinity, ICP Metals Scan (including Total Aluminum, Total Arsenic, Total Copper, Total Iron, Total Lead, Total Nickel & Total Zinc) and Oil and Grease).	Notification of Inspector at least fifteen (15) days prior to the planned pumping – Notification will include the volume proposed for discharge and the discharge location. Results of water quality sampling reported in monthly monitoring reports.
Post-Construction	Representative samples of *in situ* construction material (1 per 0.5 km, and 5 per pad area). Samples to include whole rock and screened (-2 mm) samples, where possible).	Sulphur analysis and, if required, ABA and shake flask extraction analysis of representative subset of samples	Maintain field notes. Report results in subsequent Waste Rock and Quarry Monitoring Report.
	Field identification of seeps &/or runoff from road and pads during spring freshet (2 years).	Field pH and EC of seeps and runoff Field pH and EC at reference site.	Maintain field notes. Report results in subsequent Waste Rock and Quarry Monitoring Report.
		Water sample submitted for pH, TDS, Total Sulphate, Total Ammonia, Nitrate, Alkalinity, ICP-MS Dissolved Metals Scan.	Maintain field notes. Report results in subsequent Waste Rock and Quarry Monitoring Report.
	Annual inspection of mined out quarries. If ponded water is present.	Sample and analysis of pH, EC, Eh, Total Suspended Solids, Total Sulphate, Total Ammonia, Nitrate, Alkalinity, ICP Metals Scan (including Total Aluminum, Total Arsenic, Total Copper, Total Iron, Total Lead, Total Nickel & Total Zinc) and Oil and Grease).	Maintain field notes. Results of water quality sampling reported in monthly monitoring reports.
	Inspection of watercourse crossings along the all-weather road during ice-free period.	Structural Integrity, soil and permafrost stability and confirmation of appropriate location.	Maintain field notes. Report results in Annual Geotechnical Inspection Report.

6 Concordance with Licence 2AM-DOH1323 and 2BE-HOP1222 Items

Tables 4 and 5 provide concordance tables to demonstrate where the applicable conditions of Licence 2AM-DOH1323 and 2BE-HOP1222 have respectively been incorporated into the *Hope Bay Project Quarry Management and Monitoring Plan – Revision 02, December 2014.*

Table 4: Concordance Table for Licence 2AM-DOH1323

Licence 2AM-DOH1323	*Quarry Management and Monitoring Plan – Revision 02*
Part D: Conditions Applying to Construction	-
Item 9	Section 4.1.2 & 5.2.2
Item 9b	Section 4.1.2 & 7
Item 10	Section 4.1.1
Item 20	Section 5.2.1 & 5.2.3
Item 21	Section 5.2.1 & 7
Schedule D, Conditions Applying to Construction	-
Item a	Section 4.1.4
Item b	Section 4.2.1
Item c	Section 4.2.1
Item f.i.	Section 4.1.1, 5.2.1, 5.2.2, 5.2.3 & 7
Item f.ii.	Section 5.2.1, 5.2.3 & 7
Item f.iii.	Section 4.1.2, 4.1.3, 5.1, 5.2.2 & 7
Item f.iv.	Section 5.2.4
Item k	Section 4.2.1 & 7
Item n	Section 5.2. 1 & 7

Table 5: Concordance Table for Licence 2BE-HOP1222

Licence 2BE-HOP1222	*Quarry Management and Monitoring Plan – Revision 02*
Part D: Conditions Applying to Waste Disposal	-
Item 18	Section 3.2.3 & 5.1
Part J: Conditions Applying to the Monitoring Program	-
Item 5	Section 3.2.3 & 5.1
Item 6	Section 3.2.3 & 5.1
Item 20	Section 3.2.3, 5.1 & 7

7 Reporting

To address the requirements specified in Nunavut Water Board Type A Water Licence 2AM-DOH1323, Nunavut Water Board Type B Water License No. 2BE-HOP1222 and Nunavut Water Board Type B Water Licence for Madrid Advanced Exploration Program when it is issued, the following reports will be prepared:

- Construction Monitoring Report;
- Waste Rock and Quarry Monitoring Report;
- Construction Summary Report;
- Monthly Monitoring Report; and
- Annual Geotechnical Inspection Report.

All of the aforementioned reports are to be submitted no later than March 31 of the year following construction, with the exception of the Monthly Monitoring Report, which is submitting on a monthly basis.

Generally, these reports will include, but not necessarily be limited to:

- A summary of all inspections conducted during quarry activities and road construction;
- A summary of all monitoring conducted;
- All data generated from the analysis of monitoring samples;
- The results of all samples collected and submitted for analysis;
- A summary of all mitigation activities undertaken as a result of monitoring;
- The results of the follow-up geochemical sample analysis of quarried rock used in construction to verify that the rock used is non-acid generating as predicted;
- The results of monitoring of dust generation and use of water by the contractor to manage dust emissions from crushing and construction activity;
- A summary of post-operational activities and condition of each quarry; and
- Updated “As-built” drawings of the constructed infrastructure and all-weather roads.

This report, Hope Bay Quarry Management and Monitoring Plan – Revision 02, was prepared by SRK Consulting (Canada) Inc.



Lisa Barazzuol, PGeo (BC)
Senior Consultant (Geochemistry)

and reviewed by



Kelly Sexsmith, PGeo (BC)
Principal Consultant

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendix 9

(for Chapter 9, Reclamation and Closure)

SRK, October 2014 Memo – Hope Bay Project: Madrid Advanced Exploration Project: Conceptual Closure and Reclamation Plan

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Memo

To:	John Roberts, TMAC	**Client:**	TMAC Resources Inc.
From:	Lowell Wade Peter Luedke	**Project No:**	1CT022.001.410
Cc:	Maritz Rykaart, SRK	**Date:**	October 31, 2014
Subject:	Hope Bay Project: Madrid Advanced Exploration Program: Conceptual Closure and Reclamation Plan		

1 Introduction

SRK Consulting (Canada) Inc. (SRK) was retained by TMAC Resources Inc. (TMAC) to prepare a conceptual Closure Cost Estimate and Reclamation Plan for all facilities associated with the Madrid Advanced Exploration Program (MAEP).

The basis for the MAEP Closure Cost Estimate and Reclamation Plan is the same as was used for the Doris North Mine Closure and Reclamation Plan (SRK 2014a, 2014b).

The remediation and closure cost estimate of drill sites, associated with surface exploration drilling has been provided in SRK (2013).

1.1 Background

TMAC is currently in the process of constructing their Doris North Project (Project) in the Kitikmeot region of Nunavut, Canada. Concurrent with this, TMAC is carrying out regional exploration and have identified Madrid North and Madrid South as potential high quality exploration targets.

The Madrid North area is located about 9 km south of the Doris North Camp, along the Doris-Windy All-Weather Road. The portal pad haul road will turn off the Doris-Windy All-Weather Road at kilometre 8+600 and head west up to the portal upper and portal lower pads as well as the waste rock pad and ore stockpile pad. At kilometre 9+000 an access road will turn off, on the west side, the Doris-Windy All-Weather Road, will lead to the vent raise pad. Complete details of the Madrid North surface infrastructure are described in SRK (2014c).

The Madrid South area is located about 15 km south of the Doris North Camp. Currently there is no permanent access to this area; and therefore TMAC proposes to construct a 4.7 km long all-weather road which will branch off from the southernmost end of the existing Doris-Windy All-Weather Road at kilometre 9+000 (SRK 2014d). At the end of the Madrid South All-Weather

Road are a series of pads (portal, upper portal, vent raise, infrastructure, laydown, waste rock, and ore stockpile) that are linked by two road alignments (infrastructure access road, haul road and vent raise access road) used to haul waste rock and ore, from the bulk sample, as well as provide access around the Madrid South site (SRK 2014e).

1.2 Closure Objectives

The infrastructure for the MAEP have been designed with closure in mind, and throughout operations every effort to apply progressive reclamation will be evaluated and implemented where practical to do so.

The overall objectives of this Conceptual Closure and Reclamation Plan are to:

- Establish stable chemical and physical conditions;
- Ensure the future use and aesthetics of the two sites, and following reclamation;
- Meet the requirements of Aboriginal, Federal and Territorial Governments, landowners, local communities, and regulatory authorities.

The closure objectives and the closure and reclamation strategies presented herein have been developed in accordance with the Nunavut Mine Site Reclamation Policy (DIAND 2002) and the 2007 Northwest Territories Mine Site Reclamation Guidelines (INAC 2007).

In terms of future use, some of the infrastructure associated with the MAEP is a substantial contribution to the development of Nunavut and could be left in place after closure, following consultation with all interested parties. For example, the fuel storage, roads, and pads can be used as a base for other projects. For the purposes of this memorandum, it has been assumed all infrastructure and facilities will be reclaimed and/or removed to acceptable standards which is reflected in the supporting cost estimate.

2 Description of Existing Facilities

The geographic locations of Madrid North and Madrid South in relation to the existing Doris North Mine are shown in Figures 1 and 2. The infrastructure and facilities from Madrid North to Madrid South have been grouped by location and are shown in Figures 3 through 6:

- Madrid North Site Layout Portal (Figure 3);
- Madrid North Site Layout Vent Raise (Figure 4);
- Madrid South All-Weather Road (Figure 5); and
- Madrid South Site Layout (Figure 6).

The infrastructure and facilities, within each location, have been grouped to create a Work Breakdown Structure (WBS) and alpha-numerically labelled to organize the closure cost estimate provided in Attachment 1. A summary of the WBS is provided in Table 1.

Table 1. Work Breakdown Structure

Location	Facility	WBS Code
Madrid North Surface Infrastructure		
Upper Portal Area		
	Shop	MN-001
	Diesel Generator	
	Office & Support Complex	MN-003
Lower Portal Area		
	Brine Mixing Facility	MN-004
	Portal and Underground Works	MN-005
Fuel Storage Facility		
	Fuel Storage Facility	MN-006
Pond Access Road		
	Pond Access Road	MN-007
Pollution Control Pond		
	Pollution Control Pond	MN-008
Portal Pad Road		
	Portal Pad Haul Road	MN-009
	Pipe Culvert	MN-010
	Dual Water Line - Discontinued	MN-011
Ore Stockpile Pad		
	Ore Stockpile Pad	MN-012
Waste Rock Pile		
	Waste Rock Pile	MN-013
Madrid North Vent Raise		
	Vent Raise	MN-014
	Ventilation and Heating Facilities	MN-015
	Offices & Support Complex	MN-016
	Diesel Generator	MN-017
	Fuel Containment Area	MN-018
	Vent Raise access road	MN-019
	Pipe Culvert	MN-020
Madrid South All-Weather Road		
Madrid South All-Weather Road		
	Madrid South All-Weather Road	MR-001
	Crossing #1	MR-002
	Crossing #2	MR-003

Madrid South Surface Infrastructure		
Infrastructure Pad Area		
	Shop	MS-001
	Fuel Storage Facility	MS-002
	Offices & Support Complex	MS-003
	Fresh Water Pipelines Leg 2 - Discontinued	MS-004
	Diesel Generator	MS-005
Laydown Pad		
	Laydown Pad	MS-006
Portal Area		
	Portal and Underground Works	MS-007
	Brine Mixing Facility	MS-008
Primary Pollution Control Area		
	Primary Pollution Control Pond	MS-009
Haul Road and Water Supply Infrastructure		
	Secondary Pollution Control Pond	MS-010
	Haul and Access Roads	MS-011
	Pumphouse - Discontinued	MS-012
	Freshwater Pipeline Leg 1 - Discontinued	MS-013
Infrastructure Access Road		
	Infrastructure Access Road	MS-014
Waste Rock Pile		
	Waste Rock Pile	MS-015
Ore Stockpile Pad		
	Ore Stockpile Pad	MS-016
Madrid South Vent Raise Area		
	Vent Raise	MS-017
	Ventilation and Heating Facilities	MS-018
	Fuel Containment Area	MS-019
Additional Direct Costs		
Off-site Shipping for Disposal	Ship Off-site for Disposal by Barge	DN-001
Off-Site Disposal Fees	Disposal Fees in Licensed Facility	DN-002
Water Management	Madrid North Water Management - Discontinued	WM-001
	Madrid South Water Management - Discontinued	WM-002

3 Closure and Reclamation Strategies

In accordance with the Nunavut Mine Site Reclamation Policy (DIAND 2002) and the 2007 Northwest Territories Mine Site Reclamation Guidelines (INAC 2007) the following closure and reclamation strategies will be used to fulfill the closure obligations.

3.1 Cover Materials

All material used for reclamation will be sourced from existing stockpiles of Run-of-Quarry and crushed rock. This stockpiled material will come from local approved and permitted rock quarries along the Doris-Windy All Weather Road (Quarry A, B, and D), as well as quarries along the Madrid South All-Weather Road (Quarry G and H). SRK (2008) contains complete details pertaining to geochemical characterization of the Doris-Windy All-Weather Road Quarries A, B, and D while SRK (2014f) provides the geochemical characterization of the Madrid South All-Weather Road Quarries G and H confirming the suitability of all these quarries for use.

Where overburden soils, stockpiled during quarry development, will be used for reclamation, a sampling and testing program will be carried out to ensure no chemical or hydrocarbon contamination exists within the overburden stockpiles. The Canadian Council for Ministers of the Environmental Soil Quality Guidelines (CCME 2007) provides guidance to the acceptability of overburden material for reclamation covers.

3.2 Rock Fill Pads (Pads)

The reclamation objective is to ensure long-term physical stability and to protect the permafrost. Reclamation of the pads will be limited to regrading to ensure positive drainage and prevent the ponding of water. Since construction, the permafrost will have migrated into the pads resulting in the loss of the underlying vegetation and soils. Removal of the pads is not practical because it would accelerate permafrost degradation due to lack of well-established vegetation, which provides a thermal cover to preserve the permafrost. Re-vegetation of the pads is not practical because the rock fill will not support vegetation growth.

3.3 All-Weather Roads

The all-weather roads are built using rock fill that will be left in place to protect the permafrost, as described in Section 3.2. The surface of the all-weather roads will be crowned or graded to prevent permanent ponding of water. The stream crossings will be removed for safety.

3.4 Fuel Storage Areas

At Madrid North there is a 75,000 L fuel tank in the fuel storage facility located along the haul road to the portal upper pad and a 60,000 L fuel tank, in the fuel containment area, located on the vent raise Pad.

At Madrid South there is a 75,000 L fuel tank, in the fuel storage facility, located on the infrastructure pad and a 60,000 L fuel tank, in the fuel containment area, located on the vent raise pad.

The fuel tanks will be decommissioned, drained, and hauled to Roberts Bay to be removed from the site for reuse or disposal in a licensed facility. The granular protective cover, over the geosynthetic liners, will be tested for the presence of hydrocarbons. If required, this material will be remediated onsite or removed offsite for disposal. The geosynthetic liners will be cleaned, removed, cut into pieces, and disposed of as non-hazardous waste. The containment berms will be levelled to prevent permanent ponding of water.

3.5 Buildings and Facilities

3.5.1 Salvage

SRK understands that TMAC is currently planning to complete the work at Madrid North and at Madrid South sequentially. As a result, there is the potential to re-use buildings and equipment at both sites. This potential cost savings, in closure, have not been factored into the estimate. Reusable furniture, utilities, equipment, and supplies will be salvaged prior to demolition and prepared for shipping off-site to a point of sale. Where possible, salvageable structures will be moved intact, or they will be carefully dismantled and catalogued for re-assembly. Unusable or unwanted buildings will be demolished. For the purpose of the closure cost estimate none of the buildings and facilities are assumed to have salvage value.

3.5.2 Demolition

All utilities will be dismantled and the structures emptied prior to demolition. Fuel tanks used for heating fuel will be drained and removed. Non-hazardous and hazardous waste will be segregated and disposed of as discussed in Sections 3.12 and 3.13.

3.6 Water Management Structures

All existing water management structures (pollution control ponds) will be maintained at Madrid North and at Madrid South until post-closure water quality objectives are met. Water collected in the pollution control ponds will be transported to Tail Lake for disposal as described in SRK (2014g). Discharge from Tail Lake must meet the water quality criteria for the Doris North Type “A” Water License 2AM-DOH1323.

When post-closure water quality objectives are met, the pollution control ponds will be decommissioned and breached to restore the natural drainage paths where possible. For all pollution control ponds, the downstream berm will be breached and the liner within the pollution control pond will be entirely removed and disposed of as non-hazardous waste.

Where a natural drainage path cannot be restored, measures will be taken to prevent accumulation and permanent ponding of water in order to prevent permafrost degradation. Erosion protection and sediment control measures will be installed where necessary.

All sumps will be decommissioned and backfilled with crushed rock.

3.7 Ore Stockpile and Waste Rock Pile

It is assumed that all ore from the MAEP will have been processed through the Mill at Doris North Mine. The top surfacing layer of the ore stockpile pads will be removed and processed through the Mill at Doris North Mine as well. The remaining clean rock fill will be regraded to prevent the permanent ponding of water.

Waste rock will be used for sealing the underground workings. A portion of the waste rock at Madrid North is known to be potentially acid generating (PAG). Furthermore, specific waste rock lithologies are known to leach arsenic (As) and nickel (Ni). All of the waste rock will leach ammonia (from the blasting residue) and salts (from the drilling brine). The waste rock at Madrid South is known to be non-PAG and the As and Ni leaching is less significant, compared to the waste rock at Madrid North. Like the waste rock at Madrid North, all of this waste rock will leach ammonia (from the blasting residue) and salts (from the drilling brine).

For the purpose of the closure cost estimate it has been assumed the remaining waste rock, on surface at both Madrid North and Madrid South, will be consolidated, reshaped to prevent the ponding of water with the final side slopes of 3H:1V, and covered with an HPDE liner with a 0.3 m thick protective layer of crushed rock.

3.8 Portal and Underground Workings

All underground utilities and installations will be removed and disposed of as appropriate. The entrance of the two underground portals will be sealed with 15 m thick rock fill plugs, according to regulations. The pads in front of the portals will be regraded to promote positive drainage away from the portal entrances, and prevent the permanent ponding of water.

3.9 Vent Raise

Duct works, pipes, and cables entering into the vent raises will be removed. A 0.5 m thick reinforced concrete plug will be installed to seal each vent raise.

3.10 Rock Quarries

All rock quarries will be decommissioned and reclaimed. The vertical faces, in the quarries, will be scaled and the safety berms left in place. The area of each quarry will be inspected by a qualified inspector, to ensure there are no loaded blast holes remaining on-site.

The quarries will be managed and monitored according to SRK (2014h). Quarries will be developed such that precipitation or snow melt is retained within the quarry boundaries. Generally this will be accomplished by ensuring that the quarry floors are sloped toward a natural low area and, if required, the creation of a quarry sump to collect the waters and settle out suspended solids. In the event the quarry sump requires pumping, a sample of the ponded water will be tested and the inspector will be notified at least fifteen (15) days prior to the planned

pumping to the discharge location. Should the quarry water not meet discharge criteria, a vacuum truck will remove the water to Tail Lake.

3.11 Collection and Disposal of Demolition Debris and Non-Hazardous Waste

Structures and facilities that are to be demolished will have non-hazardous waste segregated into wood waste and other non-hazardous waste.

Wood waste will either be chipped or burned. Wood waste suitable for burning will be transported to an approved burn pan location. Prior to on-site burning, appropriate approvals and permissions will be obtained from the NWB. Chipped wood may be used for reclamation activities such as being mixed with drill cuttings, overburden or other material and used to back fill depressions in the tundra caused by permafrost degradation.

All remaining non-hazardous waste will be loaded into seacans to be shipped off-site and disposed of in a licensed facility in accordance with appropriate Federal, Provincial, Territorial, or Municipal non-hazardous waste regulations.

3.12 Collection and Disposal of Hazardous Waste

Hazardous wastes and chemicals, remaining on-site, will be collected and stored in suitable sealed containers and/or empty drums. This includes any remaining fuel, hydraulic oil, antifreeze, batteries, other lubricating fluids, and chemicals. Reusable items will be shipped off-site to a third party destination. Unusable items will be packaged and manifested at the Waste Management Facility, located at Roberts Bay, for transport to a licensed facility in accordance with Federal, Provincial, Territorial, or Municipal non-hazardous waste regulations.

4 Post-Closure Monitoring and Maintenance

Post-closure monitoring will take place until such time as the objectives of the closure and remediation activities, described above, have been met to the satisfaction of the regulatory authorities and all affected parties. The extent of post-closure monitoring may vary given that the MAEP have been designed with closure in mind.

The following post-closure monitoring will be required to ensure the closure and remediation objectives are met:

- Madrid North, Madrid South All-Weather Road, and Madrid South will be inspected annually by a Professional Engineer for three consecutive years to ensure that any permafrost degradation areas have stabilized.
- Post-closure monitoring of all covers will be performed every two years for a ten year period or until it is confirmed the areas are physically stable. These inspections will be completed by a Professional Engineer to ensure the physical integrity of the cover is maintained. Maintenance will be performed on areas that monitoring identifies as needing repairs.
- An annual seep sampling program, carried out in accordance with the Type “B” Water Licence, will be continued to detect any changes in the leachate chemistry downstream of the remediated areas for a period of five years or until the leachate is confirmed to be chemically stable and consistent with the closure criteria in the Type “B” Water License.

The post-closure monitoring requirements may require additional activities following the implementation of the Madrid Advanced Exploration Program Final Closure and Remediation Plan and the subsequent Madrid Advanced Exploration Program Reclamation Completion Remediation Report.

In addition, the monitoring requirements may change as a result of the Madrid Advanced Exploration Program Performance Assessment Report. This report will be prepared and submitted to the NWB for their review following the initial post-closure monitoring period which will be defined in consultation with NWB as part of the Madrid Advanced Exploration Program Final Closure and Remediation Plan.

5 Cost Estimate

The basis for the closure cost estimate is the same as the one used for the Doris North Mine Closure and Reclamation Plan (SRK 2014a, 2014b). The closure cost estimate is presented in 2014 CAD. These costs were developed using an NWB approved MS Excel spreadsheet based cost estimating process that is consistent with the principles of RECLAIM6.1 (SRK 2014i). The details of the estimated costs for closure of the MAEP are provided in Attachment 1 with a summary provided in Table 2.

Table 2. Summary of Closure Cost Estimate

Location	Cost
Direct Cost	
Madrid North Surface Infrastructure	$ 1,834,000
Madrid South All-Weather Road	$ 17,000
Madrid South Surface Infrastructure	$ 1,757,000
Additional Direct Costs	$ 817,000
Total Direct Costs	**$ 4,425,000**
Indirect Cost	
Total Indirect Costs	**$ 2,706,000**
Total Closure Cost	
Total Closure Costs	**$ 7,131,000**

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6 References

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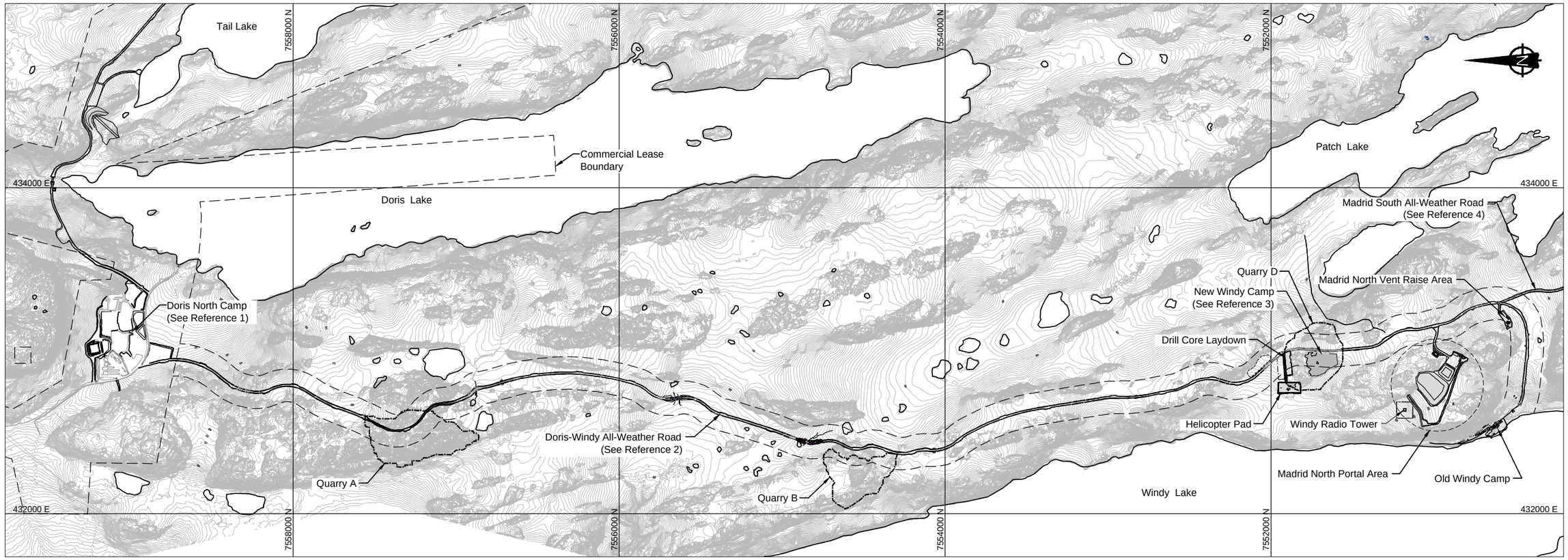
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Figures



NOTES

1. Topographic contour data for the terrain model were provided by Hope Bay Mining, and is based on 2007 Aerial Photography. Contour intervals are 0.5m.
2. The co-ordinate system is UTM NAD 83, Zone 13.
3. All dimensions are in metric units, unless specifically mentioned.
4. Notes in this drawing apply to all other active drawings.

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1) Engineering Drawings for the Doris North Camp Area, Doris North Project, Nunavut, Canada. Revision AB1. As-Built Drawings Prepared for Hope Bay Mining Limited. Project Number 1CH008.033. May 18, 2012
2) Engineering Drawings for the Doris-Windy All-Weather Road, Doris Infrastructure Project, Nunavut, Canada. Revision AB1. As-Built Drawings Prepared for Hope Bay Mining Ltd. Project Number: 1CH008.033/.058. May 11, 2012
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0 200 400 600 800 1000
Scale in Metres

srk consulting

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TMAC RESOURCES

HOPE BAY PROJECT

Madrid Closure and Reclamation Plan

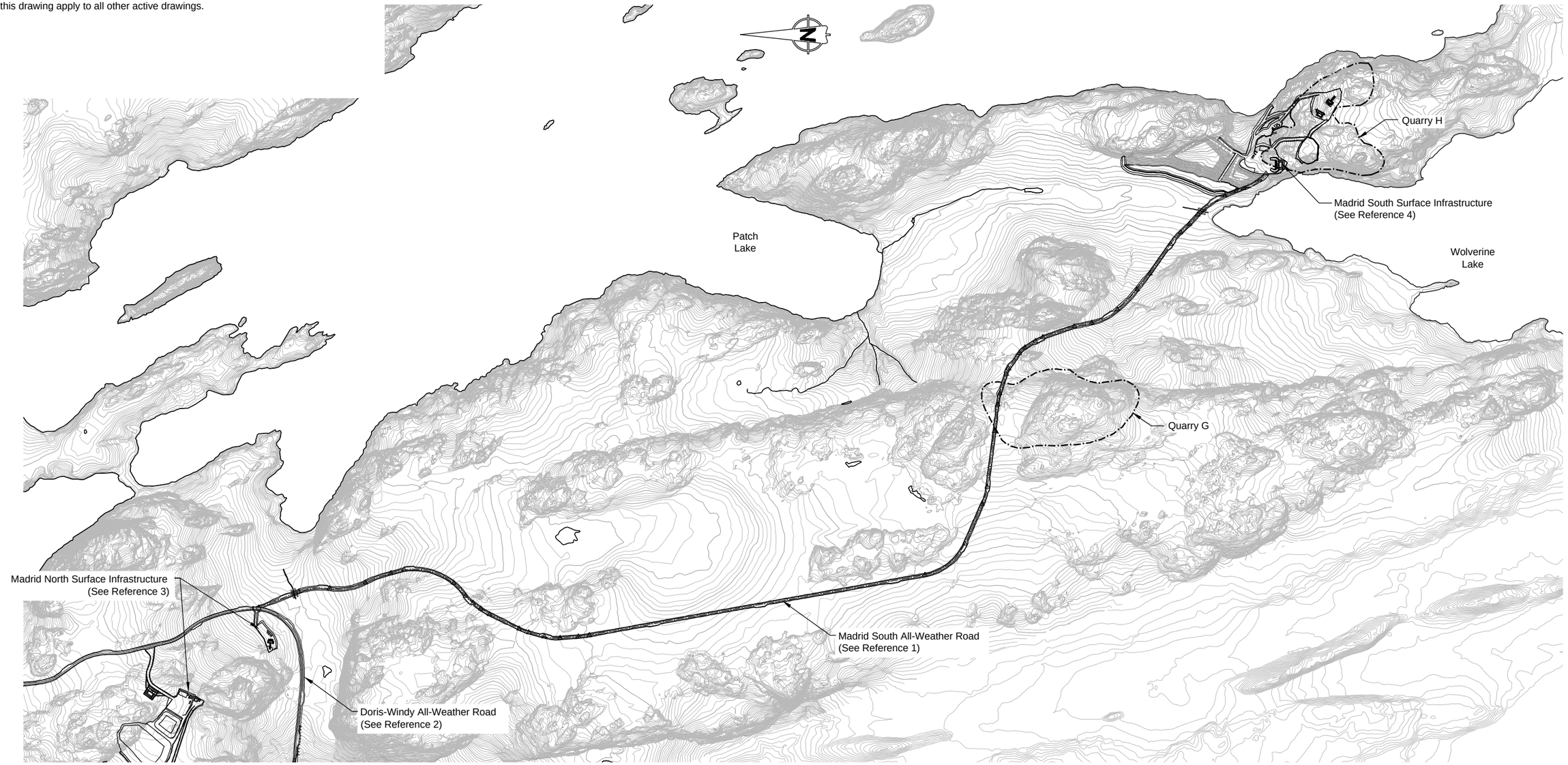
General Arrangement
Doris North Camp to Madrid North Portal

DATE:	APPROVED:	FIGURE:
Oct. 2014	LW	1

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NOTES

1. Topographic contour data for the terrain model were provided by Hope Bay Mining, and is based on 2007 Aerial Photography. Contour intervals are 0.5m.
2. The co-ordinate system is UTM NAD 83, Zone 13.
3. All dimensions are in metric units, unless specifically mentioned.
4. Notes in this drawing apply to all other active drawings.



LEGEND

- Existing Approved and Permitted Quarry
- Proposed Development Quarry
- Road Alignment

REFERENCES

1. Engineering drawings for the Madrid South All-Weather Road, Hope Bay Project, Nunavut, Canada. Issued for Discussion. Revision D. Project No. 1CT022.001. October 31, 2014.
2. Engineering Drawings for the Doris-Windy All-Weather Road, Doris Infrastructure Project, Nunavut, Canada. Revision AB1. As-Built Drawings Prepared for Hope Bay Mining Ltd. Project Number: 1CH008.033/.058. May 11, 2012
3. Engineering drawings for the Madrid North Surface Infrastructure, Hope Bay Project, Nunavut, Canada. Issued for Discussion. Revision E. Project No. 1CT022.001. October 31, 2014.
4. Engineering drawings for the Madrid South Surface Infrastructure, Hope Bay Project, Nunavut, Canada. Issued for Discussion. Revision F. Project No. 1CT022.001. October 31, 2014.

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Scale in Metres

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MAC RESOURCES

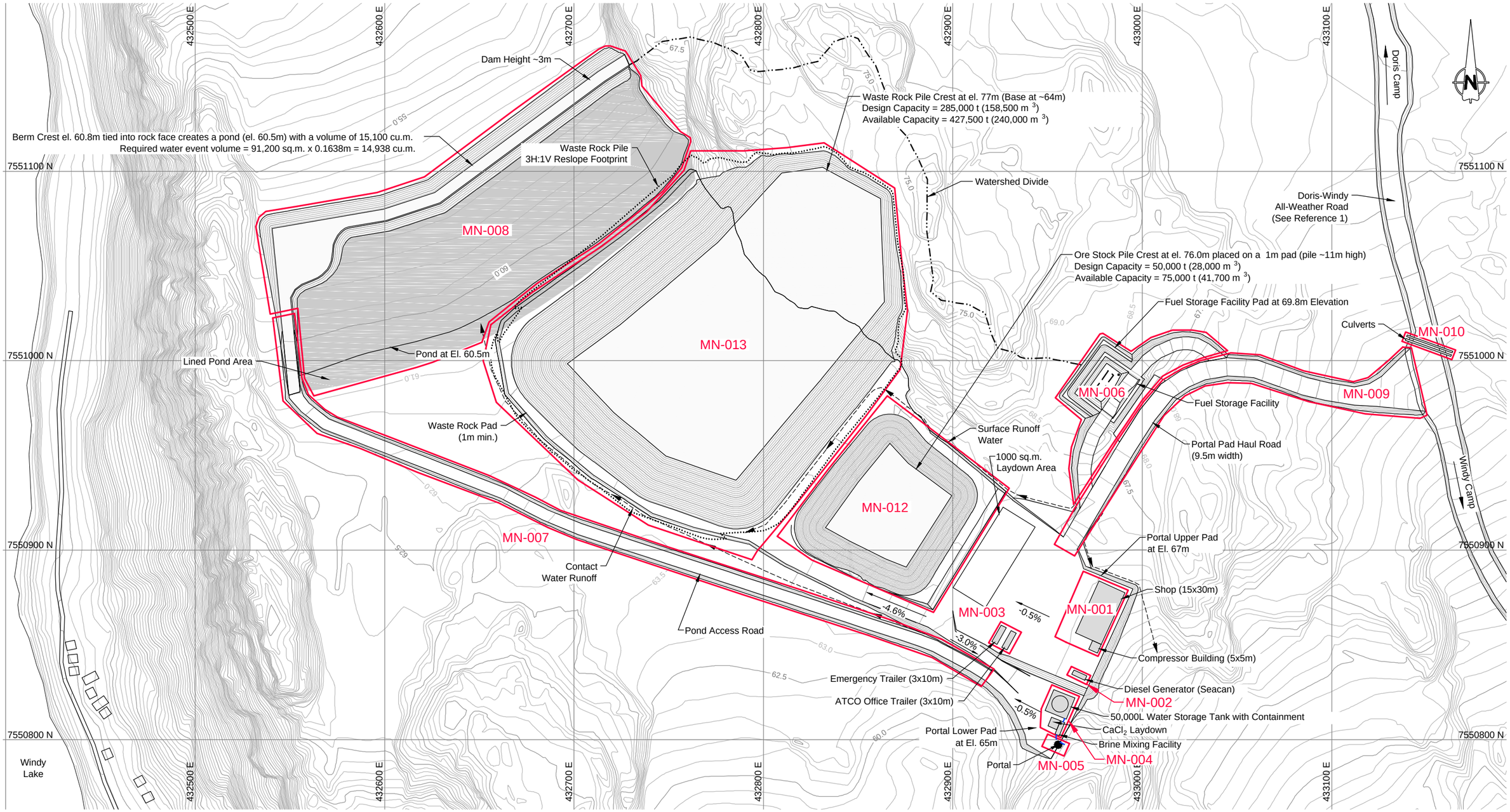
HOPE BAY PROJECT

Madrid Closure and Reclamation Plan

General Arrangement
Madrid North to Madrid South

DATE:	APPROVED:	FIGURE:
Oct. 2014	LW	2

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NOTES

1. All dimensions in metres unless noted otherwise.
2. Notes in this drawing apply to all other active drawings.

0 10 20 30 40 50
Scale in Metres

REFERENCE

1) Engineering Drawings for the Doris-Windy All-Weather Road, Doris Infrastructure Project, Nunavut, Canada. Revision AB1. As-Built Drawings Prepared for Hope Bay Mining Ltd. Project Number: 1CH008.033/.058. May 11, 2012

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SRK JOB NO.: 1CH022.001
FILE NAME: 1CT022.001_Madrid North Closure.dwg

TMAC RESOURCES

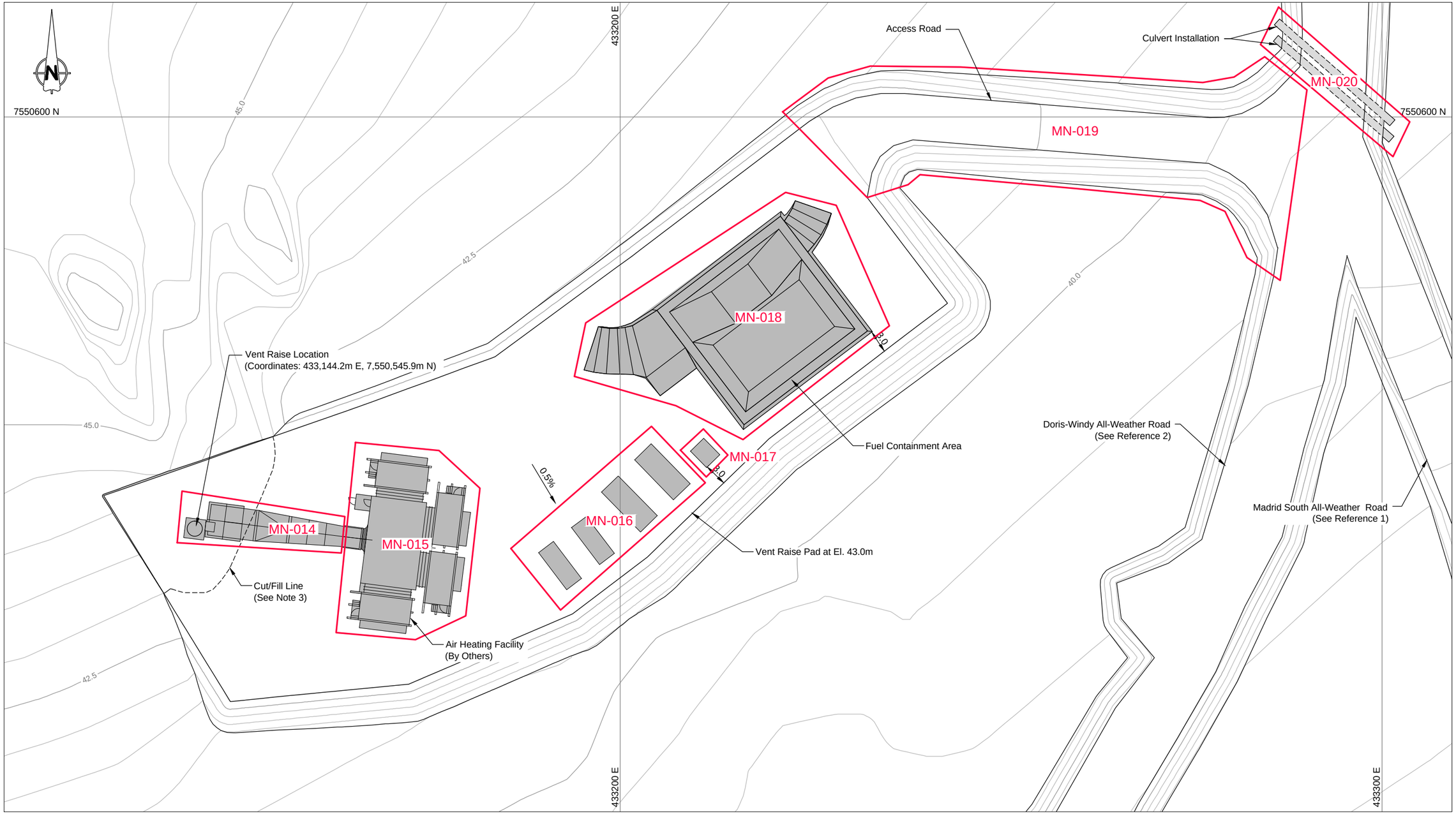
HOPE BAY PROJECT

Madrid Closure and Reclamation Plan

Madrid North
Site Layout Portal

DATE:	APPROVED:	FIGURE:
Oct. 2014	LW	3

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NOTES

1. All dimensions in metres unless noted otherwise.
2. Cut into bedrock outcrop required for construction of vent raise collar.
3. Notes in this drawing apply to all other active drawings.

REFERENCES

1) Engineering Drawings for the Madrid South All-Weather Road, Hope Bay Project, Nunavut, Canada. Revision D. Issued for Discussion Drawings Prepared for TMAC Resources Inc. Project Number 1CT022.001.410. October 31, 2014

2) Engineering Drawings for the Doris-Windy All-Weather Road, Doris Infrastructure Project, Nunavut, Canada. Revision AB1. As-Built Drawings Prepared for Hope Bay Mining Ltd. Project Number: 1CH008.033/.058. May 11, 2012

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Scale in Metres

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HOPE BAY PROJECT

Madrid Closure and Reclamation Plan

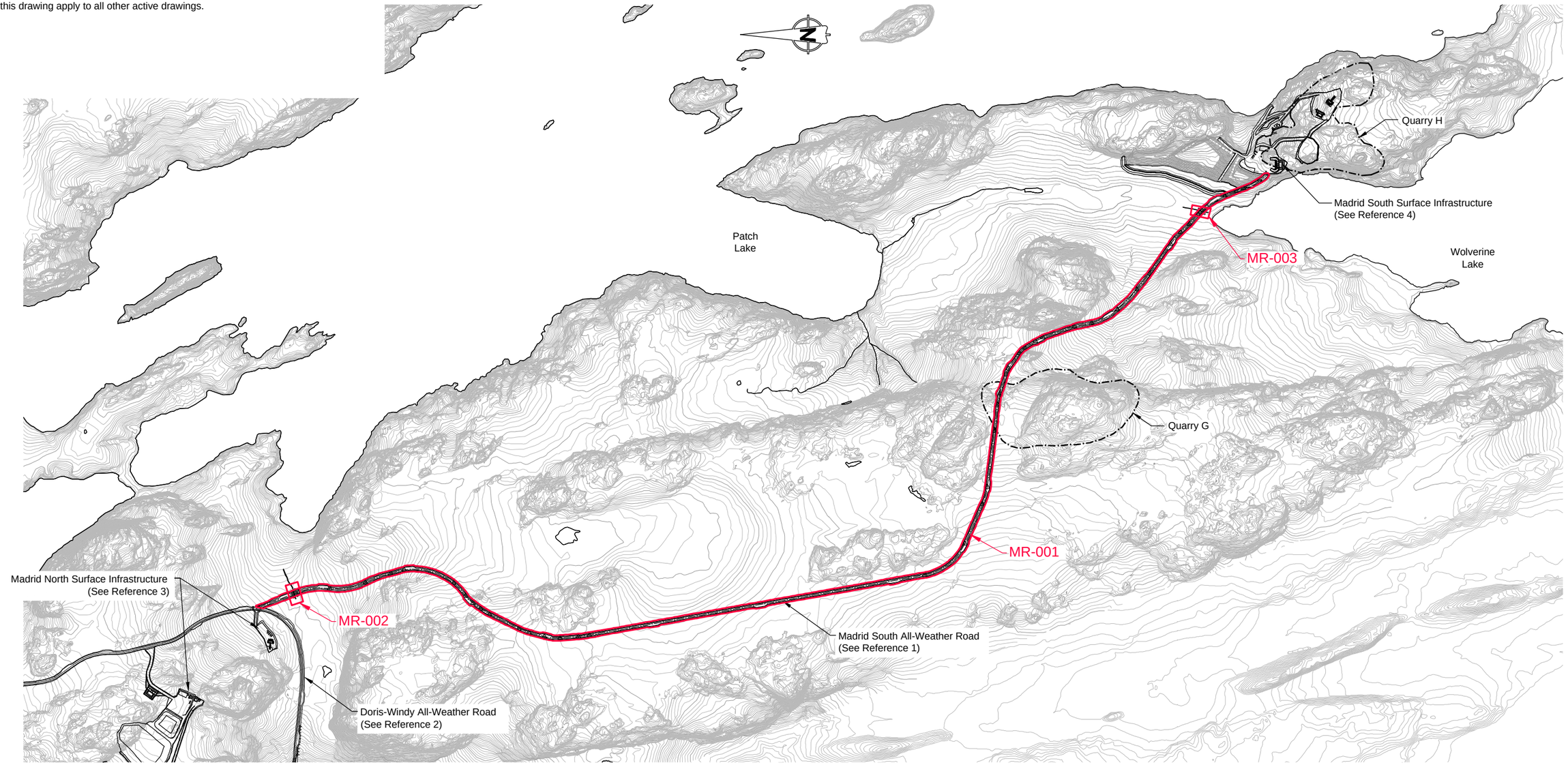
Madrid North
Site Layout Vent Raise

DATE:	APPROVED:	FIGURE:
Oct. 2014	LW	4

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NOTES

1. Topographic contour data for the terrain model were provided by Hope Bay Mining, and is based on 2007 Aerial Photography. Contour intervals are 0.5m.
2. The co-ordinate system is UTM NAD 83, Zone 13.
3. All dimensions are in metric units, unless specifically mentioned.
4. Notes in this drawing apply to all other active drawings.



LEGEND

- Existing Approved and Permitted Quarry
- Proposed Development Quarry
- Road Alignment

REFERENCES

1. Engineering drawings for the Madrid South All-Weather Road, Hope Bay Project, Nunavut, Canada. Issued for Discussion. Revision D. Project No. 1CT022.001. October 31, 2014.
2. Engineering Drawings for the Doris-Windy All-Weather Road, Doris Infrastructure Project, Nunavut, Canada. Revision AB1. As-Built Drawings Prepared for Hope Bay Mining Ltd. Project Number: 1CH008.033/.058. May 11, 2012
3. Engineering drawings for the Madrid North Surface Infrastructure, Hope Bay Project, Nunavut, Canada. Issued for Discussion. Revision E. Project No. 1CT022.001. October 31, 2014.
4. Engineering drawings for the Madrid South Surface Infrastructure, Hope Bay Project, Nunavut, Canada. Issued for Discussion. Revision F. Project No. 1CT022.001. October 31, 2014.

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Scale in Metres

srk consulting

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FILE NAME: 1CT022_001_Madrid South_Overview.dwg

TMAC RESOURCES

HOPE BAY PROJECT

Madrid Closure and Reclamation Plan

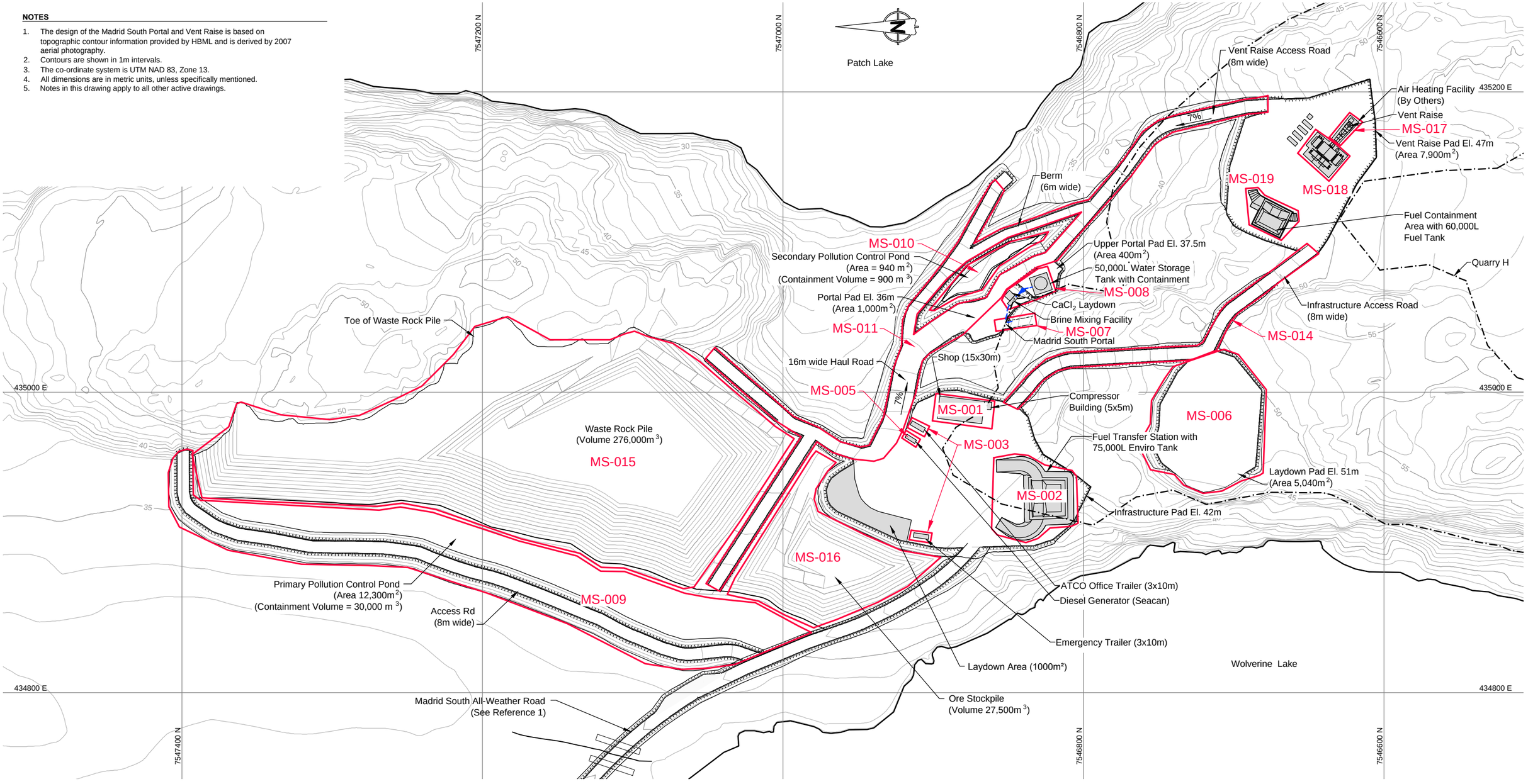
Madrid South
All-Weather Road

DATE:	APPROVED:	FIGURE:
Oct. 2014	LW	5

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NOTES

1. The design of the Madrid South Portal and Vent Raise is based on topographic contour information provided by HBML and is derived by 2007 aerial photography.
2. Contours are shown in 1m intervals.
3. The co-ordinate system is UTM NAD 83, Zone 13.
4. All dimensions are in metric units, unless specifically mentioned.
5. Notes in this drawing apply to all other active drawings.



LEGEND

- Proposed Quarry Boundary
- Water Line

REFERENCES

1. Engineering drawings for the Madrid South All-Weather Road, Hope Bay Project, Nunavut, Canada. Issued for Discussion. Revision D. Project No. 1CT022.001. October 31, 2014.

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Scale in Metres

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FILE NAME: 1CT022.001_Madrid_South_Closure.dwg

TMAC RESOURCES

HOPE BAY PROJECT

Madrid Closure and Reclamation Plan

Madrid South Site Layout

DATE:	APPROVED:	FIGURE:
Oct. 2014	LW	6

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Attachment 1
Madrid Advanced Exploration Bulk Samples
Conceptual Closure and Reclamation Cost Estimate

Worksheet 1: Summary of Costs

Location	Facility	WBS Code	Cost (rounded to the nearest thousand)	
			By task	By work Area
Direct Cost Items				
Madrid North Surface Infrastructure				**$ 1,834,000**
Upper Portal Area				$25,000
	Shop	MN-001	$21,000	
	Diesel Generator			
	Office & Support Complex	MN-003	$4,000	
Lower Portal Area				$25,000
	Brine Mixing Facility	MN-004	$1,000	
	Portal and Underground Works	MN-005	$24,000	
Fuel Storage Facility				$7,000
	Fuel Storage Facility	MN-006	$7,000	
Pond Access Road				$1,000
	Pond Access Road	MN-007	$1,000	
Pollution Control Pond				$12,000
	Pollution Control Pond	MN-008	$12,000	
Portal Pad Road				$6,000
	Portal Pad Haul Road	MN-009	$1,000	
	Pipe Culvert	MN-010	$5,000	
	Dual Water Line - Discontinued	MN-011	$0	
Ore Stockpile Pad				$1,000
	Ore Stockpile Pad	MN-012	$1,000	
Waste Rock Pile				$1,707,000
	Waste Rock Pile	MN-013	$1,707,000	
Madrid North Vent Raise				$48,000
	Vent Raise	MN-014	$23,000	
	Ventilation and Heating Facilities	MN-015	$4,000	
	Offices & Support Complex	MN-016	$7,000	
	Diesel Generator	MN-017	$2,000	
	Fuel Containment Area	MN-018	$7,000	
	Vent Raise access road	MN-019	$1,000	
	Pipe Culvert	MN-020	$4,000	
Madrid South All-Weather Road				**$ 17,000**
Madrid South All-Weather Road				$17,000
	Madrid South All-Weather Road	MR-001	$5,000	
	Crossing #1	MR-002	$6,000	
	Crossing #2	MR-003	$6,000	
Madrid South Surface Infrastructure				**$ 1,757,000**
Infrastructure Pad Area				$36,000
	Shop	MS-001	$22,000	
	Fuel Storage Facility	MS-002	$7,000	
	Offices & Support Complex	MS-003	$5,000	
	Fresh Water Pipelines Leg 2 - Discontin	MS-004	$0	
	Diesel Generator	MS-005	$2,000	
Laydown Pad				$1,000
	Laydown Pad	MS-006	$1,000	
Portal Area				$25,000
	Portal and Underground Works	MS-007	$24,000	
	Brine Mixing Facility	MS-008	$1,000	
Primary Pollution Control Area				$11,000
	Primary Pollution Control Pond	MS-009	$11,000	
Haul Road and Water Supply Infrastructure				$5,000
	Secondary Pollution Control Pond	MS-010	$4,000	
	Haul and Access Roads	MS-011	$1,000	
	Pumphouse - Discontinued	MS-012	$0	
	Freshwater Pipeline Leg 1 - Discontinue	MS-013	$0	
Infrastructure Access Road				$1,000
	Infrastructure Access Road	MS-014	$1,000	
Waste Rock Pile				$1,648,000
	Waste Rock Pile	MS-015	$1,648,000	
Ore Stockpile Pad				$1,000
	Ore Stockpile Pad	MS-016	$1,000	
Madrid South Vent Raise Area				$26,000
	Vent Raise	MS-017	$15,000	
	Ventilation and Heating Facilities	MS-018	$4,000	
	Fuel Containment Area	MS-019	$7,000	
Additional Direct Costs				
Off-site Shipping for Disposal	Ship Off-site for Disposal by Barge	DN-001	$740,000	**$ 740,000**
Off-Site Disposal Fees	Disposal Fees in Licensed Facility	DN-002	$77,000	**$ 77,000**
Water Management	Madrid North Water Management - Disc	WM-001	$0	**$ -**
	Madrid South Water Management - Disc	WM-002	$0	**$ -**
TOTAL DIRECT COSTS				**$ 4,425,000**
Indirect Cost Items				
Contingency			$720,000	**$ 720,000**
Mobilization & Demobilization			$712,000	**$ 712,000**
General and Administration costs			$34,000	**$ 34,000**
Field support			$30,000	**$ 30,000**
Hydrocarbon decontamination			$150,000	**$ 150,000**
Post-closure Monitoring			$1,060,000	**$ 1,060,000**
Subtotal Indirect Costs				**$ 2,706,000**
CLOSURE COSTS - TOTAL				**$ 7,131,000**

Worksheet 2: Detailed Cost Estimate

Work Area Code	Item	Task	Sub-task	Activity	Task	Quantity	Unit	Cost Code	Unit Cost	Task Total	Activity Total	Subtotals	Source / Comments
DIRECT COSTS													
Madrid North Portal and Vent Raise												**$1,830,377**	
Upper Portal Area												**$25,959**	
MN-001		1	1	Shop	Decommission electrical, mechanical (including connections to generator house & transformer)	2	each	C.1.05	$603.78	$ 1,207.57	$ 20,899.37		Assume large tent structure
	1	1	2		Demolish building	2,250	m^2	C.3.05	$7.93	$ 17,835.91			
	1	1	3		Collect debris	450	m^3	C.3.10	$0.14	$ 61.29			
	1	1	4		Load waste into containers for shipping off-site	198	m^3	C.4.01	$4.97	$ 985.38			
	1	1	5		Haul debris to Roberts Bay laydown	198	m^3	C.4.14	$4.09	$ 809.22			
MN-002	1	2	1	#N/A	Decommission (electrical)	1	each	C.1.05	$603.78	$ 603.78	$ 1,366.64		Mobile Generator
	1	2	2		Disconnect generator units and prep for shipping off-site	1	each	C.1.06	$636.82	$ 636.82			
	1	2	3		Haul units to Roberts Bay laydown	1	each	C.4.16	$94.94	$ 94.94			
	1	2	4		Collect all debris	30	m^2	C.3.10	$0.14	$ 4.06			
	1	2	5		Load waste into containers for shipping off-site	3	m^3	C.4.01	$4.97	$ 14.84			
	1	2	6		Haul containers to Roberts Bay laydown	3	m^3	C.4.14	$4.09	$ 12.19			
MN-003	1	3	1	Office & Support Complex	Decommission (electrical, mechanical, plumbing)	2	each	C.1.05	$603.78	$ 1,207.57	$ 3,693.39		
	1	3	2		Disconnect trailers and prep for moving (remove boards, cladding, etc.; wrap in plastic)	2	each	C.1.08	$1,110.00	$ 2,220.01			ATCO trailers
	1	3	3		Haul trailers to Roberts Bay for shipping off-site	2	each	C.4.16	$94.94	$ 189.88			
	1	3	4		Demolish cribbing, stairs, entryways, etc.	-	m^2	C.3.05	$7.93	$ -			Demolish extras around ATCO trailers
	1	3	5		Collect all debris	60	m^2	C.3.10	$0.14	$ 8.17			
	1	3	6		Load waste into containers for shipping off-site	-	m^3	C.4.01	$4.97	$ -			
	1	3	7		Haul containers to Roberts Bay laydown	-	m^3	C.4.14	$4.09	$ -			
	1	3	8		Regrade area for positive drainage	5,800	m^2	C.5.18	$0.01	$ 67.77			
Lower Portal Area												**$24,413**	
MN-004	1	4	1	Brine Mixing Facility	Drain and decommission 50000L water storage tank	1	each	C.1.12	$241.82	$ 241.82	$ 515.80		
	1	4	2		Haul water tank to Roberts Bay Laydown	1	each	C.4.17	$113.57	$ 113.57			
	1	4	3		Load excess CaCl2 into container for shipping off site	2	m^3	C.4.01	$4.97	$ 9.95			Assume open skid on site
	1	4	4		Collect all debris	54	m^2	C.3.10	$0.14	$ 7.41			
	1	4	5		Haul water tank to Roberts Bay Laydown	1	each	C.4.17	$113.57	$ 113.57			
	1	4	6		Load waste into containers for shipping off-site	2	m^3	C.4.01	$4.97	$ 9.95			Base waste quantities
	1	4	7		Haul containers to Roberts Bay laydown	4	m^3	C.4.15	$4.89	$ 19.55			
MN-005	1	5	1	Portal and Underground Works	Remove ducts, pipes, electrical cables	100	lm	C.3.16	$105.70	$ 10,570.01	$ 23,896.73		Estimate based on Doris estimate
	1	5	2		Construct portal plug	707	m^3	C.5.03	$18.83	$ 13,309.78			
	1	5	3		Regrade area for positive drainage	1,450	m^2	C.5.18	$0.01	$ 16.94			Entire Lower Pad area
Fuel Storage Facility												**$7,379**	
MN-006	1	6	1	Fuel Storage Facility	Decommission Enviro Tank	1	each	C.2.03	$241.82	$ 241.82	$ 7,379.48		Estimate based on Doris estimate
	1	6	2		Haul Enviro Tank to Roberts Bay	1	each	C.4.16	$94.94	$ 94.94			
	1	6	3		Load contained contaminated soils into megabags for shipping off-site	80	m^3	C.4.12	$69.79	$ 5,610.96			
	1	6	4		Remove liner and cut into manageable pieces	2,302	m^2	C.3.02	$0.15	$ 347.92			Design quantities
	1	6	5		Load all debris and waste into containers	21	m^3	C.4.01	$4.97	$ 103.06			
	1	6	6		Haul containers to Roberts Bay	101	m^3	C.4.14	$4.09	$ 413.08			
	1	6	7		Backfill area to prevent permanent ponding	750	m^2	C.5.05	$0.76	$ 567.71			
Pond Access Road												**$456**	
MN-007	1	7	1	Pond Access Road	Crown road for positive drainage	0	km	C.5.17	$1,017.65	$ 455.91	$ 455.91		
Pollution Control Pond												**$12,492**	
MN-008	1	8	1	Pollution Control Pond	Disconnect piping and electrical wiring, remove sump pumps	2	each	C.1.05	$603.78	$ 1,207.57	$ 12,491.80		
	1	8	2		Remove and cut liner into manageable pieces	14,300	m^2	C.3.02	$0.15	$ 2,161.25			Liner+Geotextile
	1	8	3		Load waste into containers for shipping off-site	465	m^3	C.4.01	$4.97	$ 2,314.59			Liner+Geotextile in breach area
	1	8	4		Haul containers to Roberts Bay laydown	465	m^3	C.4.15	$4.89	$ 2,273.78			
	1	8	5		Breach Pollution Control pond	2,500	m^3	C.5.05	$0.76	$ 1,892.36			
	1	8	6		Remove and cut liner into manageable pieces (breach only)	4,400	m^2	C.3.02	$0.15	$ 665.00			Liner+Geotextile in breach area
	1	8	7		Rip-rap breach for erosion protection	105	m^3	C.5.03	$18.83	$ 1,977.26			
Portal Pad Road												**$5,080**	
MN-009	1	9	1	Portal Pad Haul Road	Crown road for positive drainage	0	km	C.5.17	$1,017.65	$ 247.29	$ 247.29		
MN-010	1	10	1	Pipe Culvert	Remove pipe culvert at Doris Windy Road entrance	51	lm	C.5.15	$92.11	$ 4,697.39	$ 4,832.42		
	1	10	2		Load all debris and waste into containers and	15	m^3	C.4.01	$4.97	$ 74.14			
	1	10	3		Haul containers to Roberts Bay	15	m^3	C.4.14	$4.09	$ 60.89			
MN-011	1	11	1	Dual Water Line - Discontinued	Cut pipelines into manageable pieces	-	lm	C.3.03	$10.38	$ -	$ -		
	1	11	2		Decommission electrical (heat tracing)	-	each	C.1.05	$603.78	$ -			
	1	11	3		Collect electrical cables and controllers and prep for shipping off-site	-	m^3	C.3.10	$0.14	$ -			1 m either side of pipeline
	1	11	4		Load debris into containers for transport (to Roberts Bay)	-	m^3	C.4.01	$4.97	$ -			
	1	11	5		Haul debris to Roberts Bay	-	m^3	C.4.14	$4.09	$ -			
Ore Storage Pad												**$93**	
MN-012	1	12	1	Ore Stockpile Pad	Regrade area for positive drainage	8,000	m^2	C.5.18	$0.01	$ 93.47	$ 93.47		Assume no ore was left on surface after end of operation
Waste Rock Pile												**$1,707,412**	
MN-013	1	13	1	Waste Rock Pile	Regrade top surface for positive drainage	12,300	m^2	C.5.05	$0.76	$ 9,310.41	$ 1,707,411.53		no waste rock left on surface
	1	13	2		Resloping from 2:1 to 3:1	20,200	m^2	C.5.06	$1.01	$ 20,387.01			
	1	13	3		Cover entire dump with HDPE liner,	35,750	m^2	M.01	$29.81	$ 1,065,705.13			
	1	13	4		Place 0.3 m thick liner protection layer of crushed rock	32,500	m^3	C.5.03	$18.83	$ 612,008.98			
Madrid North Vent Raise												**$47,093**	
MN-014	1	14	1	Vent Raise	Remove ducts, pipes, and cables	100	lm	C.3.16	$105.70	$ 10,570.01	$ 23,119.65		
	1	14	2		Construct a concrete cap (0.5 m thick reinforced concrete) to seal the top	1	each	C.6.03	$12,549.65	$ 12,549.65			
MN-015	1	15	1	Ventilation and Heating Facilities	Decommission and dismantle all ventilation and heating facilities	2	each	C.1.05	$603.78	$ 1,207.57	$ 3,658.81		
	1	15	2		Prepare units for shipping off-site	2	each	C.1.08	$1,110.00	$ 2,220.01			
	1	15	3		Haul units to Roberts Bay	2	each	C.4.16	$94.94	$ 189.88			
	1	15	4		Regrade pads for positive drainage	3,540	m^2	C.5.18	$0.01	$ 41.36			
MN-016	1	16	1	Offices & Support Complex	Decommission (electrical, mechanical, plumbing)	4	each	C.1.05	$603.78	$ 2,415.13	$ 7,285.13		
	1	16	2		Disconnect trailers and prep for moving (remove boards, cladding, etc.; wrap in plastic)	4	each	C.1.08	$1,110.00	$ 4,440.02			Modular trailers / Seacans
	1	16	3		Haul trailers to Roberts Bay for shipping off-site	4	each	C.4.16	$94.94	$ 379.75			
	1	16	4		Demolish cribbing, stairs, entryways, etc.	2	m^2	C.3.05	$7.93	$ 15.85			
	1	16	5		Collect all debris	119	m^2	C.3.10	$0.14	$ 16.26			
	1	16	6		Load waste into containers for shipping off-site	2	m^3	C.4.01	$4.97	$ 9.95			
	1	16	7		Haul containers to Roberts Bay laydown	2	m^3	C.4.14	$4.09	$ 8.17			
	1	16	8		Regrade area for positive drainage	-	m^2	C.5.18	$0.01	$ -			Accounted for in MN-015
MN-017	1	17	1	Diesel Generator	Decommission (electrical)	1	each	C.1.06	$636.82	$ 636.82	$ 1,872.86		Mobile generator
	1	17	2		Disconnect containers and prep for shipping off-site	1	each	C.1.08	$1,110.00	$ 1,110.00			
	1	17	3		Haul containers to Roberts Bay laydown	1	each	C.4.16	$94.94	$ 94.94			
	1	17	4		Collect all debris	30	m^3	C.3.10	$0.14	$ 4.06			
	1	17	5		Load waste into containers for shipping off-site	3	m^3	C.4.01	$4.97	$ 14.84			
	1	17	6		Haul containers to Roberts Bay laydown	3	m^3	C.4.14	$4.09	$ 12.19			
MN-018	1	18	1	Fuel Containment Area	Drain and decommission Enviro Tank	1	each	C.2.03	$241.82	$ 241.82	$ 7,276.42		
	1	18	2		Haul Enviro Tank to Roberts Bay	1	each	C.4.16	$94.94	$ 94.94			
	1	18	3		Load contained contaminated soils into megabags for shipping off-site	80	m^3	C.4.12	$69.79	$ 5,610.96			
	1	18	4		Remove liner and cut into manageable pieces	2,302	m^2	C.3.02	$0.15	$ 347.92			
	1	18	5		Haul containers to Roberts Bay	101	m^3	C.4.14	$4.09	$ 413.08			
	1	18	6		Backfill area to prevent permanent ponding	750	m^2	C.5.05	$0.76	$ 567.71			
MN-019	1	19	1	Vent Raise access road	Crown road for positive drainage	0	km	C.5.17	$1,017.65	$ 71.24	$ 71.24		
MN-020	1	20	1	Pipe Culvert	Remove pipe culvert at Doris Windy Road entrance	40	lm	C.5.15	$92.11	$ 3,702.65	$ 3,809.08		Double Culvert
	1	20	2		Load all debris and waste into containers and	12	m^3	C.4.01	$4.97	$ 58.44			
	1	20	3		Haul containers to Roberts Bay	12	m^3	C.4.14	$4.09	$ 47.99			
Madrid South All-weather Road												**$17,239**	
Madrid South All-weather Road												**$17,239**	
MR-001	2	1	1	Madrid South All-Weather Road	Crown road for positive drainage	5	km	C.5.17	$1,017.65	$ 5,134.04	$ 5,134.04		
MR-002	2	2	1	Crossing #1	Remove pipe culvert at crossing #1	61	lm	C.5.15	$92.11	$ 5,618.45	$ 6,052.48		Double Culvert
	2	2	2		Load all debris and waste into containers and	48	m^3	C.4.01	$4.97	$ 238.32			
	2	2	3		Haul containers to Roberts Bay	48	m^3	C.4.14	$4.09	$ 195.72			
MR-003	2	3	1	Crossing #2	Remove pipe culvert at Crossing #2	61	lm	C.5.15	$92.11	$ 5,618.45	$ 6,052.48		Double Culvert
	2	3	2		Load all debris and waste into containers and	48	m^3	C.4.01	$4.97	$ 238.32			
	2	3	3		Haul containers to Roberts Bay	48	m^3	C.4.14	$4.09	$ 195.72			

Worksheet 2: Detailed Cost Estimate

Work Area Code	Item	Task	Sub-task	Activity	Task	Quantity	Unit	Cost Code	Unit Cost	Task Total	Activity Total	Subtotals	Source / Comments
Madrid South Portal and Vent Raise												**$1,751,218**	
Infrastructure Pad Area												**$35,666**	
MS-001	3	1	1	Shop	Decommission electrical, mechanical (including connections to generator house & transformer)	3	each	C.1.05	$603.78	$ 1,811.35	$ 21,661.94		
	3	1	2		Demolish building	2,250	m^2	C.3.05	$7.93	$ 17,835.91			
	3	1	3		Collect Debris	450	m^2	C.3.10	$0.14	$ 61.29			
	3	1	4		Load waste into containers for shipping off-site	198	m^3	C.4.01	$4.97	$ 985.38			
	3	1	5		Haul debris to Roberts Bay laydown	198	m^3	C.4.15	$4.89	$ 968.01			
MS-002	3	2	1	Fuel Storage Facility	Drain and decommission Enviro Tank	1	each	C.2.03	$241.82	$ 241.82	$ 7,131.24		
	3	2	2		Haul Enviro Tank to Roberts Bay	1	each	C.4.17	$113.57	$ 113.57			
	3	2	3		Load contained contaminated soils into megabags for shipping off-site	80	m^3	C.4.12	$69.79	$ 5,610.96			
	3	2	4		Load all debris and waste into containers for Shipping offsite	21	m^3	C.4.01	$4.97	$ 103.06			
	3	2	5		Haul containers to Roberts Bay	101	m^3	C.4.15	$4.89	$ 494.13			
	3	2	6		Backfill area to prevent permanent ponding	750	m^2	C.5.05	$0.76	$ 567.71			
MS-003	3	3	1	Offices & Support Complex	Decommission (electrical, mechanical, plumbing)	4	each	C.1.05	$603.78	$ 2,415.13	$ 5,001.89		
	3	3	2		Disconnect trailers and prep for moving (remove boards, cladding, etc.; wrap in plastic)	2	each	C.1.08	$1,110.00	$ 2,220.01			
	3	3	3		Haul trailers to Roberts Bay for shipping off-site	2	each	C.4.17	$113.57	$ 227.13			
	3	3	4		Demolish cribbing, stairs, entryways, etc.	-	m^2	C.3.05	$7.93	$ -			Demolish Office Buiilidng, Minedry, and Admin Buiilidng
	3	3	5		Collect all debris	60	m^2	C.3.10	$0.14	$ 8.17			
	3	3	6		Load waste into containers for shipping off-site	-	m^3	C.4.01	$4.97	$ -			
	3	3	7		Haul containers to Roberts Bay laydown	-	m^3	C.4.15	$4.89	$ -			
	3	3	8		Regrade area for positive drainage	11,250	m^2	C.5.18	$0.01	$ 131.44			
MS-004	3	4	1	Fresh Water Pipelines Leg 2 - Discontinued	Cut pipelines into manageable pieces	-	lm	C.3.03	$10.38	$ -	$ -		
	3	4	2		Decommission electrical (heat tracing)	-	each	C.1.05	$603.78	$ -			
	3	4	3		Collect electrical cables and controllers and prep for shipping off-site	-	m^2	C.3.10	$0.14	$ -			
	3	4	4		Load debris into containers for transport (to Roberts Bay)	-	m^3	C.4.01	$4.97	$ -			
	3	4	5		Haul debris to Roberts Bay	-	m^3	C.4.15	$4.89	$ -			
MS-005	3	5	1	Diesel Generator	Decommission (electrical)	1	each	C.1.06	$636.82	$ 636.82	$ 1,870.66		Mobile Generator
	3	5	2		Disconnect containers and prep for shipping off-site	1	each	C.1.08	$1,110.00	$ 1,110.00			
	3	5	3		Haul containers to Roberts Bay laydown	1	each	C.4.17	$113.57	$ 113.57			
	3	5	4		Collect all debris	3	m^2	C.3.10	$0.14	$ 0.41			
	3	5	5		Load waste into containers for shipping off-site	1	m^3	C.4.01	$4.97	$ 4.97			
	3	5	6		Haul containers to Roberts Bay laydown	1	m^3	C.4.15	$4.89	$ 4.89			
Laydown Pad												**$58**	
MS-006	3	6	1	Laydown Pad	Regrade area for positive drainage	5,000	m^2	C.5.18	$0.01	$ 58.42	$ 58.42		
Portal Area												**$24,293**	
MS-007	3	7	1	Portal and Underground Works	Remove ducts, pipes, electrical cables	100	lm	C.3.16	$105.70	$ 10,570.01	$ 23,890.31		assuming 100m length
	3	7	2		Construct portal plug	707	m^3	C.5.03	$18.83	$ 13,309.78			
	3	7	3		Regrade area for positive drainage	900	m^2	C.5.18	$0.01	$ 10.52			
MS-008	3	8	1	Brine Mixing Facility	Drain and decommission 50000L water storage tank	1	each	C.1.12	$241.82	$ 241.82	$ 402.23		
	3	8	2		Haul water tank to Roberts Bay Laydown	1	each	C.4.17	$113.57	$ 113.57			
	3	8	3		Load excess CaCl2 into container for shipping off site	2	m^3	C.4.01	$4.97	$ 9.95			
	3	8	4		Collect all debris	54	m^2	C.3.10	$0.14	$ 7.41			
	3	8	5		Load waste into containers for shipping off-site	2	m^3	C.4.01	$4.97	$ 9.95			
	3	8	6		Haul containers to Roberts Bay laydown	4	m^3	C.4.15	$4.89	$ 19.55			
Primary Pollution Control Area												**$10,902**	
MS-009	3	9	1	Primary Pollution Control Pond	Disconnect piping and electrical wiring, remove sump pumps	2	each	C.1.05	$603.78	$ 1,207.57	$ 10,901.68		
	3	9	2		Breach Pollution Control pond containment berms	300	m^2	C.5.05	$0.76	$ 227.08			
	3	9	3		Remove and cut liner system into manageable pieces	27,359	m^2	C.3.02	$0.15	$ 4,134.94			Liner+Geotextile
	3	9	4		Load waste into containers for shipping off-site	340	m^3	C.4.01	$4.97	$ 1,692.34			Liner+Geotextile
	3	9	5		Haul containers to Roberts Bay laydown	340	m^3	C.4.15	$4.89	$ 1,662.50			
	3	9	6		Rip-rap breach for erosion protection	105	m^3	C.5.03	$18.83	$ 1,977.26			
Haul Road and Water Supply Infrastructure												**$5,038**	
MS-010	3	10	1	Secondary Pollution Control Pond	Disconnect piping and electrical wiring, remove sump pumps	2	each	C.1.05	$603.78	$ 1,207.57	$ 4,059.14		
	3	10	2		Breach pollution pontrol pond containment berms	300	m^2	C.5.05	$0.76	$ 227.08			
	3	10	3		Remove and cut liner into manageable pieces	2,586	m^2	C.3.02	$0.15	$ 390.84			Liner+Geotextile
	3	10	4		Load waste into containers for shipping off-site	26	m^3	C.4.01	$4.97	$ 129.34			Liner+Geotextile
	3	10	5		Haul containers to Roberts Bay laydown	26	m^3	C.4.15	$4.89	$ 127.06			
	3	10	6		Rip-rap breach for erosion protection	105	m^3	C.5.03	$18.83	$ 1,977.26			
MS-011	3	11	1	Haul and Access Roads	Crown road for positive drainage -	1	km	C.5.17	$1,017.65	$ 978.98	$ 978.98		Haul road + VR access road (Haul road width ~2x standard 2 lane
MS-012	3	12	1	Pumphouse - Discontinued	Remove water intake line from Patch Lake	-	lm	C.3.03	$10.38	$ -	$ -		
	3	12	2		Decommission pumping facility (remove electrical)	-	each	C.1.03	$1,237.87	$ -			
	3	12	3		Prep containers for shipping off-site	-	each	C.1.08	$1,110.00	$ -			
	3	12	4		Collect Debris	-	m^2	C.3.10	$0.14	$ -			
	3	12	5		Load debris into containers for transport (to Roberts Bay)	-	m^3	C.4.01	$4.97	$ -			
	3	12	6		Haul debris to Roberts Bay	-	m^3	C.4.15	$4.89	$ -			
MS-013	3	13	1	Freshwater Pipeline Leg 1 - Discontinued	Cut pipelines into manageable pieces	-	lm	C.3.03	$10.38	$ -	$ -		
	3	13	2		Decommission electrical (heat tracing)	-	each	C.1.05	$603.78	$ -			
	3	13	3		Collect electrical cables and controllers and prep for shipping off-site	-	m^2	C.3.10	$0.14	$ -			
	3	13	4		Load debris into containers for transport (to Roberts Bay)	-	m^3	C.4.01	$4.97	$ -			
	3	13	5		Haul debris to Roberts Bay	-	m^3	C.4.15	$4.89	$ -			
Infrastructure Access Road												**$247**	
MS-014	3	14	1	Infrastructure Access Road	Crown road for positive drainage	0	km	C.5.17	$1,017.65	$ 247.29	$ 247.29		
Waste Rock Pile												**$1,648,470**	
MS-015	3	15	1	Waste Rock Pile	Resloping from 2:1 to 3:1	26,470	m^2	C.5.06	$1.01	$ 26,715.06	$ 1,648,469.53		no waste rock left on surface
	1	15	2		Regrade top surface for positive drainage	18,738	m^2	C.5.05	$0.76	$ 14,183.61			
	3	15	3		Cover entire dump with HDPE liner,	46,002	m^2	M.01	$29.81	$ 1,371,316.57			
	3	15	4		Place 0.3 m thick liner protection layer of crushed rock	12,546	m^3	C.5.03	$18.83	$ 236,254.30			
Ore Storage Pad												**$143**	
MS-016	3	16	1	Ore Stockpile Pad	Regrade area for positive drainage	12,200	m^2	C.5.18	$0.01	$ 142.54	$ 142.54		Assume no ore was left on surface after end of operation
Madrid South Vent Raise Area												**$26,402**	
MS-017	3	17	1	Vent Raise	Remove ducts, pipes, and cables	25	lm	C.3.16	$105.70	$ 2,642.50	$ 15,192.15		
	3	17	2		Construct a concrete cap (0.5 m thick reinforced concrete) to seal the top	1	each	C.6.03	$12,549.65	$ 12,549.65			
MS-018	3	18	1	Ventilation and Heating Facilities	Decommission and dismantle all ventilation and heating facilities	4	each	C.1.05	$603.78	$ 2,415.13	$ 3,731.00		
	3	18	2		Prepare units for shipping off-site	1	each	C.1.08	$1,110.00	$ 1,110.00			
	3	18	3		Haul units to Roberts Bay	1	each	C.4.17	$113.57	$ 113.57			
	3	18	4		Regrade pads for positive drainage	7,900	m^2	C.5.18	$0.01	$ 92.30			
MS-019	3	19	1	Fuel Containment Area	Drain and decommission Enviro Tank	1	each	C.2.03	$241.82	$ 241.82	$ 7,479.16		
	3	19	2		Haul Enviro Tank to Roberts Bay	1	each	C.4.17	$113.57	$ 113.57			
	3	19	3		Load contained contaminated soils into megabags for shipping off-site	80	m^3	C.4.12	$69.79	$ 5,610.96			
	3	19	4		Remove liner and cut into manageable pieces	2,302	m^2	C.3.02	$0.15	$ 347.92			
	3	19	5		Load all debris and waste into containers and	21	m^3	C.4.01	$4.97	$ 103.06			
	3	19	6		Haul containers to Roberts Bay	101	m^3	C.4.15	$4.89	$ 494.13			
	3	19	7		Backfill area to prevent permanent ponding	750	m^2	C.5.05	$0.76	$ 567.71			
Additional Direct Costs												**$816,544**	
Off-site Shipping for Disposal												$816,544	
DN-001	4	1	1	Ship off-site for disposal by barge	Hazardous waste	37	m^3	S.02	$212.35	$ 7,772.06	$739,778		
	4	1	2		Non-Hazardous waste and demolition debris	1,450	m^3	S.03	$212.35	$ 307,910.22			
	4	1	3		Hydrocarbon contaminated soils	241	m^3	S.01	$1,050.08	$ 253,278.75			Major areas within fuel containment berms; remainder to be identified by inspector on site
	4	1	4		Shipping Mobile units from Roberts Bay	21	each	S.04	$8,134.12	$ 170,816.54			
	4	1	5		Warehouse inventory in seacan containers or loose materials	-	each	S.04	$8,134.12	$ -			
DN-002	4	2	1	Disposal fees in licensed facility	Hazardous waste	1	LS		$25,000.00	$ 25,000.00	$76,766		
	4	2	2		Non-hazardous waste and demolition debris	1,450	m^3	M.10	$5.68	$ 8,229.96			
	4	2	3		Disposal fees at Hay River	410	t	H.05	$106.18	$ 43,536.29			
Water Management												$0	
WM-001	4	1	1	Madrid North Water Management - Discontinued		0	LS	x	$	-	$ -	$0	
WM-002	4	2	1	Madrid South Water Management - Discontinued		0	LS	x	$	-	$ -	$0	90 day seasons assumed for each year of post-closure water management
TOTAL DIRECT COSTS												**$4,415,378**	
INDIRECT CLOSURE COSTS													
Contingency												**$719,767**	
-	1	1	-	Contingency	20% of direct costs	20%	%	x		$3,598,834	$719,766.84		
Mobilization & Demobilization												**$ 711,993**	
-	2	1	1	Site demolition	Mob/Demob	1.0	ls	x	$	427,514.83	$427,515		Equipment mobilised from Edmonton
	2	2	1	Dam breach	Mob/Demob	1.0	ls	x	$	284,478.30	$284,478		Equipment demobilised to Edmonton
General and Administration costs												**$ 34,313**	
-	3	1	-	Travel allowance		1	LS	x		$11,592.18	$11,592		Charter Yellowknife-Doris and return
-	3	3	-	Camp Operations		147.0	person-days	OC.02		$154.56	$22,721		For all work including Water management, assumes use of Doris camp (Calculated on the MobDemob Tab)
Field support												**$ 30,499**	
-	4	1	-	Supervision		13	days	x	$	1,244	$16,287		
-	4	2	-	Equipment maintenance support - Mechanic		13	days	x	$	1,086	$14,212		
Hydrocarbon decontamination												**$ 150,000**	
-	5	1	-	Engineering Design		1.0	LS	x	$	50,000	$50,000		
-	5	2	-	Confirmatory Sampling and Analysis		1.0	LS	x	$	100,000	$100,000		
Post-closure Monitoring												**$ 1,060,000**	
	6	1	1	Covers Monitoring	Bi-annual for 10 years	5	LS	x	$	70,000	$350,000		
	6	1	2	Geotechnical Inspection (including Permafrost Monitoring)	Annual for 3 consecutive years	3	LS	x	$	70,000	$210,000		
	6	1	3	Vegetation Survey	Years 1, 3, 7, and 10 after closure	4	LS	x	$	50,000	$200,000		
	6	1	4	Water Quality Monitoring	Yearly for 5 years	5	LS	x	$	60,000	$300,000		
Other													
-	9	1	-	Contractor profit	% of direct and other indirect costs (excluding contingency)	-	%	of	$	5,342,183	$0.00		included in equipment unit rates and POH (i.e. Production Overhead) labor cost
-	9	2	-	Contractor Bonding	% of direct cost	-	%	of	$	4,415,378	$0		
Subtotal Indirect Costs				Subtotal Indirect Costs								**$2,706,572**	
CLOSURE COSTS - TOTAL												**$7,121,950**	

Worksheet 3: Indirect Cost Calculations

Mob/Demob Costs

Crew mobilization costs included in loaded labour rates.
The barging fee for equipment is calculated on a square foot basis.

No. of units	Description	Units	Quantity	Unit cost	Task cost	Notes
Camp Demolitior	Construction equipmen	Footprint				
1	Bobcat	m^2	11.0	$ 332.96	$ 3,657.90	From Hay River to Roberts Bay
1	Loader	m^2	10.2	$ 332.96	$ 3,400.45	From Hay River to Roberts Bay
1	Dozer	m^2	20.3	$ 332.96	$ 6,750.26	From Hay River to Roberts Bay
1	Excavator	m^2	38.1	$ 332.96	$ 12,687.55	From Hay River to Roberts Bay
1	small equipment	m^2	24.1	$ 332.96	$ 8,025.01	From Hay River to Roberts Bay
1	Trucks (CAT 735)	m^2	41.6	$ 332.96	$ 13,860.35	From Hay River to Roberts Bay
1	Tractor trailer	m^2	86.8	$ 332.96	$ 28,907.95	From Hay River to Roberts Bay
1	Crewcab pickup (Ford F35	m^2	33.8	$ 332.96	$ 11,254.35	From Hay River to Roberts Bay
8	Haul equipment to Shippin	each	8	$ 15,000.00	$ 120,000.00	hauling 8 trailers from Edmonton to Hay River / source: Doris cost estimate
Subtotal Mobilization					**$ 208,544**	
Subtotal Demobilization					**$ 218,971**	Assumes same cost as mobilization, updated by 5%
Total					***$ 427,515***	

Dam Breach	Construction equipmen	Footprint				
0	Bobcat	m^2	11.0	$ 364.67	$ -	From Hay River to Roberts Bay
1	Loader	m^2	10.2	$ 364.67	$ 3,724.30	From Hay River to Roberts Bay
1	Dozer	m^2	20.3	$ 364.67	$ 7,393.14	From Hay River to Roberts Bay
1	Excavator	m^2	38.1	$ 364.67	$ 13,895.89	From Hay River to Roberts Bay
0	small equipment	m^2	24.1	$ 364.67	$ -	From Hay River to Roberts Bay
1	Trucks (CAT 735)	m^2	41.6	$ 364.67	$ 15,180.38	From Hay River to Roberts Bay
0	Tractor trailer	m^2	86.8	$ 364.67	$ -	From Hay River to Roberts Bay
1	Crewcab pickup (Ford F35	m^2	33.8	$ 364.67	$ 12,326.20	From Hay River to Roberts Bay
5	Haul equipment to Shippin	each	5	$ 17,250.00	$ 86,250.00	hauling 8 trailers from Edmonton to Hay River / source: Doris cost estimate
Subtotal Mobilization					**$ 138,770**	
Subtotal Demobilization					**$ 145,708**	Assumes same cost as mobilization, updated by 5%
Total					***$ 284,478***	

Camp Cost

Description	Units	Cost Code	Unit Cost	Quantity										Total	Task Cost	Notes
				Year 1 (Site Demolition+ Water Management)	Year 2 (Water Management)	Year 3 (Water Management+Berm Breaches)	Year 4 (Water Management)	Year 5 (Water Management)	Year 6 (Water Management)	Year 7 (Water Management)	Year 8 (Water Management)	Year 9 (Water Management)	Year 10 (Water Management)			
Camp Managemen	day	OC.01	$697.59	0	0	0	0	0	0	0	0	0	0	0	$0	
Camp Operations	per day per perso	OC.02	$154.56	131	0	16	0	0	0	0	0	0	0	147	$22,721	the cost accrued for water management is accounted for under the WM section, Dam breach crew 3 people over 5 days
Camp Renta	year	OC.03	$412,166.38	0	0	0	0	0	0	0	0	0	0	0	$0	
Travel allowance	charter flights	OC.05	$10,304.16	0	0	0								0	$0	charter flights for 15 person crews
	commercial flights	OC.04	$772.81	12	0	3								15	$11,592	3 person crew for dam breach, including engineer/surveyor
				$ 29,521.42	$ -	**$ 4,791.43**	$ -	$ -	$ -	$ -	$ -	$ -	$ -	**$ 34,312.85**	**$34,313**	

Worksheet 4: Unit Rates

Cost Code	Item	2014 Unit rate	Unit	Comment	Source
Equipment					
E.01	Dozer (CAT D7)		hr	hourly equipment rate (less operator)	Nuna 2012 Equipment Rates; Adjusted to 2014
E.02	Dozer (CAT D4)	$ 91.95	hr	hourly equipment rate (less operator)	Nuna 2012 Equipment Rates; Adjusted to 2014
E.03	Dozer (CAT D4) w/ Tiller	$ 105.74	hr	15% added for tiller attachment	Nuna 2012 Equipment Rates; Adjusted to 2014
E.04	Truck (CAT 730)	$ 147.27	hr	hourly equipment rate (less operator)	Nuna 2012 Equipment Rates; Adjusted to 2014
E.05	Excavator (CAT 330 CL)	$ 196.43	hr	hourly equipment rate (less operator)	Nuna 2012 Equipment Rates; Adjusted to 2014
E.06	Loader (CAT IT38/930)	$ 87.38	hr	hourly equipment rate (less operator)	Nuna 2012 Equipment Rates; Adjusted to 2014
E.07	Skidder (CAT Bobcat)	$ 85.05	hr	hourly equipment rate (less operator)	Nuna 2012 Equipment Rates; Adjusted to 2014
E.08	Helicopter	$ 2,229.69	hr	fuel surcharge applies	IMiskolczi (from Angela Holtzapfel@HBML ESR); Adjusted to 2014
E.09	Welding Equipment	$ 61.08	day	300 Amps, gas/diesel driven	2009 BC Blue Book + 10% Northern Allowance, 10% fuel factor; Adjusted to 2014
E.10	Power washer	$ 72.00	day	Hot water pressure washer - 3000 PSI	www.abtoolrentals.com/equipment.asp?action=category&category=190&key=190%2D0079
E.11	Drum crusher	$ 37.80	hr	30 tones, mobile	2012 cost; Adjusted to 2014
E.12	Oil-water separator	$ 29.20	hr	10 GPM, underground	2012 cost; Adjusted to 2014
E.13	Air Track Drill	$ 302.50	hr	200 cfm compressor, 196 HP diesel engine	2013-2014 BC Blue Book + 10% Northern Allowance+10% fuel factor
E.14	Tractor Trailer (6 axle lowbed+booster)	$ 81.73	hr	hourly equipment rate (less operator)	2013-2014 BC Blue Book + 10% Northern Allowance
E.15	Flatbed truck (6x4, 5 tonne)	$ 23.05	hr	hourly equipment rate (less operator)	2013-2014 BC Blue Book + 10% Northern Allowance
E.13	Clemro Crusher	$ 836.03	hr	200 tons/hr (less operator)	Nuna 2012 Equipment Rates; Adjusted to 2014
E.14	Motor Grader CAT 16M	$ 169.67	hr	hourly equipment rate (less operator)	Nuna 2012 Equipment Rates; Adjusted to 2014
Materials					
M.01	Liner - HDPE	$ 29.81	m^2	supply and install	from JDS (Surface Water Management Options Analysis); Adjusted to 2014
M.02	Liner - geotextile	$ 27.44	m^2	supply and install	from JDS (Surface Water Management Options Analysis); Adjusted to 2014
M.03	Fuel (Diesel)	$ 1.40	L	2014 Landed fuel cost at Hope Bay	Lowell (from site @ TMAC, April 2014)
M.04	Explosives	$ 64.38	lbs	15% freight cost added	Costmine 2012; Adjusted to 2014
M.05	Silt Fencing	$ 1.44	m	15% freight cost added	Cost Mine 2011; original price quoted in linear ft; Adjusted to 2014
M.06	Coco-matting	$ 1.96	m^2	15% freight cost added	Cost Mine 2011; original price quoted in sq. yards; Adjusted to 2014
M.07	Seed/Fertilizer	$ 17.12	kg	15% freight cost added	Arctic Alpine seed mix+ fertilizer (2009 increase by 6% to 2013 based on inflation); Adjusted to 2014
M.08	Winter road	$ 17,697.65	km	open and maintain for 2 months	NUNA Logistics (from Court Smith) + 18% cost increase to 2013; Adjusted to 2014
M.09	Hazardous Waste Disposal fee	$ 10,304.16	m^3	Disposal + handling and cleaning fee	SRK estimate; Adjusted to 2014
M.10	Demolition Debris Disposal Fee (@Hay River)	$ 5.68	m^3	Disposal + handling fee	Personal communication with Rob Jamieson@Hay River Disposals Ltd.; Adjusted to 2014
M.12	Bentonite chips	$ 588.33	m^3	In 50 pound bags, 15% freight cost added	Holly North Production Supplies Limited; Adjusted to 2014
M.13	Plastic wrapping	$ 1.06	m^2	in 14 ft wide rolls	web search; shrinkit-inc.com accessed June15, 2012; Adjusted to 2014
Labour					
L.01	Labour general	$ 60.45	hr		Nuna Blended 2012 rate, POH included; Adjusted to 2014
L.02	Labour - Trades	$ 90.49	hr	Electrician, Welder, plumber etc.	Nuna Blended 2012 rate, POH included; Adjusted to 2014
L.05	Supervision	$ 103.70	hr		Nuna Blended 2012 rate, POH included; Adjusted to 2014
L.06	Truck Drivers	$ 69.85	hr	Heavy Equipment	Nuna Blended 2012 rate, POH included; Adjusted to 2014
L.07	Heavy Equipment Operator	$ 75.69	hr	Light equipment	Nuna Blended 2012 rate, POH included; Adjusted to 2014
L.08	Technician (Consultant)	$ 135.00	hr	Staff Consultant	SRK-Estimate (all inclusive)
L.09	Note: Loading Rate includes allowances for (EI, CPP, MSP/Benefits/Travel/OT)				
Shipping					
S.01	Outbound Shipping - Soils	$ 1,050.08	m^3	1.7 t/m^3 bulk density	(7.75 m^3/seacan based on 29,000 lbs limit per seacan, seacan is 38.5 m^3) - from NTCL 17APR 12; Adjusted to 2014
S.02	Outbound Shipping - Haz Waste	$ 212.35	m^3	1.0 t/m^3 bulk density	(7.75 m^3/seacan based on 29,000 lbs limit per seacan, seacan is 38.5 m^3) - from NTCL 17APR 12; Adjusted to 2014
S.03	Outbound Shipping - Demolition	$ 212.35	m^3	0.733 t/m^3 bulk density	$7661/seacan (seacan is 38.5 m^3) - from NTCL 17APR 12; Adjusted to 2014
S.04	Shipping cost per seacan	$ 8,134.12	each		NTCL 17Apr 2012; Adjusted to 2014
Hydrocarbon Soils and Haz Waste					
H.01	Excavate impacted soil	$ 19.76	m^3		WESA estimate say reference; Adjusted to 2014
H.02	Low temperature thermal desorption	$ 103.04	m^3		WESA estimate say reference; Adjusted to 2014
H.03	Rehydrate and backfill	$ 11.02	m^3		WESA estimate say reference; Adjusted to 2014
H.04	Regrade and reshape	$ 2.45	m^2		WESA estimate say reference; Adjusted to 2014
H.05	Tipping Fee for HC Soils at Hay River	$ 106.18	tonne		Communication with Hay River Landfill Tsharp 18APR12; Adjusted to 2014
Owner's cost					
OC.01	Camp management	$ 697.59	day		Newmont; Adjusted to 2014
OC.02	Camp operations	$ 154.56	day	includes food and camp maintenance	Newmont; Adjusted to 2014
OC.03	Camp rental	$ 412,166.38	year	25 man mobile camp	Newmont; Adjusted to 2014
OC.04	Commercial flight	$ 772.81	person	flight from Yellowknife to Cambridge Bay and re	Adjusted to 2014
OC.05	Charter flight	$ 10,304.16	flight	Return from Yellowknife	

Worksheet 5: Task Unit Rate Calculations

Cost Code	Item	Unit	Productivity (Unit/hr)	Unit Rates: Total Unit Cost	Unit Rates: Material Unit Rate	Unit Rates: Labour Unit Rate	Unit Rates: Equipment Unit Rate	Labour: General Labour $ 60.45	Labour: Trades - Electrical $ 90.49	Labour: Trades - Mechanic $ 90.49	Labour: Trades - Plumbing $ 90.49	Labour: Engineer / Technician $ 135.00	Labour: Light Equipment Operator $ 69.85	Equipment: Heavy Equipment Operator $ 75.69	Equipment: Dozer - CAT D7 $ -	Equipment: Excavator - Cat 330 $ 196.43	Equipment: Loader - CAT 966 $ 87.38	Equipment: Motor grader CAT 14M $ 169.67	Equipment: Skidder CAT 242 $ 85.05	Equipment: Truck - CAT 730 $ 147.27	Equipment: Tractor Trailer $ 81.73	Equipment: Flatbed truck (5 tonne) $ 23.05	Equipment: Helicopter $ 2,229.69	Equipment: Drill $ 302.50	Drum crusher 37.799	Power washer 7.2	Welding Equipment 61.07781	Crusher 836.0275	Note / Source
Decomissioning																													
C.1.01	Decomission and remove all heating fuel tanks and place into lined facility	each	4.00	$ 71.00	$ -	$ 49.15	$ 21.85	2						1			1												Disconnect and remove all fuel drums and disconnect all Tidy Tanks from all structures
C.1.02	Decomission above ground storage tanks	each	0.5	$ 422.80	$ -	$ 422.80	$ -	2	1																				
C.1.03	Decomission potable water supply	each	0.25	$ 1,237.87	$ -	$ 1,041.44	$ 196.43	1	1		1			0.25		0.25													Disconnect all electrical and plumbing (intake and distribution)
C.1.04	Decomission waste incinerator	each	0.17	$ 1,150.29	$ -	$ 1,019.22	$ 131.07	1		1				0.25			0.25												Disconnect and remove fuel storage
C.1.05	Decommission Main Camp Facility electricity	each	0.25	$ 603.78	$ -	$ 603.78	$ -	1	1																				De-energise main electrical board, disconnect auxiliary power (if exists)
C.1.06	Decommission electrical generators	each	0.46	$ 636.82	$ -	$ 541.84	$ 94.98	2	1					0.5			0.5												De-energise main breaker board, disconnect external fuel tanks (if needed) / loader used for lifting; source - RSMeans (260505252100)
C.1.07	Dismantle Satelite/Comunication Equipment	each	0.5	$ 332.31	$ -	$ 332.31	$ -	2	0.5																				source - SRK estimate
C.1.08	Prep portable trailers for moving (remove cladding, apply shrinkwrap etc.)	each	0.25	$ 1,110.00	$ 58.40	$ 876.84	$ 174.77	3						0.5			0.5												
C.1.09	Decommission Airstip - Place large X's at each end of strip	each	0.5	$ 291.82	$ 50.00	$ 241.82	$ -	2																					Assumed material cost for a high density plastic, nails and sandbags.
C.1.10	Dismantle airstip approach lights	each	4	$ 37.74		$ 37.74	$ -	1	1																				
C.1.11	Dismantle Hoper, Crusher	each	0.05	$ 3,018.91		$ 3,018.91	$ -	1	1																				
C.1.12	Drain above ground water storage tank	each	0.5	$ 241.82	$ -	$ 241.82	$ -	2																					Drain 50000L water tank - SRK estimate
Decontamination																													
C.2.01	Collect hazardous chemical waste and place in suitable containers	m3	0.17	$ 2,066.64	$ -	$ 1,542.35	$ 524.30	3						1			1												Includes all chemicals on site / jm_Estimate
C.2.02	Drain and power-wash heating fuel tanks (Tidy Tanks)	each	6.00	$ 21.35	$ -	$ 20.15	$ 1.20	2																		1			Drain fuel from tanks and wash exterior with hot water (collect water for treatment)
C.2.03	Drain above ground fuel storage tank	each	0.5	$ 241.82	$ -	$ 241.82	$ -	2																					Drain fuel /source - SRK estimate
C.2.04	Pressure wash above ground fuel tank	each	0.16	$ 800.68	$ -	$ 755.68	$ 45.00	2																		1			
C.2.05	Drain and power-wash empty fuel drums	each	12	$ 16.98	$ -	$ 16.38	$ 0.60	2						1												1			Drain fuel and tripple-rinse drum (collect water for treatment)
C.2.06	Flush sewage treatment unit and collect sewage sludge	each	0.4	$ 524.12	$ -	$ 396.89	$ 127.23	2						0.5			0.5									1			Flush treatment unit with water (collect water for treatment)/source - SRK estimate
C.2.07	Empty incinerator and collect ashes	m3	0.25	$ 567.97	$ -	$ 393.21	$ 174.77	1						0.5			0.5												Place ashes and unburned contents into containers / see C.6.04
C.2.08	Operate oil/water separator	m3	6.60	$ 28.57	$ -	$ 27.48	$ 1.09	3																		1			Collect skimmed oil from seperator and place in suitable container - 15 minutes per 55 gal. drum
C.2.09	Empty soil from 45 gallon drums	each	4	$ 98.26	$ -	$ 49.15	$ 49.11	2						1		1													
C.2.10	Liner pressure wash cleaning	m2	360	$ 0.36	$ -	$ 0.34	$ 0.02	2																		1			
Demolition																													
C.3.01	Crush empty fuel drums	each	20.00	$ 16.09	$ -	$ 9.83	$ 6.26	2						1			1								1				
C.3.02	Cut Tank Farm geomembrane to manageable size	sq. m	1200.00	$ 0.15	$ -	$ 0.15	$ -	3																					source - SRK estimate
C.3.03	Remove intake hoses and cut to manegeable size	Lm	100	$ 10.38	$ -	$ 1.59	$ 8.80	2						0.5			0.5											1	source - SRK estimate
C.3.04	Dismantle pollution control berm	each	0.50	$ 241.82	$ -	$ 241.82	$ -	2																					
C.3.05	Demolish office buildings/ shop structures/ living quarters	m3	53.00	$ 7.93	$ -	$ 6.28	$ 1.65	3						2	1		1												Demolish empty wood structures (offices, shacks, etc.)/ source - ECHOS
C.3.06	Demolish helipads/ float plane dock	m3	75	$ 2.98	$ -	$ 1.82	$ 1.17	1						1			1												Demolish wood structure / source - SRK estimate
C.3.07	Demolish Above ground storage tanks	m3	5	$ 257.90	$ -	$ 51.41	$ 206.49	3						1		1												1	
C.3.08	Dismantle Old Equipment (torch)	each	0.5	$ 484.88	$ -	$ 362.73	$ 122.16	3																			1		
C.3.08	Cut off top of drill casings	each	2.00	$ 60.77	$ -	$ 30.23	$ 30.54	1																			1		
C.3.10	Clean up debris from site	m2	2529	$ 0.14	$ -	$ 0.10	$ 0.03	3						1			1												source - SRK estimate
C.3.11	Dismantle radio tower	each	0.04	$ 14,844.47	$ -	$ 10,130.27	$ 4,714.20	2	1			1		1		1													source - SRK estimate
C.3.12	Prep stacks for shipping	m	0.50	$ 447.06	$ -	$ 272.30	$ 174.77	1						1			1												Estimate
C.3.13	Dismantle Power Generator Stacks	m	0.50	$ 120.91	$ -	$ 120.91	$ -	1																					
C.3.14	Removing Cables and Posts	each	1.00	$ 393.03	$ -	$ 196.60	$ 196.43	2						1		1													
C.3.15	Remove Tank Insullation	each	0.30	$ 686.52	$ -	$ 403.03	$ 283.49	2											1										
C.3.16	Remove pipes, ducts, and electrical cables	m	2.00	$ 105.70	$ -	$ 105.70	$ -	2	1																				
C.3.17	Remove waste from Doris Mountain (helicopter support)	m3	1.00	$ 2,485.60		$ 255.91	$ 2,229.69	2				1												1					
Material Relocations																													
C.4.01	Load demolition debris/solid waste in containers	m3	48.00	$ 4.97	$ -	$ 3.15	$ 1.82							2	1		1												source - SRK calculated from first principles
C.4.02	Empty Seacan of debris at the landfill	each	5.7	$ 60.92	$ -	$ 26.52	$ 34.41							2	1	1													
C.4.04	Haul waste to Roberts Bay jetty in 20 ft container (33.2 m3/container)	m³	59.67	$ 2.54	$ -	$ 1.17	$ 1.37								1						1								Productivity calculation shown on 'Relocation Unit Cost' Worksheet
C.4.06	Haul Containers on skids from beach laydown to Roberts Bay Jetty	each	1.20	$ 63.08	$ -	$ 63.08	$ -							1	1														
C.4.07	Haul Material From Doris Windy Road to Roberts Bay	m³	36.31	$ 4.17	$ -	$ 1.92	$ 2.25								1						1								Productivity calculation shown on 'Relocation Unit Cost' Worksheet
C.4.08	Haul Material From North Dam To Roberts Bay	m³	51.64	$ 2.94	$ -	$ 1.35	$ 1.58								1						1								Productivity calculation shown on 'Relocation Unit Cost' Worksheet
C.4.09	Haul Material From Reagent Pad To Roberts Bay	m³	66.90	$ 2.27	$ -	$ 1.04	$ 1.22								1						1								Productivity calculation shown on 'Relocation Unit Cost' Worksheet
C.4.10	Haul Mateiral From Airstrip to Roberts Bay	m³	75.48	$ 2.01	$ -	$ 0.93	$ 1.08								1						1								Productivity calculation shown on 'Relocation Unit Cost' Worksheet
C.4.11	Haul Mateiral to Jetty (Roberts Bay)	m³	85.74	$ 1.77	$ -	$ 0.81	$ 0.95								1						1								Productivity calculation shown on 'Relocation Unit Cost' Worksheet
C.4.12	Load soils into megabags	m³	4.00	$ 69.79	$ -	$ 47.69	$ 22.10	2							1	0.45													
C.4.13	Haul Material From South Dam to Roberts Bay	m³	41.85	$ 3.62		$ 1.67	$ 1.95								1						1								
C.4.14	Hauling bulk materials from Madrid North (Vent Raise) to Roberts Bay	m³	37.11	$ 4.09	$ -	$ 1.88	$ 2.20								1						1								Productivity calculation shown on 'Relocation Unit Cost' Worksheet
C.4.15	Hauling bulk materials from Madrid South to Roberts Bay	m³	31.02	$ 4.89	$ -	$ 2.25	$ 2.63								1						1								Productivity calculation shown on 'Relocation Unit Cost' Worksheet
C.4.16	Hauling containers from Madrid North (Vent Raise) to Roberts Bay	each	1.60	$ 94.94	$ -	$ 43.75	$ 51.19								1						1								Productivity calculation shown on 'Relocation Unit Cost' Worksheet
C.4.17	Hauling containers from Madrid South to Roberts Bay	each	1.33	$ 113.57	$ -	$ 52.33	$ 61.23								1						1								Productivity calculation shown on 'Relocation Unit Cost' Worksheet
C.4.18	Hauling discharge water from Madrid North (Vent Raise) to Tail Lake	m³	13.25	$ 11.44	$ -	$ 5.27	$ 6.17								1						1								Productivity calculation shown on 'Relocation Unit Cost' Worksheet
C.4.19	Hauling discharge water from Madrid South to Tail Lake	m³	11.74	$ 12.91	$ -	$ 5.95	$ 6.96								1						1								Productivity calculation shown on 'Relocation Unit Cost' Worksheet
Earth works																													
C.5.01	Install HDPE Liner	m²	175	$ 32.75	$ 29.81	$ 1.81	$ 1.12	4						1		1													
C.5.02	Load, haul, dump, place: 1 truck with <0.5 km haul distance	m³	40	$ 14.12	$ -	$ 5.53	$ 8.59							2	1	1				1									
C.5.03	Load, haul, dump, place: 1 truck with <1.0 km haul distance	m³	30	$ 18.83	$ -	$ 7.37	$ 11.46							2	1	1				1									
C.5.04	Excavate: Spoil locally, no trucks	m³	100	$ 2.72	$ -	$ 0.76	$ 1.96							1		1													
C.5.05	Regrade surface - rough grading, D7	m²	100	$ 0.76	$ -	$ 0.76	$ -							1	1														
C.5.06	Reslope Stockpiles - D7	m²	75	$ 1.01	$ -	$ 1.01	$ -							1	1														
C.5.07	Relocate core box pallet (<0.5 km)	ea	6	$ 37.26	$ -	$ 22.69	$ 14.56	1						1			1												
C.5.08	Install soil stabilization measures (straw/coconut matting)	m²	269	$ 4.36	$ 1.96	$ 1.35	$ 1.06	3.5						2		1	1												
C.5.09	Drill, blast Quarry	m³	65	$ 43.72	$ 34.77	$ 4.30	$ 4.65	1				0.5		2										1					
C.5.10	Trackpack using loaded rock truck	m²	100	$ 2.17		$ 0.70	$ 1.47								1						1								
C.5.11	Scaling (loose rock)	hr	1	$ 272.12	$ -	$ 75.69	$ 196.43							1		1													
C.5.12	Load, haul, dump place: 2 trucks with <1.0km haul distance	m³	75	$ 10.43	$ -	$ 3.88	$ 6.55								2	2	1	1			2								
C.5.13	Seeding/Fertilizing: By hand, high application rate	m²	320	$ 0.82	$ 0.26	$ 0.57	$ -	3							0														
C.5.14	Summer identification of low-lying areas	day	0.08	$ 6,994.02	$ 100.00	$ 2,345.45	$ 4,548.57	1				1												0.17					
C.5.15	Remove culvert and create swale	lm	5	$ 92.11	$ -	$ 52.82	$ 39.29	2				0.5		1		1													
C.5.16	Load, haul, dump, 2 trucks<0.5 km haul distance	m³	80	$ 8.83	$ -	$ 2.69	$ 6.14							1	2	1					2								
C.5.17	Crown road	km	0.25	$ 1,017.65	$ -	$ 338.97	$ 678.68			0.1				1				1											
C.5.18	Road grading (use grader)	m2	21000	$ 0.012	$ -	$ 0.00	$ 0.01							1				1											
C.5.19	Ripping and scarifying roads and pads	m2	5000	$ 0.049	$ -	$ 0.02	$ 0.03							1				1											
C.5.20	Load, haul, dump, place: 1 truck with 9 km haul distance	m³	16.6	$ 22.90	$ -	$ 8.77	$ 14.14								1	1		1			1								SRK Estimate : LHD tool
C.5.21	Load, haul, dump, place: 1 truck with 13.7 km haul distance	m³	14	$ 27.16	$ -	$ 10.40	$ 16.76								1	1		1			1								SRK Estimate : LHD tool
Other																													
C.6.01	Sample HC contaminated soils / confirmatory samples	each	2	$ 97.73	$ -	$ 97.73	$ -	1				1																	
C.6.02	Band together core pallets	each	12	$ 10.08	$ -	$ 10.08	$ -	2			0		0		0														
C.6.03	Construction of Vent Raise Seal	each	0.042	$ 12,549.65	$ 3,000.00	$ 8,501.06	$ 1,048.59	3				1		0.5			0.5												

Worksheet 6: Relocation Unit Cost Calculations

Hauling Distance to Roberts Bay			
Doris Camp	5.3	km	One Way
Windy Camp	14.82		One Way
North Dam	7.6	km	One Way
Reagent Pads	3.7	km	One-Way
Airstrip	2.2	km	One-Way
Madrid North Portal	13.9	km	One-Way
Madrid North Vent Raise	14.3	km	One-Way
Madrid South AWR	18.97	km	One-Way
Water discharge to Tail Lake			
Doris Camp	2.15	km	One-Way
Madrid North	11.45	km	One-Way
Madrid South	15.82	km	One-Way

C.4.14 - Productivity of hauling bulk materials from Madrid North (Vent Raise) to Roberts Bay				
Equipment Cost	$	81.73	per hr	Includes fuel
Labour Cost	$	90.49	per hr	
Average speed		38	km/hr	Sleds assumed as being available on site
Hauling capacity		2	Containers	One container per skid
Cargo capacity		33.2	m^3	Standard 20 ft container
Space utilization ratio		0.7		
Load		46.48	m^3	CargoCapacity x #ofContainers x SpaceUtilizationRatio
Distance:		14.3	km	
Time Required 1 round trip:		**1.25**	**hrs**	**Includes 0.5hr unloading time**
Productivity:		**37.11**	**m^3/hr**	
C.4.15 - Productivity of hauling bulk materials from Madrid South to Roberts Bay				
Equipment Cost	$	81.73	per hr	Includes fuel
Labour Cost	$	90.49	per hr	
Average speed		38	km/hr	Sleds assumed as being available on site
Hauling capacity		2	Containers	One container per skid
Cargo capacity		33.2	m^3	Standard 20 ft container
Space utilization ratio		0.7		
Load		46.48	m^3	CargoCapacity x #ofContainers x SpaceUtilizationRatio
Distance:		18.97	km	
Time Required 1 round trip:		**1.50**	**hrs**	**Includes 0.5hr unloading time**
Productivity:		**31.02**	**m^3/hr**	
C.4.16 - Productivity of hauling containers units from Madrid North (Vent Raise) to Roberts Bay				
Equipment Cost	$	81.73	per hr	Includes fuel
Labour Cost	$	90.49	per hr	
Average speed		38	km/hr	Sleds assumed as being available on site
Hauling capacity		2	Containers	One container per skid
Distance:		14.3	km	
Time Required 1 round trip:		**1.25**	**hrs**	**Includes 0.5hr unloading time**
Productivity:		**1.60**	**Containers/hr**	
C.4.17 - Productivity of hauling container units from Madrid South to Roberts Bay				
Equipment Cost	$	81.73	per hr	Includes fuel
Labour Cost	$	90.49	per hr	
Average speed		38	km/hr	Sleds assumed as being available on site
Hauling capacity		2	Containers	One container per skid
Distance:		18.97	km	
Time Required 1 round trip:		**1.50**	**hrs**	**Includes 0.5hr unloading time**
Productivity:		**1.33**	**Containers/hr**	
C.4.18 - Productivity of trucking water from Madrid North (Vent Raise) to Tail Lake discharge				
Equipment Cost	$	81.73	per hr	Includes fuel
Labour Cost	$	90.49	per hr	
Average speed		45	km/hr	Sleds assumed as being available on site
Hauling capacity		1	Containers	One container per skid
Cargo capacity		20	m^3	Standard 20 ft container
Space utilization ratio		1		
Load		20	m^3	CargoCapacity x #ofContainers x SpaceUtilizationRatio
Distance:		11.45	km	
Time Required 1 round trip:		**1.51**	**hrs**	**Includes 0.5hr fill/drain time**
Productivity:		**13.25**	**m^3/hr**	
C.4.19 - Productivity of trucking water from Madrid South to Tail Lake discharge				
Equipment Cost	$	81.73	per hr	Includes fuel
Labour Cost	$	90.49	per hr	
Average speed		45	km/hr	Sleds assumed as being available on site
Hauling capacity		1	Containers	One container per skid
Cargo capacity		20	m^3	Standard 20 ft container
Space utilization ratio		1		
Load		20	m^3	CargoCapacity x #ofContainers x SpaceUtilizationRatio
Distance:		15.82	km	
Time Required 1 round trip:		**1.70**	**hrs**	**Includes 0.5hr fill/drain time**
Productivity:		**11.74**	**m^3/hr**	

Worksheet 7: Structure Quantities

Demolition Bulking Factors	
Tents - Empty	1.3
Wood Structures - Empty	
Wood Structures - w/ Interior Wall Allowance	2
Steel Structures - Empty	1.5
Steel Structures - w/ Interior Wall Allowance	2
Mechanical Equipment	1.1
Liners	3
Pipelines	3

Structure Volumes

Area	Structure	Quantity	Length (m)	Width/Dia. (m)	Footprint Area (m^2)	Avg Height (m)	Wall thickness (m)	Floor Thickness (m)	Roof Length (m)	Roof Thickness (m)	Wall Volume (m^3)	Floor Volume (m^3)	Roof Volume (m^3)	Total Collapse Volume (m3)	Loose Volume (m^3)	Standing Volume (m^3)	Surface area (m^2)	Source
Madrid North Portal																		
Portal Upper Pad	Portable Trailers (ATCO)	2	10	3	30.0	5	0.15	0.3	14.72	0.16	19.5	9.0	7.1	71		**150.0**		SRK Estimate
	Cribbing, stairs, entry way	2	10	3	30.0	1	0.15	0.3			3.9	9.0		26	**0.00**			SRK Estimate - debris
	Compressor Building	1																
	Shop (tent)	1	30	15	450.0	5	0.01	0.3	17.17	0.05	4.5	135.0	12.9	152	**198.09**	**2250.0**		SRK Estimate - debris
	Water Tratment Plant	1																
	50000L Water tank (Part of WTP)	1	7.25	2.5	18.1	2.75										**49.8**		SRK Estimate
	Diesel Generator	1	12.23	2.44	29.8	0.1									**2.98**			SRK Estimate - debris
Portal Lower Pad	50,000L Water Tank ith Containment	1																
	CaCl2 Laydown	1													**2.00**			Remaining CaCl2
	Brine Mixing Facility	1													**2.00**			SRK Estimate - debris
Portal & UG Works	Extent	1			1446.0											**0.0**		SRK Estimate
	Plug	1	15	7.6	114.0	6.2								707		**706.8**		Estimated
Fuel Transfer Station	75,000L Envirotank	1																SRK Estimate
	Liner				797.0			0.003						2	**7.17**			ACAD Estimate
	Geotextile				1505.0			0.003						5	**13.55**			ACAD Estimate
	HDPE sump																	
	HDPE Liner																	
	Nonwoven Geotextile																	
Pollution Control Pond	HDPE Liner	1			14300.0			0.003						43	**128.70**			ACAD Estimate
	Nonwoven Geotextile																	ACAD Estimate
Pollution Control Pond Breach	Non-woven Geotextile	4	220	10	8800.0			0.003						106	**316.80**			ACAD Estimate
	Breach Area Liner	1	220	10	2200.0			0.003						7	**19.80**			ACAD Estimate
	Breach (Berm)	1			300.0	3.5								600				ACAD Estimate
Dual Water Line	Piping	1	760	0.18	0.03									19	**58.02**			ACAD Estimate
Waterline to Patch lake discharge	Piping	1	1100	0.18	0.03									28	**83.97**			ACAD Estimate
Culvert - Madrid North Portal Entrance	24" Corrugated Steel Culvert	2	25.5	0.61	0.29		0.003							5	15			ACAD Estimate
Madrid North Vent Raise																		
	Vent Raise	1																
	Air Heating Facility	1																
	Support Facilities (Sea-can 40')	4	12.23	2.44	119.4	2.5	0.02	0.02	2.44	0.02	1.5	0.6	0.6	11		**298.4**		As built Acad, height/thickness est. from photo
	Support Facilities Debris	4													**2.00**			SRK Estimate - debris
	Diesel Generator	1	12.23	2.44	29.8	0.1									**2.98**			SRK Estimate - debris
Fuel Transfer Station	75,000L Envirotank	1																
	HDPE Sump																	
	HDPE Liner				797.0			0.003						2	**7.17**	**0.0**		SRK Estimate - debris
	Non-woven Geotextile				1505.0			0.003						5	**13.55**	**0.0**		SRK Estimate - debris
	Fuel Tank Containment	1																
	Liner																	
Culvert - Madrid North Portal Entrance	24" Corrugated Steel Culvert	2	20.1	0.61	0.29		0.003							4	**12**			SRK Estimate - debris
Madrid South AWR	Quarry G																	
	Quarry H																	
Crossing #1	24" Corrugated Steel Culvert	2	30.5	1	0.79		0.003							10	**48**			SRK Estimate - debris
Crossing #2	24" Corrugated Steel Culvert	2	30.5	1	0.79		0.003							10	**48**			SRK Estimate - debris
Madrid South Portal and Vent Raise																		
Infrastructure Pad	Portable Trailers (ATCO)	2	10	3	30.0	5	0.15	0.3	14.72	0.16	19.5	9.0	7.1	71		**150.0**		SRK Estimate - debris
	Cribbing, stairs, entry way	2	10	3	30.0	1	0.15	0.3			3.9	9.0		26	**0.00**			SRK Estimate - debris
	Compressor Building	1																
	Shop	1	30	15	450.0	5	0.01	0.3	17.17	0.05	4.5	135.0	12.9	152	**198.09**	**2250.0**		ACAD Estimate
	Water Treatment Plant	1																
	Diesel Generator	1	12.23	2.44	29.8	0.1									**2.98**			SRK Estimate - debris
Upper Portal Pad	50,000L Water Tank with Containment																	
	CaCl2 Laydown																	
	Brine Mixing Facility																	
Portal & UG Works	Extent	1			1446.0											**0.0**		SRK Estimate
	Plug	1	15	7.6	114.0	6.2								707		**706.8**		Estimated
	50000L Water Tank	1	7.25	2.5	18.1	2.75										**49.8**		SRK Estimate
	CaCl2 Laydown																	
	Brine Mixing Facility																	
Pumphouse	Pumphouse	1													**2.00**			SRK Estimate - General debris
Waterlines	Intake	1	25	0.18	0.03									1	**1.91**	**0.0**		ACAD Estimate
	Leg 1	1	225	0.18	0.03									6	**17.18**	**0.0**		ACAD Estimate
	Leg 2	1	188	0.18	0.03									5	**14.35**	**0.0**		ACAD Estimate
Fuel Transfer Station	75,000L Envirotank	1																SRK Estimate
	HDPE Sump																	
	HDPE Liner				797.0			0.003						2	**7.17**	**0.0**		ACAD Estimate
	Non-woven Geotextile				1505.0			0.003						5	**13.55**	**0.0**		ACAD Estimate
Pollution Control Pond	Non-woven Geotextile	2			10442.0			0.003						63	**187.96**			ACAD Estimate
	Pond liner	1			16917.0			0.003						51	**152.25**			ACAD Estimate
	Breach (Berm)	1			300.0	3.5								600				ACAD Estimate
Secondary Pollution Control Pond	Non-woven Geotextile	2			798.0			0.003						5	**14.36**			ACAD Estimate
	Pond Liner	1			1293.0			0.003						4	**11.64**			ACAD Estimate
	Breach (Berm)	1			300.0	3.5								600				ACAD Estimate
Madrid South Vent Raise	Diesel Generator	1	12.23	2.44	29.8	0.25												SRK Estimate - debris
	Air Heating Facility	1																
	Vent Raise Ducting	1	25															
	60000L Envirotank	1	7.25	2.6		3.25												SRK Estimate
	HDPE Sump	1																
	HDPE Liner	1			797.0			0.003						2	**7.17**	**0.0**		ACAD Estimate
	Non-woven Geotextile	1			1505.0			0.003						5	**13.55**	**0.0**		ACAD Estimate

Demolition Preparation

Area	Structure	# of Units	Decommision: Electrical	Decommision: Heating System	Decommision: Plumbing System	Decommision: Total	Heating Tanks	Hazardous Material Vol Estimate (L)	Total Hazardous Volume (L)	Special Item	Special Item Description		Source
Madrid North Portal and Vent Raise													
Portal Upper Pad	Portable Trailers (ATCO)	2	**1**	**1**	**1**				**0**				
	Cribbing, stairs, entry way	2							**0**				
	Compressor Building	1	**1**		**1**				**0**				
	Shop (tent)	1	**1**	**1**	**1**			**1000**	**1000**				
	Water Tratment Plant	1	**1**		**1**			**500**	**500**				
	50000L Water tank (Part of WTP)	1			**1**			**5000**	**5000**				
	Diesel Generator	1	**1**		**1**			**100**	**100**				
Portal Lower Pad	50,000L Water Tank ith Containment	1			**1**				**0**				
	CaCl2 Laydown	1							**0**				
	Brine Mixing Facility	1							**0**				
Portal & UG Works	Extent	1							**0**				
	Plug	1							**0**				
Fuel Transfer Station	75,000L Envirotank	1			**1**			**7500**	**7500**				
	Liner								**0**				
	Geotextile								**0**				
	HDPE sump								**0**				
	HDPE Liner								**0**				
	Nonwoven Geotextile								**0**				
Pollution Control Pond	HDPE Liner	1							**0**				
	Nonwoven Geotextile								**0**				
Pollution Control Pond Breach	Non-woven Geotextile	4							**0**				
	Breach Area Liner	1							**0**				
	Breach (Berm)	1							**0**				
									0				
Fresh Water Pipelines	Piping	2							**0**				
Waterlines									**0**				
Culvert - Madrid North Portal Entrance	24" Corrugated Steel Culvert	2							**0**				
Madrid North Vent Raise									**0**				
	Vent Raise	1							**0**				
	Air Heating Facility	1							**0**				
	Support Facilities (Sea-can 40')	4							**0**				
	Support Facilities Debris	4							**0**				
	Diesel Generator	1							**0**				
Fuel Transfer Station	75,000L Envirotank	1						**7500**	**7500**				
	HDPE Sump								**0**				
	HDPE Liner								**0**				
	Non-woven Geotextile								**0**				
	Fuel Tank Containment	1							**0**				
	Liner								**0**				
Culvert - Madrid North Portal Entrance	24" Corrugated Steel Culvert	2							**0**				
									0				
Infrastructure Pad	Portable Trailers (ATCO)	2							**0**				
	Cribbing, stairs, entry way	2							**0**				
	Compressor Building	1							**0**				
	Shop	1						1000	**1000**				
	Water Treatment Plant	1						500	**500**				
	Diesel Generator	1							**0**				
Upper Portal Pad	50,000L Water Tank with Containment							5000	**0**				
	CaCl2 Laydown								**0**				
	Brine Mixing Facility								**0**				
Portal & UG Works	Extent	1							**0**				
	Plug	1							**0**				
	50000L Water Tank	1							**0**				
	CaCl2 Laydown								**0**				
	Brine Mixing Facility								**0**				
Pumphouse	Pumphouse	1							**0**				
Waterlines	Intake	1							**0**				
	Leg 1	1							**0**				
	Leg 2	1							**0**				
									0				
Fuel Transfer Station	75,000L Envirotank	1						7500	**7500**				
	HDPE Sump								**0**				
	HDPE Liner								**0**				
	Non-woven Geotextile								**0**				
									0				
Pollution Control Pond Breach	Non-woven Geotextile	4							**0**				
	Breach Area Liner	1							**0**				
	Breach (Berm)	1							**0**				
									0				
Secondary Pollution Control Pond Breach	Non-woven Geotextile	4							**0**				
	Breach Area Liner	1							**0**				
	Breach (Berm)	1							**0**				
									0				
Madrid South Vent Raise	Diesel Generator	1							**0**				
	Vent Raise Ducting	1							**0**				
	60000L Envirotank	1						6000	**6000**				
	HDPE Sump	1							**0**				
	HDPE Liner	1							**0**				
	Non-woven Geotextile	1							**0**				
									0				

Worksheet 8: Earthwork Quantities

Earthwork Volumes/Quantities

Bulking Factors	
Soil/Rock Pad	1.2
Cover shrinkage factor	1.1

Reclamation Areas

Work Area	Location	Total Area (m^2)	Area Scarified (m^2)	Area Regraded (m^2)	Area Requiring Fill (m^2)	Coconut-matting Area (m^2)	Seeding Area (m^2)	Source/Comment

Earthwork Areas

Work Area	Item	Qnty	Length (m)	Width (m)	Height (m)	Side Slope (percent)	Area (m^2)	In-situ Volume (m^3)	Loose Volume (m^3)	Source / Comments
Madrid North Portal and Vent Raise										
Madrid North Vent Raise	Regrade area						3,540			ACAD Design estimate
Portal Upper Pad	Regrade area						5,800			ACAD Design estimate
Portal Lower Pad	Regrade area						1,450			ACAD Design estimate
Ore storage pad	Regrade area						8,000			ACAD Design estimate
Waste rock pile	Footprint						31,000			ACAD Design estimate
Waste rock pile	Sloped Footprint					0.4	12,400			ACAD Design estimate
Waste rock pile	Top Footprint					0.6	18,600			ACAD Design estimate
Waste rock pile	Place Crushed rock cover layer				0.3		31,000			ACAD Design estimate
3:1 Resloped WRP	Top Area						12,300			ACAD Design estimate
	3:1 Slope surface area						20,200			ACAD Design estimate
	WRP total Surface area (3:1)	1.1					32,500			ACAD Design estimate
Fuel Transfer Station	Liner/Geotextile Area	3					750			ACAD Design estimate
	Contaminated Gravel	1						67	80.4	Estimate from Drawing MNP-07
Fuel Tank Containment	Liner/Geotextile Area	3					750			ACAD Design estimate
	Contaminated Gravel	1						67	80.4	Estimate from Drawing MNP-07
Pond Access Road	Crown Road		448							ACAD Design estimate
Portal Pad Road	Crown Road		243							ACAD Design estimate
	Clean up spilled Ore		243	9.5	0.15			346	415.53	Assume 250m or total length, whichever is smaller
Vent Raise Access Road			70							ACAD Design estimate; Not including pad
Breach Riprap		1			0.3		350	105		Rough 2D area estimate (Single breach)
Pond discharge		1								See Water Management Tab
	Reject water; 30% of pond volume	0.3								
		0.7								
Madrid South AWR										
Madrid South AWR	Clean up spilled Ore		250	9.5	0.15			356	427.5	Assume 250m over total length
	Crown Road	1	5.045							Road length (9.5m wide) + area of pull outs
Madrid South Portal and Vent Raise										
Waste Rock Pile	Footprint						31,230			ACAD Design estimate
Ore storage pad	Footprint						12,200			ACAD Design estimate
16m Access Road	Crown Road		130							ACAD Design estimate
9.5m Haul road	Crown Road		238							ACAD Design estimate
9.5m Vent Raise Access Road	Crown Road		254							ACAD Design estimate
6m Berm / pumphouse access	Crown Road		210							ACAD Design estimate
Infrastructure Access Road	Crown Road		243							ACAD Design estimate
	Clean up spilled Ore		250	9.5	0.15			356	427.5	Assume 250m or total length, whichever is smaller
Pumphous Facilities	Debris removal		5	6			30			
Fuel Transfer Station	Liner/Geotextile Area	3					750			ACAD Design estimate
	Contaminated Gravel	1						67	80.4	Estimate from Drawing MNP-07
Infrastructure Pad	Regrade area						12,000			ACAD Design estimate
Upper Portal Pad	Regrade area						400			ACAD Design estimate
South Portal Pad	Regrade area						500			ACAD Design estimate
Laydown Pad	Regrade area						5,000			ACAD Design estimate
Vent Raise	Regrade area						7,900			ACAD Design estimate
Fuel Tank Containment	Liner/Geotextile Area	3					750			ACAD Design estimate
	Contaminated Gravel	1						67	80.4	Estimate from Drawing MNP-07
Ore storage pad	Regrade area						7,900			ACAD Design estimate
Waste Rock Pile	Footprint						31,230			ACAD Design estimate
	Top Area	0.6					18,738			ACAD Design estimate
	Sloped area	0.4					12,492			ACAD Design estimate
	Liner Cover				0.3		31,230	9369		ACAD Design estimate
3:1 Resloped WRP	Top Area						15,350			ACAD Design estimate
	3:1 Slope surface area						26,470			ACAD Design estimate
	WRP total Surface area (3:1)				0.3		41,820	12546.00		ACAD Design estimate
Breach Riprap (Primary Pond)		1			0.3		350	105		ACAD Design estimate
Breach Riprap (Secondary Pond)		1			0.3		350	105		ACAD Design estimate
Primary Pollution Control Pond										
Secondary Pollution Control Pond										See Water Management Tab
Total volume	Reject water; 30% of pond volume; discharged to Tail Lake	0.3								
	Permeate; 70% of total pond volume; discharged to Patch	0.7								

Worksheet 9a: Water Management

Activity	Task	Unit	Cost Code	Unit Cost	Quantity											Activity Total
					Year 1	Year2	Year3	Year4	Year5	Year6	Year7	Year8	Year9	Year10	Total	
Madrid North Water Management - Discontinued (WM-001)	Treatment water management	Yearly	--	$ -	0	0	0	0	0	0	0	0	0	0	0	$ -
Madrid South Water Management - Discontinued (WM-002)	Treatment water management	Yearly	--	$ -	0	0	0	0	0	0	0	0	0	0	0	$ -
	Site Services Support &Maintenance	LS	--	$ 50,000	0	0	0	0	0	0	0	0	0	0	0	$ -
	Spare Parts & Consumables	LS	--	$ 20,000	0	0	0	0	0	0	0	0	0	0	0	$ -
TOTAL																$ -

Worksheet 9b: Direct Water Mangement Costs

Activity	WBS Code	Item	Task	Sub-task	Activity	Task	Quantity	Unit	Cost Code	Unit Cost	Task Total	Activity Total	Source / Comments
Madrid North Water Management	WM-001	1	2	1	Madrid North Wa	decommission RO plant	-	each	C.1.05	$603.78	$ -	$ -	Esimate tasks based on Doris estimate
		1	1	2		disconnect RO plant containers and prep for shipping off-site	-	each	C.1.08	$1,110.00	$ -		Toggle between options below
		1	1	3		haul RO plant containers to Roberts Bay laydown	-	each	C.4.17	$113.57	$ -		
		1	1	4		Drain and decommission 50000L water tank	0	each	C.1.12	$241.82	$ -		
		1	1	5		Transport discharge water to Tail Lake	-	m^3	C.4.18	$11.44	$ -		
		1	1	5		Haul water tank to Roberts Bay Laydown	-	each	C.4.17	$113.57	$ -		
Madrid South Water Management	WM-002	3	6	1	Madrid South Wa	decommission RO plant	-	each	C.1.05	$603.78	$ -	$ -	Esimate tasks based on Doris estimate
		3	1	2		disconnect RO plant containers and prep for shipping off-site	-	each	C.1.08	$1,110.00	$ -		Toggle between options below
		3	1	3		haul RO plant containers to Roberts Bay laydown	-	each	C.4.17	$113.57	$ -		
		3	1	4		Drain and decommission 50000L water tank	0	each	C.1.12	$241.82	$ -		
		3	1	5		Transport discharge water to Tail Lake	-	m^3	C.4.19	$12.91	$ -		
		3	1	6		Haul water tank to Roberts Bay Laydown	-	each	C.4.17	$113.57	$ -		

Worksheet 10: Work Breakdown Structure

Location	Facility	WBS Code
Madrid North Surface Infrastructure		
Upper Portal Area		
	Shop	MN-001
	Diesel Generator	
	Office & Support Complex	MN-003
Lower Portal Area		
	Brine Mixing Facility	MN-004
	Portal and Underground Works	MN-005
Fuel Storage Facility		
	Fuel Storage Facility	MN-006
Pond Access Road		
	Pond Access Road	MN-007
Pollution Control Pond		
	Pollution Control Pond	MN-008
Portal Pad Road		
	Portal Pad Haul Road	MN-009
	Pipe Culvert	MN-010
	Dual Water Line - Discontinued	MN-011
Ore Stockpile Pad		
	Ore Stockpile Pad	MN-012
Waste Rock Pile		
	Waste Rock Pile	MN-013
Madrid North Vent Raise		
	Vent Raise	MN-014
	Ventilation and Heating Facilities	MN-015
	Offices & Support Complex	MN-016
	Diesel Generator	MN-017
	Fuel Containment Area	MN-018
	Vent Raise access road	MN-019
	Pipe Culvert	MN-020
Madrid South All-Weather Road		
Madrid South All-Weather Road		
	Madrid South All-Weather Road	MR-001
	Crossing #1	MR-002
	Crossing #2	MR-003
Madrid South Surface Infrastructure		
Infrastructure Pad Area		
	Shop	MS-001
	Fuel Storage Facility	MS-002
	Offices & Support Complex	MS-003
	Fresh Water Pipelines Leg 2 - Discontinued	MS-004
	Diesel Generator	MS-005
Laydown Pad		
	Laydown Pad	MS-006
Portal Area		
	Portal and Underground Works	MS-007
	Brine Mixing Facility	MS-008
Primary Pollution Control Area		
	Primary Pollution Control Pond	MS-009
Haul Road and Water Supply Infrastructure		
	Secondary Pollution Control Pond	MS-010
	Haul and Access Roads	MS-011
	Pumphouse - Discontinued	MS-012
	Freshwater Pipeline Leg 1 - Discontinued	MS-013
Infrastructure Access Road		
	Infrastructure Access Road	MS-014
Waste Rock Pile		
	Waste Rock Pile	MS-015
Ore Stockpile Pad		
	Ore Stockpile Pad	MS-016
Madrid South Vent Raise Area		
	Vent Raise	MS-017
	Ventilation and Heating Facilities	MS-018
	Fuel Containment Area	MS-019
Additional Direct Costs		
Off-site Shipping for Disposal	Ship Off-site for Disposal by Barge	DN-001
Off-Site Disposal Fees	Disposal Fees in Licensed Facility	DN-002
Water Management	Madrid North Water Management - Discontinued	WM-001
	Madrid South Water Management - Discontinued	WM-002

Appendix 10

(for Chapter 10, Predicted Environmental Effects)

10-A NIRB Application Form 1 and NIRB Screening Form 2

10-B Archaeology and Traditional Use Clearance

Appendix 10-A

NIRB Application Form 1 and NIRB Screening Form 2

PART 1 FORM
PROJECT PROPOSAL INFORMATION REQUIREMENTS

To access NIRB documents, project screenings, and project reviews please visit the Nunavut Impact Review Board's ftp site http://ftp.nirb.ca/. The NIRB's website (www.nirb.ca) is currently under construction. Please contact info@nirb.ca should you have any questions or require further information.

IMPORTANT!
Please be advised that your application will not be processed until the Sections 1 - 9 are completed in their entirety, in both English and Inuktitut (+ Inuinnaqtun, if in the Kitikmeot).

SECTION 1: APPLICANT INFORMATION

1. Project Name Madrid Advanced Exploration Project

2. Applicant's full name and mailing address:

TMAC Resources Inc.
95 Wellington Street West
Suite 1010, P.O. Box 44
Toronto, Ontario, M5J 2N7

3. Primary contact's full name and mailing address:

M. John Roberts
Vice President, Environmental Affairs
TMAC Resources Inc.
95 Wellington Street West
Suite 1010, P.O. Box 44
Toronto, Ontario, M5J 2N7
Phone: 416-628-0126
Fax: 416-644-9337
e-mail: john.roberts@tmacresources.com

SECTION 2: AUTHORIZATION NEEDED

1. Indicate <u>all</u> authorizations associated with the project proposal:

X	Regional Inuit Association (RIA)		Canadian Launch Safety (CLS)
X	Nunavut Water Board (NWB)		Environment Canada (EC)
	Nunavut Planning Commission (NPC)		Government of Nunavut (GN)
X	Indian and Northern Affairs Canada (INAC)		Department of National Defense (DND)
	Department of Fisheries and Oceans (DFO)		Hamlet
	Community Government & Services (CG&S)		Parks Canada (PC)
	Nunavut Research Institute (NRI)		Canadian Wildlife Service (CWS)
	Department of Culture, Language, Elders, and Youth (CLEY)		Other (please specify):

2. List the active permits, licences, or other authorizations related to the project proposal, and their expiry date(s):

Hope Bay Belt Authorizations

Quarry Permits (KIA)
KTP308Q010 - Quarries A, B, D (expires Jan 20, 2015)
KTP307Q010 - Quarries 2, 3, 4 (expires Jan 20, 2015)
IOL Surface tenure – Quarries G and H (application pending)

Land Use Licences (KIA)
KTL303C056 - Hope Bay Land Use (expires Jan 20, 2015)
KTL306C003 - Boston Land Use Licence (expires Jan 20, 2015)
KTL306F007 - Winter Road Land Use (expires Jan 20, 2015)
IOL Surface tenure for advanced exploration - Madrid (application pending)

Mineral Lease (NTI)
IOL Exploration Agreement BB60-00-01:TOK 1 Renewal Anniversary Date Dec 31, 2014
IOL Exploration Agreement BB60-00-03:TOK 3 Renewal Anniversary Date Dec 31, 2014

Mining Lease (AANDC/INAC)
#4648 Madrid 1 and #4649 Madrid 2 Expires Oct 12, 2022

Commercial Lease (KIA)
KTCL313D001 - Commercial Lease (expires Sept 13, 2018)

Water Licences (NWB)
2BB-BOS1217 Boston Advanced Exploration Project (expires July 31, 2017)
2AM-DOH1323 Doris North Mining and Milling Undertaking (expires Aug 15, 2023)
2BE-HOP1222 Hope Bay Regional Exploration Program (June 30, 2022)
2BB-Madrid Advanced Exploration Program (application pending)

3. List the pending permits, licences, or other authorizations related to the project proposal:

NWB water licence and IOL surface tenure

4. Has this project or any components of this project been previously screened or reviewed by NIRB?

☒ **YES** ☐ **NO**

If YES, indicate the previous project name and NIRB File No.

Exploration and bulk sampling activities at Boston have been screened and determined to be exempt **(EX148)** and regional exploration activities across the Hope Bay Belt have also been screened and determined to be exempt. Advanced exploration and mine development at Doris North Project has been screened and undergone environmental assessment (screening **05MN047** and Project Certificate 003).

SECTION 3: PROJECT PROPOSAL DESCRIPTION

1. Indicate the type of project proposal (check all that apply)[1,2]: (See Appendix A for Project Type Definitions)

1	All-Weather Road/Access Trail	☐	**9**	Site Cleanup/Remediation	☐
2	Winter Road/ Winter Trail	☐	**10**	Oil and Natural Gas Exploration/Activities	☐
3	Mineral Exploration	☐	**11**	Marine Based Activities	☐
4	Advanced Mineral Exploration	☐	**12**	Scientific/International Polar Year Research*	☐
5	Mine Development /Bulk Sampling	☐	**13**	Harvesting Activities*	☐
6	Pits and quarries	☐	**14**	Tourism Activities*	☐
7	Offshore Infrastructure (port, break water, dock)	☐	**15**	Other[2]:	☐
8	Seismic Survey	☐			☐

Please note:

1. All project types listed above, except those marked with an asterisk (*), will also require the Proponent to submit a **Part 2 Project Specific Information Requirement (PSIR) Form**. The NIRB application process will not be considered complete without the Part 2 PSIR Form.
2. Please be advised that in order to complete the NIRB process, the NIRB may request additional information at any time during the process.
3. If "Other" is selected, contact NIRB for direction on whether a Part 2 PSIR Form is required.

2. If Project Type 3, 4 or 5 was selected above, please indicate the mineral of interest that is being extracted. Include a brief description.

X	Base Metals (zinc, copper, gold, silver, etc) GOLD
	Diamonds
	Uranium
	Other: _____

3a. If Project Type 12, 13 or 14 was selected above, complete the table and questions below.
Not applicable

Transportation Type	Quantity	Proposed Use	Length of Use
E.g. Helicopter	*1*	*Site to site pick ups and drop offs*	*6 days*

3b. Describe any docks, piers, air strips or related structures that are to be used in conjunction with the proposed project activities. **Please note**: *the building of new structures may require a Part 2 Form.*

3c. If a temporary camp site is to be established, describe the proposed structures in detail and indicate the type and source of power for the camp site if applicable.

4. Personnel

Total No. of personnel on site = (A) Peak is 70

Total No. of days on-site = (B) 365

Total No. of Person days (A) × (B) = 25,550 per year

5. Timing

Period of operation: from Jan 1 to Dec 31 each year

Proposed term of authorization: from June 2015 to May 2025

6a. Region (check all that apply):

☐	North Baffin	☐	Kivalliq	X	Kitikmeot	☐	Transboundary:
☐	South Baffin	☐	National Park				

6b. Describe the location of the proposed project activities in a regional context, noting the proximity to the nearest communities and any protected areas.

The Madrid area of the belt is located approximately 130 km southwest of Cambridge Bay. The nearest communities are Umingmaktok (70 km to the southwest of the Property) and Kingaok (Bathurst Inlet; 150 km to the southwest of the Property).

6c. Discuss the history of the site if it has been used for any project activities in the past.

The Hope Bay Belt is a north-south trending greenstone belt, with economically viable zones of gold mineralization that can be divided into three areas: Doris, Madrid, and Boston. Over the past twenty years, the belt has undergone considerable exploration and development activities by TMAC and previous operators. The Doris North Project is Phase 1 of a belt-wide development, with gold production from an underground mine located near Doris Lake. The Hope Bay Belt has significant infrastructure including air strips, roads, fuel storage, a port facility, power plants, administration, geology, and lab buildings, and underground development at the Doris and Boston areas. Phase 2 includes the development of the Madrid and/or Boston areas, including infrastructure and waste management facilities to support underground and open pit mining and processing. The proposed advanced exploration at Madrid will help inform the planning and design of Phase 2 development.

6d. Indicate if there are any known archaeological/palaeontological historical sites in the area.

Sites identified in area will be recovered as per current GN requirements and a "chance find" policy will be implemented

7. Land Status (check all that applies):

X	Crown	☐	Commissioners'	☐	Municipal
X	Inuit Owned Surface Lands	X	Inuit Owned Sub-Surface Lands		

8a. Co-ordinates:

	Lat/Long		UTM	
NE	68° 06′ 34″ N	106° 32′ 22″ W	7555864	435954
NW	68° 08′ 07″ N	106° 37′ 44″ W	7555840	432309
SE	68° 00′ 13″ N	106° 29′ 00″ W	7544000	438000
SW	68° 00′ 07″ N	106° 40′ 29″ W	7544000	430000

NTS Map Sheet No: 077A03 Hope Bay (1:50 000)

(Please ensure that maps of the project are attached (1:50,000 **if available**, 1:250, 000 **Mandatory**) available from Natural Resources Canada)

8b. If the project proposal includes a **camp**, please provide the coordinates of the camp location

Not applicable

Min Lat (degree/minute) _____ Min Long (degree/minute) _____

Max Lat (degree/minute) _____ Max Long (degree/minute) _____

If different from above for the camp:

NTS Map Sheet No: _____

Please ensure that maps of the project are attached (1:50,000 **if available**, 1:250, 000 **Mandatory**) available from Natural Resources Canada

Please note that additional location information may be required in a subsequent Project Specific Information Requirement (PSIR) submission. This may take the form of a digital Geographic Information Systems (GIS) file.

SECTION 4: NON-TECHNICAL PROJECT PROPOSAL DESCRIPTION

Please include a non-technical description of the project proposal, no more than 500 words, in English and Inuktitut (+Inuinnaqtun, if in the Kitikmeot). The project description should outline the following:

- The project activities, their necessity and duration;
- Method of transportation;
- Any structures that will be erected (permanent/ temporary);
- Alternatives considered; and
- Long-term developments, the projected outcome of the development for the area and its timeline.

IMPORTANT: IF THE PROPOSED ACTIVITIES REQUIRE SUBMISSION OF A NIRB PART 2 PSIR FORM, PLEASE COMPLETE SECTION 8 ONLY, OTHERWISE CONTINUE ON WITH SECTION 5.

Refer to "Madrid Advanced Exploration Program Type B Water Licence Application Supplemental Information Report" Section 2.0 for a non-technical description of the project proposal and appropriate translations.

SECTION 5: MATERIAL USE

1. List equipment to be used (including drills, pumps, aircraft, vehicles, etc.):

Refer to Part 2 Project Specific Information Requirement (PSIR) Form.

2a. Detail fuel and hazardous material use:

Refer to Part 2 Project Specific Information Requirement (PSIR) Form

2b. Describe the proposed Spill Prevention Plan.

Spill Prevention and Response will be in accordance with the approved Hope Bay Spill Contingency Plan with updates as required to incorporate the Madrid Advanced Exploration Project.

3a. Detail the anticipated daily water consumption rates

Daily amount (m^3)	Proposed water retrieval methods	Proposed water retrieval location
Up to 295	Submersible pump and storage in portable tanks for transport via truck	Patch Lake, Windy Lake and lakes local to diamond drill locations (>15,000m2)

3b. Have you applied for a water Licence with the Nunavut Water Board?

X YES NO

If yes, what class of licence?

☐ **Class A Water Licence** X Class B Water Licence

SECTION 6: WASTE DISPOSAL AND TREATMENT METHODS

1. **List the types of waste associated with the proposed project activities:**

Refer to Part 2 Project Specific Information Requirement (PSIR) Form.

1. **List the types of waste associated with the proposed project activities (continued):**

Refer to Part 2 Project Specific Information Requirement (PSIR) Form.

2. **Describe the proposed Waste Management Plan.**

Waste management will be in accordance with the current Plans for the Doris North Project (2AM-DOH1323). Refer to Part 2 Project Specific Information Requirement (PSIR) Form.

SECTION 7: COMMUNITY INVOLVEMENT & REGIONAL BENEFITS

1. **List the community representatives that have been contacted and provide the minutes of the meetings if available:**

Refer to "Madrid Advanced Exploration Program Type B Water Licence Application Supplemental Information Report" Section 10.0

Community	Name	Organization	Date Contacted

SECTION 8: GENERAL QUESTIONS

1. **Will you be disturbing any known archaeological sites?**

X **YES** (see attached Points West memo)
☐ **NO**

SECTION 9: APPLICANT SIGNATURE

Please sign and date your application:



Signature	Vice President, Environmental Affairs **Title**	December 8, 2014 **Date**

1. GENERAL PROJECT INFORMATION REQUIREMENTS		Location (section) within Madrid Advanced Exploration Type B Water license application Supplemental Report
Project Coordinates and Maps		
1	The preferred method for submitting project coordinates information is through the use of a Geographic Information System (GIS) compatible digital file.	Application, Supplemental Information Report: Section 2.1.1 (Table 2.1-1)
2	Map of the project site within a regional context indicating the distance to the closest communities.	Supplemental Information Report: Section 3.5.1 (Figure 3.5-1)
3	Map of any camp site including locations of camp facilities.	Supplemental Information Report: Section 3.5.1 (Figure 3.5-2)
4	Map of the project site indicating existing and/or proposed infrastructure, proximity to water bodies and proximity to wildlife and wildlife habitat.	Supplemental Information Report: Figure 3.5-2, 4.2-1, 4.3-1
Project General Information		
5	Discuss the need and purpose of the proposed project.	Supplemental Information Report: Section 3.7
6	Discuss alternatives to the project and alternative methods of carrying out the project, including the no-go alternative. Provide justification for the chosen option(s).	Supplemental Information Report: Section 10.10.1 to 10.10.4, Appendix 4
7	Provide a schedule for all project activities.	Application, Supplemental Information Report: Section 3.4
8	List the acts, regulations and guidelines that apply to project activities.	Supplemental Information Report: Section 1
9	List the approvals, permits and licenses required to conduct the project.	Application and Supplemental Information Report: Section 10.2 (Table 10.2-1)
DFO Operational Statement (OS) Conformity		
10	Indicate whether any Department of Fisheries and Oceans (DFO) Operational Statement (OS) activities apply to the project proposal	Supplemental Information Report: Section 4
11	If any of the DFO's OS apply to the project proposal, does the Proponent agree to meet the conditions and incorporate the measures to protect fish and fish habitat as outlined in the applicable OS? If yes, provide a signed statement of confirmation.	Supplemental Information Report: Section 4, Appendix 4, Section 6.5
Transportation		
12	Describe how the project site will be accessed and how supplies will be brought to site. Provide a map showing access route(s).	Supplemental Information Report: Section 4.2.1, 4.3.1 (Figure 4.2-1, 4.3-1)
13	If a previous airstrip is being used, provide a description of the type of airstrip (ice-strip/all-weather), including its location. Describe dust management procedures (if applicable) and provide a map showing location of airstrip.	not applicable
14	If an airstrip is being constructed, provide the following information: a. Discuss design considerations for permafrost b. Discuss construction techniques c. Describe the construction materials, type and sources, and the acid rock drainage (ARD) and metal leaching (ML) characteristics (if rock material is required for airstrip bed). d. Describe dust management procedures. e. Provide a map showing location of proposed airstrip.	not applicable
15	Describe expected flight altitudes, frequency of flights and anticipated flight routes.	not applicable
Camp Site		
16	Describe all existing and proposed camp structures and infrastructure	Supplemental Information Report: Section 4.1.4
17	Describe the type of camp: a. Mobile b. Temporary c. Seasonal d. Permanent e. Other	Supplemental Information Report: Section 4.1.4
18	Describe the maximum number of personnel expected on site, including the timing for those personnel involved with the project.	Supplemental Information Report: Section 4.1.4
Equipment		
19	Provide a list of equipment required for the project and discuss the uses for the equipment.	Supplemental Information Report: Section 4.2.6 and 4.3.6 (Tables 4.2-1 and 4.2-2)
20	If possible, provide digital photos of equipment.	Not available
Water		
21	Describe the location of water source(s), the water intake methods, and all methods employed to prevent fish entrapment. Provide a map showing the water intake locations.	Application, Supplemental Information Report: Section 4.2.6, 4.2.7, 4.3.6, 4.3.7, 6.1
22	Describe the estimated rate of water consumption (m^3/day).	Application, Supplemental Information Report: Section 6.1 (Table 6.1-1)
23	Describe how waste water will be managed. If relevant, provide detail regarding location of sumps, including capacity of sumps and monitoring.	Application, Supplemental Information Report: Section 4.2.11.1, 4.3.11, 6.4, 7.1 to 7.5, 8.1 (Table 8.1-1) and 8.2
24	If applicable, discuss how surface water and underground water will be managed and monitored.	Supplemental Information Report: Section 6.3.1, 6.3.2, 10.4.3 and 10.4.5.1

Waste Water (Grey water, Sewage, Other)		
25	Describe the quantities, treatment, storage, transportation, and disposal methods for the following (where relevant): - Sewage - Camp grey wate - Combustible solid waste - Non-combustible solid waste, including bulky items/scrap metal - Hazardous waste or oil - Contaminated soils/snow - Empty barrels/fuel drums - Any other waste produced	Supplemental Information Report: Section 7.1 (Table 7.1-1) and Section 8.1 (Table 8.1-1)
26	If the project proposal includes a landfill or landfarm, indicate the locations on a map, provide the conceptual design parameters, and discuss waste management and contact-water management procedures.	Supplemental Information Report: Section 4.2.11.3 and 8.1 (Table 8.1-1)
Fuel		
27	Describe the types of fuel, quantities (number of containers, type of containers and capacity of containers), method of storage and containment. Indicate the location on a map where fuel is to be stored, and method of transportation of fuel to project site.	Supplemental Information Report: Section 4.1.5, 4.2.4 (Figure 4.2-1), 4.2.10.3, 4.3.4 (Figure 4.3-1), 4.3.10 and 4.4.1
28	Describe any secondary containment measures to be employed, including the type of material or system used. If no secondary containment is to be employed, please provide justification.	Supplemental Information Report: Section 4.2.4, 4.3.4 and 4.4.1
29	Describe the method of fuel transfer and the method of refuelling.	Supplemental Information Report: Section 4.2.10.3 and 4.3.10
30	Describe spill control measures in place.	Supplemental Information Report: Section 4.2.10.3, 4.3.10, 4.4.1 and 8.1 (Table 8.1-1)
Chemicals and Hazardous Materials*		
Including but not limited to oils, greases, drill mud, antifreeze, calcium or sodium chloride salt, lead acid batteries and cleaners		
31	Describe the types, quantities (number of containers, the type of container and capacity of containers), method of storage and containment. Indicate the location on a map where material is to be stored, and method of transportation of materials to project site.	Supplemental Information Report: Section 4.2.10.2, 4.2.11.3, 4.3.10, 4.3.11, Appendix 4 Figure 4.2-1 and 4.3-1
32	Describe any secondary containment measures to be employed, including the type of material or system used.	Supplemental Information Report: Section 4.2.10.2, 4.3.10, Appendix 4
33	Describe the method of chemical transfer.	Supplemental Information Report: Section 4.2.10.2, 4.2.11.3, 4.3.10, 4.3.11, Appendix 4
34	Describe spill control measures in place.	Supplemental Information Report: Section 8.1 (Table 8.1-1) and 10.8
Workforce and Human Resources/Socio-Economic Impacts		
35	Discuss opportunities for training and employment of local Inuit beneficiaries.	Supplemental Information Report: Section 11.2
36	Discuss workforce mobilization and schedule, including the duration of work and rotation length, and the transportation of workers to site.	Supplemental Information Report: Section 11.2
37	Discuss, where relevant, any specific hiring policies for Inuit beneficiaries.	Supplemental Information Report: Section 11.2
Public Involvement/ Traditional Knowledge		
38	Indicate which communities, groups, or organizations would be affected by this project proposal.	Supplemental Information Report: Section 5.5 and Section 11.2
39	Describe any consultation with interested Parties which has occurred regarding the development of the project proposal.	Supplemental Information Report: Section 11.2
40	Provide a summary of public involvement measures, a summary of concerns expressed, and strategies employed to address any concerns.	Supplemental Information Report: Section 11.2
41	Describe how traditional knowledge was obtained, and how it has been integrated into the project.	Supplemental Information Report: Section 5.5 and Section 11.2
42	Discuss future consultation plans.	Supplemental Information Report: Section 11.2
2. PROJECT SPECIFIC INFORMATION		
SECTION A: Roads/Trails		
A-1. Project Information		
1	Describe any field investigations and the results of field investigations used in selecting the proposed route (e.g. geotechnical, snow pack)	Supplemental Information Report: Section 4.2, 4.3, Appendix 4C
2	Provide a conceptual plan of the road, including example road cross-sections and water crossings.	Supplemental Information Report: Section 4.2, 4.3, Appendix 4C
3	Discuss the type and volume of traffic using the road/trail (i.e. type of vehicles and cargo and number of trips annually).	Supplemental Information Report: Section 4.2, 4.3, Appendix 4C
4	Discuss public access to the road.	The roads within the Madrid area are not public roads - there is no public road access into the Hope Bay Project area.
5	Describe maintenance procedures.	Supplemental Information Report: Section 4.2, 4.3, Appendix 4C
6	Describe whether any portion of the road will be located outside of the Nunavut Settlement Area and whether any other regulatory requirements must be met (e.g. CEAA).	not applicable

A-2. All-Weather Road/Access Trail		
7	Discuss road design considerations for permafrost.	Supplemental Information Report: Section 4.2, 4.3, Appendix 4C
8	Describe the construction materials (type and sources for materials), and the acid rock drainage (ARD) and metal leaching characteristics of the construction materials.	Supplemental Information Report: Section 4.2, 4.3, Appendix 4C
9	Discuss construction techniques, including timing for construction activities.	Application, Supplemental Information Report: Section 4.2, 4.3, 4.4, Appendix 4C
10	Indicate on a map the locations of designated refuelling areas, water crossings, culverts, and quarries/borrow sources.	Supplemental Information Report: Section 4.2, 4.3, Appendix 4C
11	Identify the proposed traffic speed and measures employed to ensure public safety.	There are no public roads associated with the project. Otherwise 20 to 25km/hour in congested areas, up to 40km/hour for light vehicles in non-congested areas.
12	Describe dust management procedures.	Supplemental Information Report: Section 4.2, 4.3, Appendix 4, Section 6.1 and 10.5.1
SECTION B: Mineral Exploration /Advanced Exploration /Development		
B-1. Project Information		
1	Describe the type of mineral resource under exploration.	Application, Supplemental Information Report: Section 5.2, Appendix 5
B-2. Exploration Activity		
2	Indicate the type of exploration activity: - Bulk Sampling (underground or other) - Stripping - Trenching - Pitting - Delineation drilling - Prelimnary delineation drilling - Exploration Drilling - Geophysical Work (ground and/or air) - Other	Application, Supplemental Information Report: Section 3.5, 3.6 and 4.4
3	Describe the exploration activities associated with this project: - Satellite remote sensing - Aircraft remote sensing - Soil sampling - Sediment sampling - On land drilling (indicate drill type) - On ice drilling (indicate drill type) - Water based drilling (indicate drill type) - Overburden removal - Explosives transportation and storage - work within navigable waters - On site sample processing - Off site sample processing - Waste rock storage - Ore storage - Tailings disposal - Portal and underground ramp construction - Landfilling - Landfarming	Application, Supplemental Information Report: Section 3.5, 3.6 and 4.2 to 4.4
B-3. Geosciences		
4	Indicate the geophysical operation type: a. Seismic b. Magnetic c. Gravimetric d. Electromagnetic e. Other	Supplemental Information Report: Section 4.4, Appendix 4
5	Indicate the geological operation type: a. Geological Mapping b. Aerial Photography c. Geotechnical Survey d. Ground Penetrating Survey e. Other	Supplemental Information Report: Section 4.4, Appendix 4
6	Indicate on a map the boundary subject to air and/or ground geophysical work.	Supplemental Information Report: Section 3.5.1 (Figure 3.5-2)
7	Provide flight altitudes and locations where flight altitudes will be below 610m.	TBD

B-4. Drilling		
8	Provide the number of drill holes and depths (provide estimates and maximums where possible).	Supplemental Information Report: Section 3.6, Section 4
9	Discuss any drill additives to be used.	Supplemental Information Report: Section 4.4.1
10	Describe method for dealing with drill cuttings.	Supplemental Information Report: Section 4.4.1
11	Describe method for dealing with drill water.	Supplemental Information Report: Section 4.4.2
12	Describe how drill equipment will be mobilized.	Supplemental Information Report: Section 4.4.1
13	Describe how drill holes will be abandoned.	Supplemental Information Report: Section 4.4.3
14	If project proposal involves uranium exploration drilling, discuss the potential for radiation exposure and radiation protection measures. Please refer to the *Canadian Guidelines for Naturally Occurring Radioactive Materials* for more information.	not applicable
B-5. Stripping/ Trenching/ Pit Excavation		
15	Discuss methods employed. (i.e. mechanical, manual, hydraulic, blasting, other)	not applicable
16	Describe expected dimensions of excavation(s) including depth(s).	not applicable
17	Indicate the locations on a map.	not applicable
18	Discuss the expected volume material to be removed.	not applicable
19	Discuss methods used to determine acid rock drainage (ARD) and metal leaching potential and results.	not applicable
B-6. Underground Activities		
20	Describe underground access.	Supplemental Information Report: Section 4, Appendix 4
21	Describe underground workings and provide a conceptual plan.	Supplemental Information Report: Section 4, Appendix 4
22	Show location of underground workings on a map.	Supplemental Information Report: Section 4, Appendix 4
23	Describe ventilation system.	Supplemental Information Report: Section 4, Appendix 4
24	Describe the method for dealing with ground ice, groundwater and mine water when encountered.	Supplemental Information Report: Section 4, Appendix 4, Section 10.4.3
25	Provide a Mine Rescue Plan.	TBD
B-7. Waste Rock Storage and Tailings Disposal		
26	Indicate on a map the location and conceptual design of waste rock storage piles and tailings disposal facility.	Supplemental Information Report: Section 4, Appendix 4
27	Discuss the anticipated volumes of waste rock and tailings.	Supplemental Information Report: Section 4.2.3, 4.3.3, Appendix 4
28	Discuss methods used to determine acid rock drainage (ARD) and metal leaching (ML) potential and results.	Supplemental Information Report: Section 4, Appendix 4
B-8. Stockpiles		
29	Indicate on a map the location and conceptual design of all stockpiles.	Supplemental Information Report: Section 4, Appendix 4
30	Describe the types of material to be stockpiled. (i.e. ore, overburden)	Supplemental Information Report: Section 4.2.2, 4.3.2, Appendix 4
31	Describe the anticipated volumes of each type of material to be stockpiled.	Supplemental Information Report: Section 4.2.2, 4.3.2, Appendix 4
32	Describe any containment measures for stockpiled materials as well as treatment measures for runoff from the stockpile.	Supplemental Information Report: Section 4.2.2, 4.2.7, 4.2.8, 4.3.2, 4.3.7, 4.3.8, Appendix 4
33	Discuss methods used to determine acid rock drainage (ARD) and metal leaching (ML) potential and results.	Supplemental Information Report: Section 8.3, Appendix 8B
B-9. Mine Development Activities		
34	Indicate the type(s) of mine development activity(s): - Underground **BULK SAMPLE** - Open Pit - Strip Mining - Other	Supplemental Information Report: Section 4
35	Describe mine activities.	Supplemental Information Report: Section 4.1 to 4.4
	- Mining development plan and methods - Mine development plan - Site access - Site infrastructure - Milling process - Water source(s) for domestic and industrial uses, required volumes, distribution and management - Solid waste, wastewater and sewage management - Water treatment systems - Hazardous waste management - Ore stockpile management - Tailings containment and management - waste rock management - Site surface Water management - Mine Water management - Pitting and quarrying activities - Explosives use, supply and storage - Power generation, fuel requirements and storage - Continuing exploration	Supplemental Information Report: Section 4.1 to 4.4, 6.4, 8.1 to 8.4 and Table 8.1-1
36	Describe the explosive type(s), hazard class, volumes, uses, location of storage (show on map), and method of storage.	Supplemental Information Report: Section 4.2.10.1, 4.3.10

B-10. Geology and Mineralogy		
37	Describe the physical nature of the ore body, including known dimensions and approximate shape.	Supplemental Information Report: Section 5.2, Appendix 5
38	Describe the geology/ mineralogy of the ore deposit	Supplemental Information Report: Section 5.2, Appendix 5
39	Describe the host rock in the general vicinity of the ore body.	Supplemental Information Report: Section 5.2, Appendix 5
40	Discuss the predicted rate of production.	Supplemental Information Report: Section 4
41	Describe mine rock geochemical test programs which have been or will be performed on the ore, host rock, waste rock and tailings to determine acid generation and contaminant leaching potential. Outline methods and provide results if possible.	Supplemental Information Report: Section 4, Appendix 4, 5 and 8
B-11. Mine		
42	Discuss the expected life of the mine.	Supplemental Information Report: Section 3.4
43	Describe mine equipment to be used.	Supplemental Information Report: Section 4.2.6 and 4.3.6 (Tables 4.2-1 and 4.2-2)
44	Does the project proposal involve lake and/or pit dewatering? If so, describe the activity as well as the construction of water retention facilities if necessary.	not applicable
45	Discuss the possibility of operational changes occurring during the mine life with consideration for timing. (e.g. open pit to underground)	not applicable
46	If project proposal involves uranium mining, consider the potential for radiation exposure and radiation protection measures. Particular attention should be paid to *The Nuclear Safety and Control Act* .	not applicable
B-12. Mill		
47	If a mill will be operating on the property in conjunction with mining, indicate whether mine-water may be directed to the mill for reuse.	not applicable
48	Describe the proposed capacity of the mill.	not applicable
49	Describe the physical and chemical characteristics of mill waste as best as possible.	not applicable
50	Will or does the mill handle custom lots of ore from other properties or mine sites?	not applicable
SECTION C: Pits and Quarries		
1	Describe all activities included in this project: - Pitting - Quarrying - Overburden removal - Road use and/or construction - Explosives transportation and storage - Work within navigable waters - Blasting - Stockpiling - Crushing - Washing - Other	Supplemental Information Report: Section 4, Appendix 8C
2	Describe any field investigations and the results of field investigations used in determining new extraction sites.	Supplemental Information Report: Section 5, Section 8, Appendix 8C
3	Identify any carving stone deposits.	not applicable
4	Provide a conceptual design including footprint.	Supplemental Information Report: Section 4, Appendix 4 and 8C
5	Describe the type and volume of material to be extracted.	Supplemental Information Report: Section 4, Appendix 4
6	Describe the depth of overburden.	Supplemental Information Report: Section 4, Appendix 4
7	Describe any existing and potential for thermokarst development and any thermokarst prevention measures.	Supplemental Information Report: Section 5.2, Appendix 5, Section 7.3 and 10.4.3
8	Describe any existing or potential for flooding and any flood control measures.	Supplemental Information Report: Section 4.2.7, 4.2.8, 4.3.7, 4.3.8
9	Describe any existing or potential for erosion and any erosion control measures.	Supplemental Information Report: Section 6.4, 7.2, 10.4.2 and Table 10.3-1
10	Describe any existing or potential for sedimentation and any sedimentation control measures.	Supplemental Information Report: Section 10.4.2, 10.4.5.1 and Table 10.3-1
11	Describe any existing or potential for slumping and any slump control measures.	not applicable
12	Describe the moisture content of the ground.	Supplemental Information Report: Section 5.2, Appendix 5, Section 8, Appendix 8C
13	Describe any evidence of ice lenses.	not applicable
14	If blasting, describe methods employed.	Supplemental Information Report: Section 4.2.10.2, 4.3.10, Appendix 4, 6.2
15	Describe the explosive type(s), hazard class, volumes, uses, location of storage (show on map), and method of storage.	Supplemental Information Report: Section 4.2.10.2, 4.3.10
16	Discuss methods used to determine acid rock drainage (ARD) and metal leaching (ML) potential and results.	Supplemental Information Report: Section 8.3, Appendix 8B
17	Discuss safety measures for the workforce and the public.	Supplemental Information Report: Section 4, 8.1 (Table 8.1-1) and 10.5.2

3. DESCRIPTION OF THE EXISTING ENVIRONMENT		
Physical Environment		
	§ Proximity to protected areas, including:	Supplemental Information Report: Section 5.2 and Appendix 5
	§ Eskers and other unique landscapes (e.g. sand hills, marshes, wetlands, floodplains).	
	§ Evidence of ground, slope or rock instability, seismicity.	
	§ Evidence of thermokarsts.	
	§ Evidence of ice lenses.	
	§ Surface and bedrock geology.	
	§ Topography.	
	§ Permafrost (e.g. stability, depth, thickness, continuity, taliks).	
	§ Sediment and soil quality.	
	§ Hydrology/ limnology (e.g. watershed boundaries, lakes, streams, sediment geochemistry, surface water flow, groundwater flow, flood zones).	
	§ Tidal processes and bathymetry in the project area (if applicable).	
	§ Water quality and quantity.	
	§ Air quality.	
	§ Climate conditions and predicted future climate trends.	
	§ Noise levels.	
	§ Other physical Valued Ecosystem Components (VEC) as determined through community consultation and/or literature review.	
Biological Environment		
	§ Vegetation (terrestrial as well as freshwater and marine where applicable).	Supplemental Information Report: Section 5.3 and Appendix 5
	§ Wildlife, including habitat and migration patterns.	
	§ Birds, including habitat and migration patterns.	
	§ Species of concern as identified by federal or territorial agencies, including any wildlife species listed under the *Species at Risk Act (SARA)* , its critical habitat or the residences of individuals of the species.	
	§ Aquatic (freshwater and marine) species, including habitat and migration/spawning patterns.	
	§ Other biological Valued Ecosystem Components (VEC) as determined through community consultation and/or literature review.	
Socioeconomic Environment		
	§ Proximity to communities.	Supplemental Information Report: Section 3.5.1, 3.6
	§ Archaeological and culturally significant sites (e.g. pingos, soap stone quarries) in the project (Local Study Area) and adjacent area (Regional Study Area).	
	§ Palaeontological component of surface and bedrock geology.	
	§ Land and resource use in the area, including subsistence harvesting, tourism, trapping and guiding operations.	
	§ Local and regional traffic patterns.	
	§ Human Health, broadly defined as a complete state of wellbeing (including physical, social, psychological, and spiritual aspects).	
	§ Other Valued Socioeconomic Components (VSEC) as determined through community consultation and/or literature review.	
4. IDENTIFICATION OF IMPACTS AND PROPOSED MITIGATION MEASURES		
1	Please complete the attached Table 1 – Identification of Environmental Impacts, taking into consideration the components/activities and project phase(s) identified in Section 4 of this document. Identify impacts in Table 1 as either positive (P), negative and mitigable (M), negative and non- mitigable (N), or unknown (U).	Supplemental Information Report: Section 10.3 and Table 10.3-1
2	Discuss the impacts identified in the above table.	Supplemental Information Report: Section 10.3 and Table 10.3-1
3	Discuss potential socioeconomic impacts, including human health.	Supplemental Information Report: Section 5.5, 10.6 and Appendix 5
4	Discuss potential for transboundary effects related to the project.	Supplemental Information Report: Section 10.9
5	Identify any potentially adverse effects of the project proposal on species listed under the *Species at Risk Act (SARA)* and their critical habitats or residences, what measures will be taken to avoid or lessen those effects and how the effects will be monitored.	Supplemental Information Report: Section 10.5.2
6	Discuss proposed measures to mitigate all identified negative impacts.	Supplemental Information Report: Section 10.4 and 10.5
5. CUMULATIVE EFFECTS		
	Discuss how the effects of this project interact with the effects of relevant past, present and reasonably foreseeable projects in a regional context.	Supplemental Information Report: Section 10.7

6. SUPPORTING DOCUMENTS		
	Where relevant, provide the following supporting documents:	
	Abandonment and Decommissioning Plan	Supplemental Information Report: Section 8, Appendix 8C
	Existing site photos with descriptions	Not available
	Emergency Response Plan	Supplemental Information Report: Section 8.1 (Table 8.1-1)
	Comprehensive Spill Prevention/Plan (must consider hazardous waste and fuel handling, storage, disposal, spill prevention measures, staff training and emergency contacts)	Supplemental Information Report: Section 8.1 (Table 8.1-1)
	Waste Management Plan/Program	Supplemental Information Report: Section 4.2.11, 4.3.11, 7.1 (Table 7.1-1) and 8.1 (Table 8.1-1)
	Monitoring and Management Plans (e.g. water quality, air pollution, noise control and wildlife protection etc.)	Supplemental Information Report: Section 8.1 (Table 8.1-1)
	If project activities are located within Caribou Protection Areas or Schedule 1 Species at Risk known locations, please provide a Wildlife Mitigation and Monitoring Plan	not applicable
	In addition, for Project Type 9 (Site Cleanup/Remediation), please provide the following additional supporting documents:	
	§ Remediation Plan including cleanup criteria and how the criteria were derived.	not applicable
	§ Human Health Risk Assessment of the contaminants at the site.	not applicable

TABLE 1 - IDENTIFICATION OF ENVIRONMENTAL IMPACTS

PROJECT ACTIVITIES	ENVIRONMENTAL COMPONENTS	PHYSICAL	designated environmental values (ie. Parks, Wildlife Protected areas)	ground stability	permafrost	hydrology/ limnology	water quality	climate conditions	odors and other emissions to air	landscapes	surface and bedrock	geology	sediment and soil quality	tidal processes and bathymetry	air quality	noise levels	other VEC:	other VEC:	other VEC:	BIOLOGICAL	vegetation	wildlife, including habitat and migration patterns	birds, including habitat	land migration patterns	aquatic species, incl. habitat and migration patterns	wildlife protected areas	other VEC:	other VEC:	other VEC:	SOCIO-ECONOMIC	archaeological and cultural historic sites	employment	community wellness	community infrastructure	human health	other VSEC
CONSTRUCTION																																			
OPERATION																																			
DECOMMISSIONING																																			

Did not use table; see attached

Note: Please indicate in the matrix cell whether the interaction causes an impact and whether the impact is

P = Positive

N = Negative and non-mitigatable

M = Negative and mitigatable

U = Unknown

If no impact is expected please leave the cell blank

Table 1 - TMAC Madrid Type B Application - Environmental Affects

	Project Phase				
Potential Effect	**Construction**	**Operations**	**Temporary Closure/ Closure**	**Post-Closure**	**Summary of Mitigation Measures**
Air Quality					
Degradation of air quality due to exhaust emissions from vehicles, aircraft and other combustion equipment	M	M	M		Use of well-maintained, fuel efficient equipment and promotion of fuel conservation measures.
Degradation of air quality due to fugitive dust emissions from blasting and quarrying	M	M			Dust generated will be short term and localized in nature and may settle on nearby overburden/soils, vegetation and surface water. As needed, water will be applied during periods of dry weather and/or application of approved dust suppression chemicals.
Degradation of air quality due to fugitive dust emissions from increased use of the existing airstrip and road traffic	M	M	M		Dust generated will be localized in nature and may settle on nearby overburden/soils, vegetation and surface water. As needed, water will be applied during the summer periods of dry weather and/or application of approved dust suppression chemicals.
Greenhouse gas emissions contributing to climate change	M	M	M		Use of well-maintained, fuel efficient equipment and promotion of fuel conservation measures. The equivalent emissions of GHG from the Madrid Advanced Exploration Program during the peak year is approximately 0.002% of Canada's annual emissions.
Noise					
Changes to background noise conditions due to movement of vehicles, aircraft and other equipment	M	M	M		Equipment fitted with appropriate mufflers and silencers. Use enclosures, berms, acoustic screening and shrouding where stationary sources requiring control are identified. Keeping equipment in a well maintained condition.
Increased noise and vibration due to blasting and exploration drilling	M	M			Use enclosures, berms, acoustic screening and shrouding where stationary sources requiring control are identified. Keeping equipment in a well maintained condition.
Ground Stability and Permafrost					
Alteration of the active layer	M/N	M/N	M/N	M/N	Effects to permafrost will be mitigated as far as practical by reducing the extent of cut and fill areas; cut and fill will be allowed in designated rock quarries Appropriate thermal insulation will be placed to prevent onset of thermal erosion. Where fill is required, it will be of sufficient thickness and quality such that the active layer is not reduced.
Acceleration of permafrost-related processes such as mass wasting and erosion	M	M	M	M	Minimizing areas of disturbance. Where disturbance occurs, erosion and sediment control measures including compaction, sediment fences, and erosion control blankets will be implemented.
Groundwater					
Changes in groundwater quality due to the interaction between talik groundwater and underground mine water	M	M			Minimize operations within talik zone. Underground water will be collected into sumps and re-used for underground drilling. If excess water accumulates, the collected water will be transported to the Pollution Control Pond on surface.
Changes in groundwater quality due to the interaction between deep groundwater and underground mine water					Mine operations do not extend below the base of the permanently frozen zone.
Degradation of active layer water due to contact with poor quality (contact) water	M	M			Surface water management strategies including diversion/collection systems have been incorporated to reduce the risk of degradation of very shallow groundwater in the active-layer.
Surface Water Quantity					
Surface water drawdown of area lakes as a result of use	M	M			Recycling of intercepted contact water for drilling purposes will reduce the demand for fresh water and lake drawdown. Compliance with DFO Guidelines for under ice water taking.
Alteration in surface runoff patterns due to diversions	M	M	M		Minimizing footprint and diversion of surface runoff, minimizes the alteration to runoff patterns. Diverted surface runoff is kept within the existing watershed.
Surface Water Quantity and Sediment Quality					
Changes in surface water quality from disposal of contact water at bulk sample sites		M	M	M	Contact water meeting discharge criteria will be released from the bulk sample pad to the tundra at least 31m away from the local waterways. If the discharge water does not meet the water quality criteria, it will be transported to the Doris North Project for disposal in TIA. Transport of treated or untreated contact water for discharge to the TIA at the Doris North Project may also be implemented.
Changes in water quality from fugitive dust emissions	M	M			Appropriate drainage and sediment control structures will be used to prevent sediment laden water from entering surrounding waters. Dust generation will be minimized by road watering or by using other non-toxic, non-wildlife attractant substances to suppress dust.
Changes in surface water quality from runoff from quarry sites	M	M			Contact water within the quarry boundaries will be collected in a sump. If this contact water meets discharge criteria it will be discharged to the environment. If it does not meet discharge criteria it will be trucked to the Pollution Control Pond for reuse, or trucked to Doris North Project for disposal in TIA. Management plans will outline the storage, handling and use of explosives to minimize excessive residue and nitrogen loading.
Changes in surface water quality from runoff water from roads, pads, and other infrastructure	M	M	M	M	Runoff from the pads will be directed to the Pollution Control Pond and runoff from the roads may be monitored for two years to confirm geochemical stability of the material. Roads and infrastructure pads have been sited to avoid water bodies and are designed to minimize the risk for erosion and use of silt fencing if and where necessary. Available spill and emergency response equipment.
Presence of hydrocarbons owing to fuel spills	M	M	M		The possibility of accidental spills or releases will be eliminated or reduced by implementation of management plans and standard operating procedures.
Changes in surface water quality from disposal of treated sewage effluent and/or sludge					The existing camp facilities at Doris North Project will be used and portable, latrine style toilet facilities at Madrid South and Madrid North. Toilet wastes will be returned to the Doris North Project for disposal at existing sewage treatment facilities.
Changes in surface water quality from disposal of underground mine water	M	M	M		Underground contact water will be collected in underground sumps and reused for drilling. Excess water will be pumped to the surface and discharged to the Pollution Control Ponds.

	Project Phase				
Potential Effect	**Construction**	**Operations**	**Temporary Closure / Closure**	**Post-Closure**	**Summary of Mitigation Measures**
Mobilization of particulate material dust-generating activities	M	M			Dust generation will be minimized by road watering or by using other non-toxic, non-wildlife attractant substances to suppress dust.
Changes in surface water quality from runoff from quarry sites	M	M	M	M	Disposal of the drilling wastes in either a local sump or pumped to a system allowing the solids to settle out and clarified water to be released to tundra away from any surface water body. The remaining solids (sludge) can then be left in place at the local sump and reclaimed, or can be deposited in a dedicated containment location.
Disturbance and suspension of sediments from in-water construction activities	M				Appropriate drainage and sediment control structures will be used to prevent sediment laden water from entering surrounding waters.
Changes in sediment quality from disposal of treated contact water at bulk sample sites	M	M	M	M	Contact water meeting discharge criteria will be released from the bulk sample pad to the tundra at least 31 m away from the local waterways. If the discharge water does not meet the water quality criteria, a treatment plant may be installed to treat to the required concentration and release to the tundra 31 m away from local waterways. Transport of treated or untreated contact water for discharge to the TIA at the Doris North Project may also be implemented.
Presence of hydrocarbons in sediment quality owing to fuel spills	M	M			The possibility of accidental spills or releases will be eliminated or reduced by implementation of management plans and standard operating procedures.
Changes in sediment quality from disposal of treated sewage effluent and/or sludge					The existing camp facilities at Doris North Project will be used and portable, latrine style toilet facilities at Madrid South and Madrid North. Toilet wastes will be returned to the Doris North Project for disposal at existing sewage treatment facilities.
Vegetation					
Loss of ecosystems and vegetation to infrastructure development	N	N			Loss of ecosystems and vegetation will be minimized by minimizing Project footprint and utilization of existing infrastructure and access corridors associated with the Doris North Project. The total area that will be converted to roads, pads, and laydown areas amounts to approximately 25 ha across the Madrid area.
Degradation of eco-systems and vegetation through increased dust deposition, chemical spills, alteration of local hydrology, or the introduction of invasive species	M	M	M	M	Implementation of dust mitigation measures and available spill and emergency response measures Where practical, road construction and maintenance will prevent the ponding of water to maintain local hydrological patterns. The introduction of invasive plant species to newly disturbed areas will be minimized by washing machinery and vehicles thoroughly prior to their use on site.
Degradation of ecosystems and vegetation through discharge to the tundra		M			Erosion will be mitigated through the use of silt curtains and Pollution Control Ponds, as required.
Terrestrial Fauna					
Habitat loss due to infrastructure development	M	M	M	M	Minimizing overall Project footprint and avoiding significant habitat. Avoiding clearing during wildlife sensitive periods or using qualified personnel to conduct pre-clearing surveys if clearing occurs within sensitive wildlife periods.
Changes in movement and behaviour due to sensory disturbance from blasting, human presence, vehicle and aircraft traffic	M	M	M		Equipment fitted with appropriate mufflers and silencers. Use enclosures, berms, acoustic screening and shrouding where stationary sources requiring control are identified. Keeping equipment in a well maintained condition.
Mortality due to vehicle and aircraft traffic	M	M	M		Vehicle speed limits will be implemented and enforced and vehicles restricted to site roads and quarry footprints.
Mortality or reduced vigor from ingestion of contaminants deposited in food and water sources due to construction activities, vehicle traffic, and drilling activities	M	M	M	M	A waste and wildlife attractant management protocol implemented such that wildlife do not have access to camp wastes, contaminated areas, and attractants.
Aquatic Fauna					
Reduction in habitat or de-oxygenation of water through water withdrawals for operations and dust suppression activities	M	M			Recycling of intercepted contact water for drilling purposes will reduce the demand for fresh water and lake drawdown. Compliance with DFO Guidelines for under ice water taking. Minimizing footprint and diversion of surface runoff, minimizes the alteration to runoff patterns. Diverted surface runoff is kept within the existing watershed.
Reduction in habitat quality through reduced water or sediment quality associated with the introduction of nutrients or contaminants, including elevated TSS levels through dust-generating and in-water construction activities	M	M			The mitigation measures already described for water and sediment quality will help minimize the potential effects to aquatic organisms, fish, and fish habitat by minimizing changes to water and sediment. Elevated levels of TSS will be mitigated through the use of silt curtains and Pollution Control Ponds, as required.
Removal or alteration of aquatic habitat for infrastructure, including the construction of bridges or culverts	M	M			Minimized accepted techniques for sediment control, riparian care, site isolation, and timing windows. Location of infrastructure to minimize the loss of aquatic systems, with a particular focus on avoiding important fish habitat. Infrastructure is designed with a minimum 30 m setback distance from adjacent water bodies and the water that comes into contact with these facilities will be intercepted for management prior to release to the environment.
Historical and Traditional Uses					
Disturbance or loss of recorded and unrecorded archaeological sites or significant heritage resources	M	M			The footprint has been surveyed and the recorded archaeological sites are mitigable with recovery in accordance with Territorial legislation and implementation of a "chance find" procedure.
Damage or removal of archaeological material	M	M			The footprint has been surveyed and the recorded archaeological sites are mitigable with recovery in accordance with Territorial legislation and implementation of a "chance find" procedure.
Decrease in access to land for land users	N	N	M	M	Communication will be a major component of mitigation to changes to access to the area. This would inform other land users of activities associated with Project construction and operations, including restricted areas, blasting activities, and wildlife management. Communication will enable land users to adjust their activities accordingly, and stay informed regarding Project development.
Changes to the aesthetic quality of the area	M	M	M	M	TMAC will also consider suggestions made by land users and residents of local communities in the development of mitigation and enhancements, in the interest of ensuring that these measures are meaningful and effective in the local context.

Note: P = Positive
N = Negative and non-mitigatable
M = Negative and mitigatable
U = Unknown
If no impact is expected cell is blank

Appendix 10-B

Archaeology and Traditional Use Clearance

Hope Bay Project Madrid Bulk Sample Application Archaeological Assessment

By Gabriella Prager
Points West Heritage Consulting Ltd.

Madrid South

The landform on which the Madrid South portal and vent raise infrastructure and laydowns are proposed has been thoroughly covered by surveys for archaeological resources several times over the past years of intensive exploration activity. Thus, there is a low possibility for undiscovered archaeological resources within the portal infrastructure development zone.

There are three recorded archaeological sites in the portal-vent raise development area. One site, NaNh-7, is within 30m of proposed infrastructure and laydown pads. This site contains three stone semi-circles and associated hearths. It was partly mitigated in 2011. Due to the close proximity and intensity of advanced exploration activities related to the proposed bulk sampling and exploration program, it is recommended that the small amount of mapping and excavation still required be completed in order to fully mitigate this site.

One site, NaNh-8, is within the Quarry H outline, approximately 85m from the proposed vent raise pad. It contains four features distributed over a large area. Mitigation possibilities could include protection by staking and fencing and not using that section of the quarry. However, given the wide distribution of the site features together with the proximity and intensity of activities such as quarrying and proposed advanced exploration, full data recovery consisting of mapping to scale and excavation is recommended prior to development.

NaNh-74 is a single stone circle on a small bench on Wolverine Lake. It is about 40m from the limits of the infrastructure. This site was fully mitigated by mapping to scale in 2011; therefore, it presents no further concerns.

The waste rock stockpile is proposed on a large expanse of open tundra which typically has low potential for archaeological remains in this area. The east side of the stockpile area was examined in 2014 by pedestrian transects, from the tundra level to the upper height of the adjacent bedrock outcrop. One new site, NaNh-101, was recorded which consists of a stone circle and hearth on the upper bedrock surface. It is approximately 20m from the outline of the toe of the stockpile and the height of that pile is proposed to be several metres below the upper edge of the bedrock height. It is recommended to complete detailed mapping of this site and to regularly monitor the site as the height of the stockpile increases.

Road to Madrid South

The entire length of this proposed road route was visually assessed by low and slow helicopter overflight. Much of this road route is proposed over low lying open tundra that generally does not contain archaeological remains in this region. It passes by occasional bedrock outcrops of various heights. Adjacent edges of those outcrops were surveyed for archaeological resources by ground reconnaissance in both 2011 and in 2014. One site recorded in 2011, NaNh-84, is approximately 140m from the road centre line and occurs on a higher bedrock outcrop, thus, is unlikely to be affected. Two sites were recorded in 2014. One, NaNh-102, contains a stone circle with hearth and is about 75m from the road centre line on low bedrock. The other, NaNh-103, consists of a rock cluster possibly representing a cache or collapsed inukshuk, and is about 200m away. These sites are unlikely to be directly affected by the simple presence of the road, but it is recommended to conduct detailed mapping of the stone circle site due to its proximity. Care will be necessary during design and construction to ensure that no construction or operation related activities would be situated closer to these sites.

Proposed quarry G is a large bedrock outcrop which was surveyed by limited pedestrian transects in past years and covered fairly intensively in 2014. One previously recorded site, NaNh-76, is within Quarry G. This is a large multi-feature site in the southeast part of the uppermost surface of the bedrock outcrop. There is an associated area of small rocks on a bedrock surface approximately 70m northwest of the other features, more or less central within the quarry outline. Due to the location, distance from the rest of the site, and small size, the northwest feature was mapped to scale in 2014. Since this group of rocks is on bare bedrock, no further work is judged necessary relative to this feature. The remainder of this site will require full site data recovery mitigation involving accurate mapping to scale and excavation prior to quarry use.

Madrid North

The area identified for proposed Madrid North portal infrastructure was walked and visually assessed in 2014. All bedrock outcrops within and adjacent to this outlined area were examined. Much of this infrastructure area is typified by tussock tundra which is typically rated as low potential for archaeological sites in this region. The Madrid North vent raise is proposed on low lying tundra some distance south of the portal area, adjacent to the existing Doris-Windy road. This locality has been frequently viewed, has no known sites and is considered low potential for archaeological resources. One new site, NaNh-99, was recorded approximately 150m from the portal pad. This site was mapped to scale upon discovery and because it is on bare bedrock, no further work is considered necessary.

One site, NaNh-59, is in a vegetated pass and summit on a bedrock outcrop on the northern edge of the identified location for the waste rock stockpile which is proposed to extend up the pass.

The waste rock stockpile was designed to reach no closer than 30m from the original features, but three new features were found during ground reconnaissance in 2014. One of those features is approximately 6m from the waste rock stockpile crest limits which is well within the required avoidance zone. Minimally, recommended mitigation is detailed mapping to scale with protection and monitoring if the buffer zone can be increased to greater than 30m. If the waste rock stockpile cannot be redesigned to increase the buffer zone, it is recommended that this site be mitigated by detailed mapping to scale and some excavation prior to development.