TMAC Resources Inc.

Revisions to TMAC Resources Inc. Amendment Application No. 1 of Project Certificate No. 003 and Water Licence 2AM-DOH1323

Package 5: Management and Other Plans

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Revisions to TMAC Resources Inc. - Amendment Application No. 1 of Project Certificate No. 003 and Water Licence 2AM-DOH1323

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TMAC RESOURCES

Package 5

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Package 5
Management and Other Plans

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TMAC RESOURCES

AIR QUALITY MANAGEMENT PLAN

HOPE BAY, NUNAVUT

June 2015

PLAIN LANGUAGE SUMMARY

This Plan identifies activities at Hope Bay that have the potential to generate dust or other air-borne emissions, and describes measures and monitoring undertaken to prevent or mitigate negative environmental effects to local air quality.

This Air Quality Management Plan (AQMP) documents the monitoring programs that are in place for air quality management and describes the mitigation measures that will be being implemented at the Doris Mine in the Hope Bay region of Nunavut. This Plan is intended to fulfil the requirements outlined in the Doris North Project Certificate and Type A Water Licence, and is an updated version of the previous plan.

The AQMP outlines legislation and guidance relevant to the Doris North Project, and the management of the AQMP. The AQMP also identifies the potential sources of point and non-point air emissions during construction and operations. In an ongoing effort to mitigate air contaminants and dust emissions during the construction and operation phases of the Doris Project, the AQMP outlines a number of mitigation measures which TMAC is currently implementing or plans to implement.

The AQMP also provides details of the six monitoring programs in place or planned at the Doris Project. They are:

- passive air quality monitoring;
- particulate monitoring;
- dustfall monitoring;
- construction dustfall monitoring;
- snow core dustfall sampling;
- tailings facility dustfall monitoring;
- incinerator stack emissions testing; and
- meteorological monitoring.

REVISION HISTORY

Revision #	Date	Section	Summary of Changes	Author	Approver
0	October 2006	Throughout	Original. Approved Plan under 2AM-DOH1323	Golder	HBML
1	March 2011	Throughout	General Revision	Rescan	HBML
2	October 2012	Throughout	Modification for care and maintenance, general revision	Newmont, Hope Bay Mining Company Ltd.	HBML, NWB
3	June 2015	Throughout	Update TMAC as current licensee for the Hope Bay region, revised Plan Management responsibilities and template change.	TMAC (ERM)	TMAC
		Sections 2; 2.1; 3.3.	Added: • tailing deposition as a point source; • snow core dustfall monitoring; • tailings dustfall monitoring; • control measures to mitigate dustfall arising from tailings deposition.		

GLOSSARY AND ACRONYMS

TERM	DEFINITION
Air Quality Standards	Objectives for maximum concentrations of criteria air contaminants in the atmosphere developed to ensure long-term protection of public health and the environment.
Ambient Air Quality	The outdoor air quality at a particular site.
ASTM	American Society for Testing and Materials
BC MoE	British Columbia Ministry of Environment
CAAQS	Canadian Ambient Air Quality Standards
CALA	Canadian Association for Laboratory Accreditation
Carbon Monoxide (CO)	Carbon monoxide is a colourless, odourless gas emitted from combustion processes. CO can cause harmful health effects by reducing oxygen delivery to the body's organs and tissues.
Carbon Dioxide (CO_2)	Carbon dioxide is a greenhouse gas and is emitted by combustion.
CEPA	Canadian Environmental Protection Agency
CO_2e	CO_2 equivalent is the measure of the global warming potential of greenhouse gases relative to CO_2, which has a global warming potential of 1.
Criteria Air Contaminants	Contaminants for which environmental regulatory agencies have established ambient air concentration limits.
CWS	Canada Wide Standards
Dioxins	Polychlorinated dibenzodioxins (PCDDs), or simply dioxins, are a group of polyhalogenated compounds which are significant because they act as environmental pollutants. They are commonly referred to as dioxins for simplicity in scientific publications because every PCDD molecule contains a dioxin skeletal structure. Members of the PCDD family have been shown to bioaccumulate in humans and wildlife due to their lipophilic properties.
Fugitive Dust	Particulate matter, often sand or mineral dust, released to the atmosphere by mechanical disruption of soil or by wind scouring.
Furans	Polychlorinated dibenzofurans (PCDFs), or simply furans, are a group of halogenated organic compounds which are toxic environmental pollutants. PCDFs tend to co-occur with polychlorinated dibenzodioxins (PCDDs). PCDFs can be formed by pyrolysis or incineration at temperatures below 1,200°C of chlorine containing products, such as PVC, PCBs, and other organochlorides, or of non-chlorine containing products in the presence of chlorine donors.
Mercury	Mercury is a natural and persistent bioaccumulative element which can be transported many miles in the atmosphere; mercury can have impacts many years and many miles removed from its original source. A common thread through all mercury impacts is that deposition to waterbodies from anthropogenic emissions poses a threat to human and ecosystem health. Mercury also enters into the environment through the disposal (e.g., land filling, incineration) of certain products. Products containing mercury include: auto parts, batteries, fluorescent bulbs, medical products, thermometers, and thermostats.

TERM	DEFINITION
Nitrous Oxide (N_2O)	Nitrous oxide is a greenhouse gas. Primary human-related sources of N_2O associated with the Hope Bay Belt are are sewage treatment, and mobile and stationary combustion of fossil fuel. Nitrous oxide is also produced naturally from a wide variety of biological sources in soil and water.
NAAQO	National Ambient Air Quality Objectives
NAPS	National Air Pollution Surveillance
NIRB	Nunavut Impact Review Board
NPRI	National Pollutant Reporting Inventory
NWB	Nunavut Water Board
Oxides of Nitrogen (NO_x)	NO_x gas primarily consists of nitrogen oxide (NO) and nitrogen dioxide (NO_2). The gases are emitted with exhaust from combustion engines and products from blasting operations. NO_x can be converted to nitric acid in the atmosphere and thus contribute to acid deposition.
Ozone (O_3)	A colourless, odourless reactive gas naturally found in the earth's stratosphere, where it absorbs the ultraviolet component of incoming solar radiation that could be harmful to life on earth. It is also found near earth's surface where pollutants emitted from human activities react in the presence of sunlight to form ozone. Sunny weather and stagnant conditions favour ozone formulation. The principal pollutants involved in these reactions are NO_X, volatile organic carbon (VOC) and carbon monoxide (CO).
PM_{10}	Inhalable particulate matter. PM_{10} particles are airborne particles that have a diameter of 10 µm or less and are thus a subset of total suspended particulate. The majority of PM_{10} particles are from fugitive dust sources. PM_{10} can enter the respiratory system and have been linked to health problems.
$PM_{2.5}$	Respirable particulate matter $PM_{2.5}$ particles are a subset of PM_{10} and are defined as particles with a diameter less than 2.5 µm. These particles are small enough to enter deep into the respiratory system. The majority of PM emitted in diesel engine exhaust is $PM_{2.5}$.
Sulphur Dioxide (SO_2)	Fossil fuel contains a small amount of organic compounds. During fuel combustion, the sulphur is oxidized and emitted as SO_2 gas with the engine exhaust. In the atmosphere, SO_2 can further oxidize to sulphate particles, which contribute to acid deposition.
TSP	Total suspended particulates (TSP) are solid matter or liquid droplets having aerodynamic particle sizes from 0.01 to 100 µm in diameter and larger from smoke, dust, fuel ash, or condensing vapours that can be suspended in the air.
US EPA	United States Environmental Protection Agency. The US EPA has promulgated a variety of guidelines, objectives, emission factors, air dispersion modeling procedures and statutes for the protection of ambient air quality.

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1. INTRODUCTION

This AQMP has been prepared by TMAC Resources Inc. (TMAC) in accordance with authorizations held by TMAC associated with developments throughout the Hope Bay region.

TMAC and its contractors intend to use the AQMP primarily to ensure that best practices for air quality are followed, and that the conditions of water licences are met.

This AQMP is structured in a manner such that one plan pertaining to air quality is approved and implemented across all TMAC Hope Bay project sites, incorporating site- and licence-specific requirements. The main document outlines TMAC's approach to air quality management as it pertains to all TMAC Doris developments; subsequent modules provide details for each site and the associated water licence, and a final module provides all of the standard operating procedures that may be required to implement the AQMP. In the event of a new water licence or an existing licence amendment, only the specific modules pertaining to that licence and site will need to be revised. This is intended for consistency and efficiency across operations and for compliance management.

1.1. OBJECTIVES

The purpose of the AQMP is to outline the mitigation measures that are being implemented on site and to document the monitoring programs that are in place. This AQMP is intended to fulfil the requirements outlined in the Doris North Project Certificate and Type A Water Licence.

TMAC is committed to complying with the atmospheric monitoring requirements initially agreed to by HBML and outlined in the Doris North Project Certificate (NIRB No. 003, issued September 15, 2006; NIRB 2006). Specific text relating to the Air Quality Management Plan from the Project Certificate is as follows:

1. *Section 4.0. Item 8. HBML will fund and install a weather station at the mine site to collect atmospheric data, including air temperature and precipitation. The design and location of this station shall be developed in consultation with Environment Canada officials.*
2. *Section 4.0. Item 30. HBML will install and fund an atmospheric monitoring station. This station and its location shall be developed in consultation with Environment Canada and Health Canada air quality officials and focus on particulates of concern generated at the mine site. The results of air-quality monitoring are to be reported every six months to NIRB through the Monitoring Officer, and from there to all of the parties.*
3. *Section 4.0. Item 30. Commentary: NIRB expects that Canada Wide Standards for Dioxins and Furans and the Canada Wide Standards for Mercury will apply and should be followed including stack testing of incinerators.*

In addition, the following construction atmospheric monitoring requirements are outlined in the Doris North Type A Water Licence (NWB Licence No. 2AM-DOH1323 Type A). Specific text relating to the AQMP from the Type A Water Licence is as follows:

1. *Part D, Item 8. The Licensee shall submit an annual Construction Monitoring Report no later than March 31 in the year following the calendar year being reported. The report shall be developed in accordance with Schedule D Item 1.*
2. *Schedule D Item 1. The Construction Monitoring Report referred to in Part D, Item 8 shall include the following: Item i. Monitoring of dust generation and use of water by the contractor to manage dust emissions from crushing and construction activity.*

1.2. Relevant Legislation and Guidance

Table 1.2-1 summarizes the ambient air quality standards used to monitor the Doris North Project (the Project) emissions on ambient air quality. This table has been updated from previous AQMP versions to reflect changes made in the various standards. The applicable standards include:

- National Ambient Air Quality Objectives (NAAQO) (EC 2013);
- Canadian Ambient Air Quality Standards (CAAQSs) (CCME 2014)
- Canada Wide Standards (CWS) (CCME 2000c);
- Government of Nunavut Environmental Guideline for Air Quality (GN 2011);
- Alberta Environment Ambient Air Quality Objective for Dustfall (Alberta Environment 2013); and
- British Columbia Ministry of Environment Level B Standard for PM10 (BC MoE 2011).

Table 1.2-1. Relevant Ambient Air Quality Standards for the Doris North Project

Pollutant	Averaging Time	Concentrations (µg/m^3)					Deposition (mg/m^2/30 day) Alberta
		NAAQO			Nunavut	CAAQS[b]	
		Maximum Desirable	Maximum Acceptable	Maximum Tolerable			
CO	1-hour	15,000	35,000		-	-	-
	8-hour	6,000	15,000	20,000	-	-	-
Dustfall	30-day	-	-	-	-	-	53 and 158
NO_2	1-hour	-	400	1,000	400	-	-
	24-hour	-	200	300	200	-	-
	Annual	60	100	-	60	-	-
O_3	8-hour	-	-	127[f]	-	135 and 133 (2020)[e]	-
PM_{10}	24-hour	-	-	-	50	-	-
$PM_{2.5}$	24-hour	-	30	30[d]	-	28 and 27 (2020)[f]	-
	Annual	-	-	-	-	10 and 8.8 (2020)[g]	-
SO_2	1-hour	450	900	-	450	-	-
	24-hour	150	300	800	150	-	-
	Annual	30	60	-	30	-	-
TSP	24-hour	-	120	400	120	-	-
	Annual	60	70	-	60	-	-

Notes: (-) dash indicates not applicable

[a] *Annual 98th percentile value, averaged over three consecutive years. Canada-wide standard published by CCME.*

[b] *CAAQS adopted in 2013 and will be effective from 2015 and 2020.*

[c] *Only criteria for pollutants and averaging periods absent in NAAQO or Nunavut standard are presented.*

[d] *Based on 98th percentile ambient measurement annually, averaged over 3 consecutive years.*

[e] *The 3-year average of the annual 4th-highest daily maximum 8-hour average concentrations.*

[f] *The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations*

[g] *The 3-year average of the annual average concentrations.*

Alberta objectives and standards are used for dustfall as there are no standards set by Federal or Nunavut Territorial governments. Although there is no mandatory requirement to achieve these objectives and standards in Nunavut, TMAC strives for best practice.

TMAC is subject to the National Pollutant Release Inventory (NPRI) ~~Regulation~~ under the Canadian Environmental Protection Act (CEPA) in years when the activities trigger the NPRI Reporting requirements. A reporting requirement may be triggered in any given year in facilities where the employees work a total of 20,000 hours or more during the calendar year. In addition, the owner/operator must report to the NPRI, regardless of the number of hours worked by the employee, if there is:

- non-hazardous solid waste incineration of ≥ 26 tonnes of waste, including, but not limited to, conical burners and beehive burners;
- sewage sludge incineration;
- discharge of treated or untreated wastewater from a wastewater collection system at an average of ≥ 10,000 m^3/day into surface waters; or
- operations at pits or quarries where production is ≥ 500,000 tonnes.

Where the employee threshold is not met, but the reporting criteria for qualifying substance under Schedule 1 of the NPRI is met, the list of substances reported on would typically include SO_2, NOx, CO, TSP, PM_{10}, $PM_{2.5}$, hexachlorobenzene, dioxins and furans.

TMAC is also subject to Environment Canada's Greenhouse Gas (GHG) Reporting Program under CEPA. All facilities that emit 50,000 tonnes or more of greenhouse gases in carbon dioxide equivalent (CO_2e) per year are required to submit a report. Although this threshold may not be met, the program requires TMAC to submit a "does not meet criteria" report annually, and as best practice, TMAC has been voluntarily reporting GHG emissions through the program.

1.3. Plan Management and Execution

The AQMP is valid until August 15, 2023 (the duration of 2AM-DOH1323), and is reviewed annually.

Personnel responsible for implementing and updating the AQMP are identified in Table 1.3-1.

Table 1.3-1. Roles and Responsibilities

Role	Responsibility
VP Operations (or designate)	• Overall responsibility for this management plan. • Provide the necessary resources to operate and maintain monitoring and analysis within the AQMP.
Surface Manager	• Implement this management plan; • Provide the on-site resources to operate, manage, and maintain the monitoring program in accordance with this AQMP; • Conduct regular inspections of the monitoring stations and audits of the maintenance records;
Environment Manager	• Review and update this AQMP as required; • Maintain database of collected air quality samples analysis, and report to assess whether air quality has met applicable regulatory standards

Results from the monitoring programs will be reviewed annually to determine if any trends are evident and if target criteria are being met. Corrective actions based on the air quality monitoring results will be determined on a case-by-case basis; however, examples of responses are provided below:

- If particulate matter shows a trend of increasing concentrations, the issue will be investigated and additional control measures will be implemented if warranted and where possible.
- If issues are raised by regulators or local communities, discussions will be initiated to resolve the issues.

The AQMP will be reviewed on a regular basis (i.e., at least once per calendar year) and revised as required. It is possible that components of the AQMP may need to be revised over the life of the Doris North Project based on regulatory changes and technological advances. Any modifications made to the AQMP will be communicated to regulatory authorities where applicable.

2. AIR QUALITY MANAGEMENT ISSUES

Management and mitigation measures have been designed to protect ambient air quality during all phases of the Doris Project. Key project activities that will require management and mitigation include:

- All phases: operation of light and heavy vehicles and stationary equipment such as generators;
- Construction: blasting and crushing; and
- Operation: activities associated with mining, ore processing, and tailings deposition.

The AQMP includes:

- control measures that are already in place or that will be established to mitigate combustion and fugitive emissions from all phases of the Doris Project;
- control measures to mitigate dustfall arising from tailings deposition; and
- a monitoring program to collect on-site air quality and meteorological data to allow for an adaptive approach to air quality management during all phases of the Doris North Project.

2.1. SOURCES OF EMISSION

The Doris North Project has the following potential sources of point and non-point air emissions during construction and operations. These include:

- generators;
- portable heaters (e.g., Herman Nelson heaters), and light plants (e.g., Whacker Light Plants);
- waste oil burners;
- mine air heaters;
- mill and processing plant;
- heavy equipment (surface, construction);
- heavy equipment (underground);
- light equipment (surface, e.g., skidsteers);
- light vehicles;
- aircraft;
- boat motors;
- snowmobiles;
- incinerators;
- burn pan;
- quarries;
- crusher;
- tailings facility; and
- crushed rock/overburden stockpiles.

2.2. MITIGATION MEASURES

TMAC is committed to complying with the licences and authorizations issued for the Doris North Project, and has worked with the regulators to develop appropriate on-site air quality mitigation measures and monitoring plans. In an ongoing effort to mitigate air contaminant and dust emissions during the Construction and Operation phases of the Doris North Project, TMAC is currently implementing or plans to implement the following measures:

- Vehicles are driven at designated speeds on site roads.
- Vehicle and equipment idling is minimized when not in use, taking account of differing operation requirements in summer and winter.
- All mobile and stationary engines are regularly serviced to maintain efficiency;
- A preventive maintenance program is in place for all machinery and equipment
- On-site staff at all levels have the necessary training and instruction in their duties relating to process control and air emissions (e.g., the required measures to be implemented during start-up, shut down and abnormal conditions).
- Dust suppression methods used are implemented either in accordance with the Nunavut Environmental Guideline For Dust Suppression (GN 2002b) or as otherwise approved, and are suitable for use at below-freezing temperatures.
- Water or dust suppression fluids are applied to roadways to minimize dust from ore and waste rock haulage, site road traffic and maintenance (grading), and tailings when ambient air temperatures permit;
- Discharge heights from the crushers onto conveyers, and conveyors onto stockpiles are minimized. In addition, the discharge from crushers onto conveyors or into other equipment is enclosed where practicable (e.g., free fall of materials from conveyors carrying material should be fitted with a full hood such as a chute).
- Water or chemical additive (e.g., Soil Sement®) sprays compatible with the ambient air temperatures are utilized to suppress dust generation from tailings in the TIA, when ambient air temperatures permit, and as approved by the GN-DOE.
- Storage areas are kept in a condition that does not give rise to visible dust emissions.
- Waste oil burners are equipped with a settling tank and filter system for particulate removal from the waste oil, and waste oil sampling is conducted in accordance with the Environmental Guideline for Used Oil and Waste Fuel (GN 2012); and
- Incinerators operated on site comply with Nunavut standards (GN 2012), Canada-Wide Standards for Dioxins and Furans (CCME 2000a) and Canada-Wide Standards for Mercury emissions (CCME 2000b).

Operation of the incinerator includes:

- Waste segregation to divert materials that are unsuitable for incineration (e.g., chlorinated plastics);
- properly trained incinerator operators;
- Stack testing is undertaken, when required, to determine compliance with standards.

3. MONITORING AND EVALUATION

The components of the Air Quality Monitoring Program are outlined in Table 3-1 and the locations of the monitoring stations are shown in Figure 3-1.

The following sections provide further details of these monitoring components.

Table 3-1. Doris North Air Quality Monitoring Program

Monitoring	Parameter	Date
Passive air quality monitoring	NO_2, O_3 and SO_2	Initiated in the fall of 2008
Particulate monitoring	PM_{10}, $PM_{2.5}$ and TSP	Began in 2009
Dustfall monitoring	Particulates, anions, cations and total metals	Began in 2009 and put on hold while in care and maintenance
Construction dustfall monitoring	Particulates, anions, cations and total metals	Began in 2009, was expanded in 2011, and put on hold while in care and maintenance. Dustfall monitoring will occur during future periods of construction, as needed.
Snow core dustfall monitoring	Total particulate	Program under development
Tailings facility dustfall monitoring	Program under devleopment	
Incinerator stack emissions testing	Dioxin, furan and mercury	2009, 2011 and 2012
Meteorological monitoring	Temperature, wind speed, wind direction, relative humidity, solar radiation and rainfall	Ongoing since 2003

3.1. Passive Air Quality Monitoring (NO_2, O_3 and SO_2)

Emissions of NO_2 and SO_2 are expected as a result of fuel combustion associated with the Project. O_3 is formed by chemical reactions between combustion by-products initiated by sunlight.

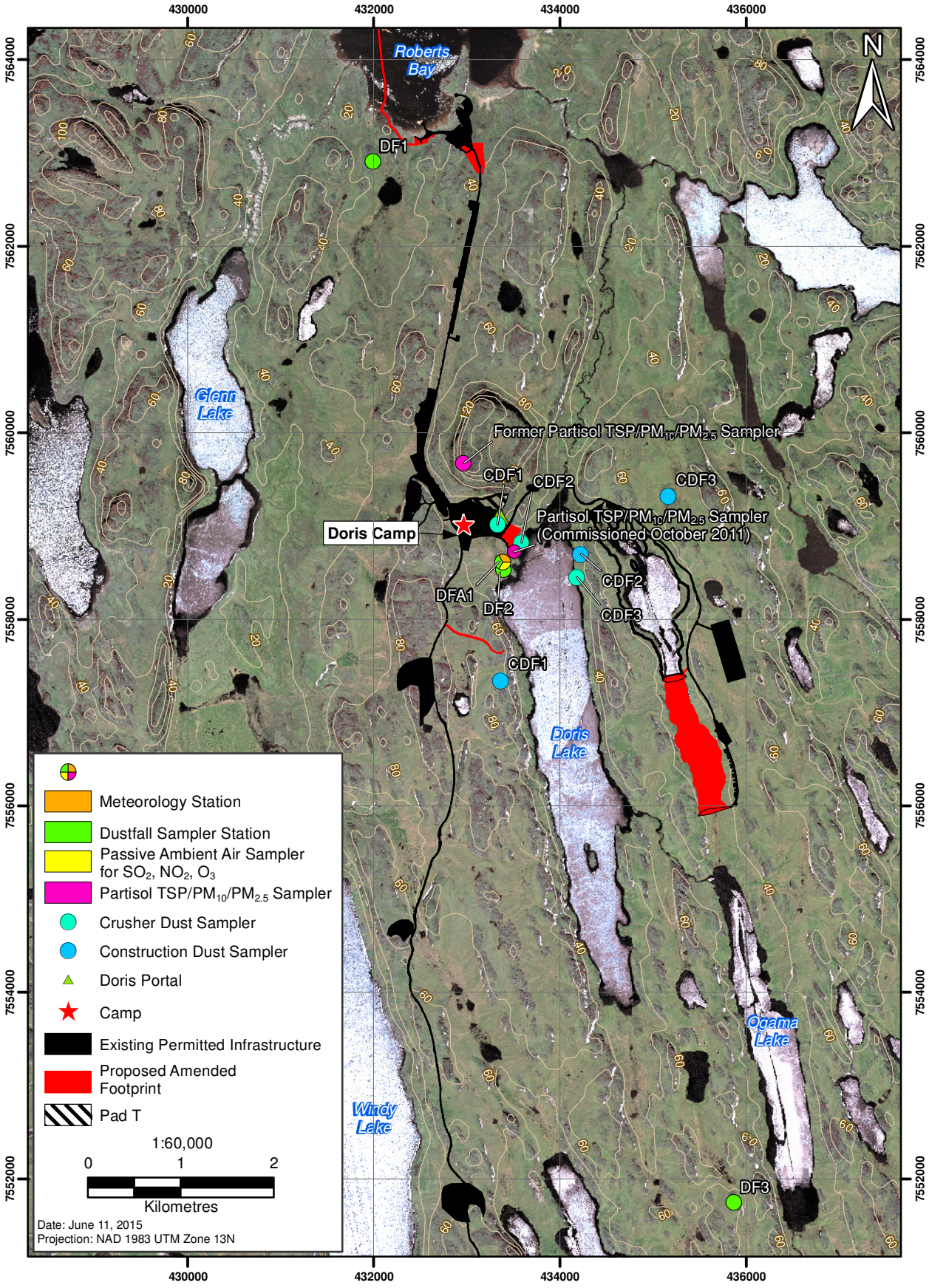
Sample Locations

The passive monitoring program was implemented at a single location in the vicinity of the Project in the fall of 2008. The location of this station is shown in Figure 3-1. Nunavut does not have established siting requirements for ambient air samplers. Therefore, the siting criteria from the British Columbia Ministry of Environment (BC MoE 2009) and the US EPA methods (US EPA 2009) were used. The monitoring location is selected based on the following criteria:

- The sampler is not in an area of future infrastructure development.
- The sampler can be mounted at a height of 3 to 15 m above ground level.
- The sampler was free from wind interference.
- The sampler is away from structures, vegetation and topographic features that may create a local microclimate.
- The sampler is safely accessed year-round.

Monitoring is ongoing at this station. During periods of care and maintenance, this passive monitoring station will be operated seasonally when the camp is occupied. This station is co-located with the Doris Meteorological Station.

Figure 3-1
Air Quality Monitoring Program Stations



Sampling Methods

An all-season Passive Air Sampling System (PASS) is used to monitor NO_2, O_3 and SO_2. The PASS sampler has low detection-limit capabilities and includes a shelter to allow for year-round operation. The PASS sampler monitors gas or vapour pollutants from the air through the process of diffusion through a static air layer or permeation through a membrane (Maxxam Analytics Inc. 2011). The sample media are installed in the field and exposed in protective shelters that are mounted to a support pole or small tripod for a period of 30 days. Following the set exposure period the samples are retrieved, replaced and sent to the laboratory for analysis along with meteorological data including air temperature, wind speed and relative humidity to allow the ambient air concentration of the compound over the sampling period to be determined.

Data Analysis

The NO_2, O_3 and SO_2 sampling provides a one-month average ground-level concentration for each compound. Compliance with the relevant air quality standards needs to be determined after a full calendar year of monthly data is available, since the relevant standards are based on one-year time averages. In addition, ambient air quality temporal trends of NO_2, O_3 and SO_2 must take into consideration the time of year and meteorological conditions during the sampling period.

The monitoring data are also used to provide feedback to modify the air quality management procedures incorporated at the site, if required. However, sampling does not occur in "real time" and there is a delay between the events that lead to any elevated concentrations and the receipt of monitoring results.

3.2. Particulate Monitoring (PM_{10}, $PM_{2.5}$ and TSP)

Suspended particulate matter includes both airborne solid and low-vapour-pressure liquid particles having diameters ranging in size from 0.01 to 100 µm. The generation of particulate matter is expected as a result of the movement of vehicles, mobile equipment, crushing, blasting, bulk handling and storage and other associated mineral processing and construction activities. Wind erosion from sources such as tailings can also generate particulate emissions.

Sample Locations

Ambient suspended particulate matter has been measured via monitoring PM_{10}, $PM_{2.5}$ and TSP concentrations at one location in the vicinity of the Doris North Project since the summer of 2009. The station was moved from the butte (elevation 150 m) in 2011 and monitoring is now undertaken near the Doris Meteorological Station. The location of this station is shown in Figure 3-1. Nunavut does not have established siting requirements for ambient air samplers. Therefore, the siting criteria from the British Columbia Ministry of Environment (BC MoE 2009) and the US EPA methods (US EPA 2009 and US EPA 1999) were used. The monitoring location is selected based on the following criteria:

- A stable 120 VAC power source was available.
- The sampler is not in an area of future infrastructure development.
- The sampler inlet is mounted at height of 2 to 15 m above ground level.
- The sampler is free from wind interference.
- The location is accessible year-round.
- The sampler is away from structures, vegetation and topographic features that may create a local microclimate.

Monitoring is ongoing at this station; however, during care and maintenance data will only be collected seasonally when the camp is occupied.

Sampling Methods

A Partisol Plus Model 2025 ambient air sampler is used to monitor TSP and a Partisol Sequential Dichotomous Model 2025D ambient air sampler is used to monitor PM_{10} and $PM_{2.5}$ simultaneously.

The Partisol ambient air samplers draw a particulate-laden ambient air stream through a size-selective inlet, and then through a filter. A built-in pump provides the vacuum required to draw the air flow through the sample filter and a volume flow controller monitors and automatically adjusts the flow rate. The filters are sealed off pre and post use, thereby protecting them from environmental interferences during sampling operations. The filters are weighed before and after sampling at a laboratory that is accredited by the Canadian Association for Laboratory Accreditation (CALA 2011). The Partisol instruments are widely used in Canada for compliance monitoring programs and are recognized as reference equivalent methods by the US EPA (US EPA 2009).

Monitoring of TSP, PM_{10}, and $PM_{2.5}$ concentrations is carried out according to the National Air Pollution Surveillance (NAPS) (EC 2011) schedule, which follows a monitoring cycle where a single 24-hour sample is collected every six days. Sampling in accordance with the NAPS schedule provides consistency between the on-site stations and stations at other facilities across the country. In addition, by operating on a six-day cycle, different days are sampled each week thus allowing for differing production intensity or other cyclical production variations.

Additional factors, not specified in standard site selection criteria, are also considered. Due to the very cold climate, the Partisol samplers are installed inside a temperature-controlled shelter. As a result the sample schedule interruptions potentially caused by cold weather, wet conditions and excess humidity (filter conditioning), air leaks, and pump malfunctioning are minimized. The Partisol air sampler location is free from obstructions and nearby pollutant sources that may cause interference in suspended particulate monitoring.

Data Analysis

The particulate sampling provides a 24-hour average ground-level concentration for each size fraction. This is compared to the relevant 24-hour standards (Table 1.2-1). In addition, temporal trends of the TSP, PM_{10} and $PM_{2.5}$ ambient concentrations are examined, taking into consideration the time of year and meteorological conditions during the sampling period.

The monitoring data is also used to provide feedback to modify the dust and air quality management procedures incorporated at the site, as required. However, sampling does not occur in “real time” and there is a delay between the events that lead to any elevated concentrations and the receipt of monitoring results.

3.3. DUSTFALL MONITORING

While the previously discussed particulate matter is measured based on its airborne concentration, dustfall is the measure of particulate that has settled onto a given surface. The main dust generation sources will be from wind erosion from the tailings facility and the movement of vehicles and large equipment on site. The dustfall monitoring program will measure the quantities of dust deposited near the Doris North Project.

Ambient Dustfall Monitoring

Sample Locations

Dustfall monitoring has been undertaken at four locations in the vicinity of the Doris North Project since 2009. One of these stations is co-located with the Doris Meteorological Station and the passive ambient air quality monitoring station (NO_2, O_3, SO_2). The other three stations monitored dustfall over consecutive 30-day periods from May until September. The location of these stations is shown in Figure 3-1. During care and maintenance, all dustfall stations are held in abeyance; monitoring continues when construction and

operations resume. with modifications or additions to the sampler locations as needed to meet siting criteria.

Nunavut does not have established siting requirements for ambient air samplers. Therefore, the siting criteria from the British Columbia Ministry of Environment (BC MoE 2009) and the US EPA methods (US EPA 2009 and US EPA 1999) are used. The monitoring locations are selected based on the following criteria:

- The samplers are not in an area of future infrastructure development.
- Samplers are sited up and down wind of the surface facilities and zones of high activity, taking into account the dominant wind direction during the summer months.
- The samplers are more than 20 m away from structures, vegetation and topographic features.
- The samplers can be safely accessed.

Sampling Methods

Dustfall collection is a passive monitoring method which provides a measure of particulates that would be directly deposited onto vegetation or soil. There are various sampling methodologies available, but the basis of all methodologies is that canisters are exposed in the field to collect and retain ambient dustfall. The canisters are then sent to a laboratory for analysis after a set exposure period. At the Doris Project two methodologies are used.

- A dustfall station co-located with the meteorological station is operated in accordance with the Alberta Environment sampling method (Alberta Environment 1989). One dustfall collector is used.
- At the other dustfall stations, dustfall is monitored in accordance with the ASTM D1739-98 sampling method (Reapproved 2010). The dustfall monitoring stations collect particles small enough to pass through a 1-mm screen and large enough to settle by virtue of their weight. During 2015 all dustfall stations will be monitored in accordance with the ASTM D1739-98 sampling method (Reapproved 2010).

The ASTM method requires containers of a standard size and shape, which are sealed in a laboratory. The containers are installed on a 2-m pole, surrounded by a windscreen, and are each exposed to the atmosphere for approximately 30 days during the summer months. The stations that use the ASTM method (DF1-DF5) have two dustfall collectors at each station. One of the containers is analyzed in the laboratory for particulates (total, soluble and insoluble) and anions (sulphate, nitrate, chloride, and ammonia) and the other for total metals and various cations. Because algae interfere with dustfall measurements, the deionized water in the dustfall containers also contains algaecide. The windscreen around the sample container improves the dustfall collection efficiency, and bird spikes are used to minimize contaminants from bird faeces.

Data Analysis

For the Alberta method, samples are sent to the laboratory for analysis of total dustfall and total fixed dustfall. Total dustfall is defined as the amount of material left after evaporation of a sample of dustfall and its subsequent drying. Total fixed dustfall is the residue that is left after ignition of the total dustfall sample (Alberta Environment 1989). For the ASTM method, samples are sent to the laboratory for analysis of total, soluble and insoluble particulate matter. All dustfall results are prorated by the laboratory to a 30-day average so that they can be compared with standards.

The dustfall monitoring provides a one-month average ground-level mass of deposited dust. This is compared to the relevant Alberta guidelines since Nunavut does not currently have dustfall standards. In addition, analysis of temporal trends is undertaken to determine if there are any increasing trends in the measured concentrations with consideration of the time of year and meteorological conditions.

The monitoring data is also used to provide feedback to modify the dust management procedures implemented at the site, as required. However, sampling does not occur in “real time” and there is a

delay between the events that lead to any elevated dust deposition and the receipt of monitoring results.

Construction Dustfall Monitoring

Construction of the Doris North Project officially commenced in 2010. All air-quality monitoring program components described above were active in 2010. In addition to these stations, three construction dustfall monitoring stations were established in early 2011 to increase the number of dustfall stations used to monitor construction dust during 2011 and 2012. Locations for these stations are shown in Figure 3-1. These monitoring locations were selected based on the following criteria:

- The samplers were outside the footprint of areas of future infrastructure development.
- Samplers were sited up and down wind of the zones of high activity, taking into account the dominant wind direction during the survey period.
- The samplers were more than 20 m away from other structures, vegetation and topographic features.
- The samplers were safely accessible.

A construction dustfall monitoring program is anticipated to be active during any construction phase in order to fulfill the requirements of Schedule D, item 1i of the Type A Water License; the locations of the samplers may be adjusted to correspond with crusher operations in various permitted quarries Construction dustfall monitoring will be discontinued during care and maintenance and operation phases.

Snow Core Dustfall Monitoring

Dust deposition monitoring using snow surveys will be conducted once annually. Snow core samples will be collected during spring for Total Particulate analysis to determine rate of particulate deposition over the prior winter season. This program is currently in development and transects and specific sample locations are yet to be determined, but will include areas upwind and downwind of dust-generating facilities or activities along transects aligned with the prevailing wind direction. An update to this program will be included in the next iteration of this plan.

Tailings Facility Dustfall Monitoring

A dustfall monitoring program will also be developed specifically to monitor dust mobilization and disposition to surrounding areas from subaerial tailings in the TIA. This program is currently in development and transects and specific sample locations are yet to be determined, but will include areas upwind and downwind of the TIA along a transect aligned with the prevailing wind direction. An update to this program will be included in the next iteration of this plan.

3.4. Incinerator Stack Testing

Incinerator stack-emissions testing programs were implemented in October 2009, July 2011, and July 2012 to measure emissions of dioxins, furans and mercury from the domestic waste incinerator. Prior to the beginning of the stack-emissions testing programs, the general methodology was reviewed by Environment Canada (pers. comm. Mr. Dave Fox, Air Protection Management Analyst North, Environment Canada, Yellowknife). New waste management procedures implemented in 2011 were aimed at improving the stack emissions. In 2011 and 2012, ongoing improvements to the waste processing procedures were made and compliance with the CWS was achieved in 2012 (A. Lanfranco & Associates Inc. 2012). During care and maintenance, stack testing is not required if the annual waste volume burned remains below 26 tonnes and continued “determined efforts” to apply the best available pollution prevention and control techniques remain implemented. Stack testing will continue annually if the annual amount incinerated is greater than 26 tonnes.

The sampling and analytical methods used for the dioxin and furan emissions testing conform to the procedures outlined in the Environment Canada–Environmental Protection Service (EC-EPS 1989) emission monitoring reference method manuals. The sampling and analytical methods used for the mercury emissions testing conformed to the procedures outlined in the Environment Canada–Environmental Protection Service (EC-EPS 1993) emission monitoring reference method manuals.

The analysis of samples will continue to be undertaken by an accredited laboratory. Following each stack-emissions testing program an Incinerator Stack Testing Compliance Report is completed. This report includes a description of the Doris North Project incinerator(s) and how it was being operated at the time of the stack-emissions testing program, the methods used for sampling and analysis, and a discussion of the results, including comparison with the Canada Wide Standards for Dioxins and Furans (CCME 2000a) and the Canada Wide Standards for Mercury (CCME 2000b).

3.5. METEOROLOGICAL MONITORING PROGRAM

A meteorological monitoring program is ongoing. A meteorological station was installed on the northern shore of Doris Lake in May 2003 (Figure 3-1). The station is a self-contained, solar/battery-powered system and includes instrumentation to measure hourly values of temperature, wind speed, wind direction, relative humidity, solar radiation and rainfall. Meteorological data is reported in annual compliance reports.

3.6. REPORTING

The results of the Air Quality Monitoring Program components are reported annually to the NIRB and the NWB. One report generated that addresses all air quality monitoring requirements including, when applicable:

- meteorology;
- air quality;
- incinerator stack testing; and
- ambient, construction, and snow core dustfall monitoring.

In addition, this AQMP will be updated as required.

The air quality monitoring data will be reviewed annually to determine if any trends are evident. The need for any corrective actions to on-site emission management or additional control measures will be determined on a case-by-case basis. Indications of the need for corrective actions and additional control measures may include the following criteria:

- Monitoring data shows an increasing trend in ambient air concentrations and deposited dust.
- Issues are raised by on-site staff, regulators or local communities.

Discussions will be initiated to resolve any issues as soon as possible after the issue has been identified.

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Package 5
Management and Other Plans

P5-2 Interim Closure and Reclamation Plan

TMAC RESOURCES

DORIS NORTH MINE
INTERIM CLOSURE AND RECLAMATION PLAN
JUNE 2015

HOPE BAY, NUNAVUT

June 2015

REVISION HISTORY

Revision #	Date	Section	Summary of Changes	Author	Approver
0	October 2005	Entire Document	Initial version of plan submitted in support of Final Environmental Impact Statement Report	Miramar Hope Bay Ltd. (Written by AMEC)	Miramar Hope Bay Ltd.
1	April 2007	Entire Document	Submitted in support of Water Licence Application	Miramar Hope Bay Ltd.	Miramar Hope Bay Ltd.
2	August 2012	Entire Document	Project entered Care and Maintenance phase. Closure and Reclamation of existing advanced exploration facilities (no operating mine was constructed) in accordance with Type A Water Licence 2AM-DOH0713	Newmont, Hope Bay Mining Ltd. (Written by SRK)	Newmont, Hope Bay Mining Ltd.
3	March 2014	Entire Document	Transfer of ownership and re-activation of construction activities. Revised Plan in accordance with Type A Water Licence 2AM-DOH1323	TMAC Resources Inc. (Written by SRK)	TMAC Resources Inc.
4	June 2015	Entire Document	Updated Mine Development Plan Revised Interim Plan in accordance with Type A Water Licence 2AM-DOH1323 Amendment 1.	TMAC Resources Inc. (Written by SRK)	TMAC Resources Inc.

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1 INTRODUCTION

1.1 BACKGROUND

The Doris North Project (the Project) is owned and operated by TMAC Resources Inc. (TMAC). The project is located on Inuit Owned Land administered by the Kitikmeot Inuit Association (KIA), in the West Kitikmeot Region of Nunavut, approximately 120 km southwest of Cambridge Bay (Figure 1).

The project involves the construction, operation and closure of a small underground gold mine and mill with an average throughput of 1,000 tonnes per day, for the first two years, then increasing in production to 2,000 tonnes per day for the remaining years of the mine life. Closure of the mine will be undertaken upon completion of mining and milling of the ore. The mill, crushing plant, fuel storage tank farm, camp, office complex, workshops, power generation plant, sewage treatment plant and all other operational mine infrastructure is located in a central location adjacent to the underground mine portal. Processing of the ore will take place on-site with the gold doré being shipped by air to an off-site refinery. The mill will produce two types of tailings. The detoxified cyanide leach tailings will be mixed with underground waste rock and returned underground to be used as structural backfill for the underground workings. The flotation tailings will be pumped to the Tailings Impoundment Area (TIA) approximately 5 km east of the mill site and will be subaerially deposited between the Interim Dike and the South Dam. The overall footprint of the project is approximately 54 hectares and is authorized under the Nunavut Water Board (NWB) Type A Water Licence 2AM-DOH1323 (NWB 2013) and the Nunavut Impact Review Board (NIRB) Project Certificate 003.

Since the issuance of the project's initial Type A Water Licence (2AM-DOH0713), in September 2007, the ownership of the Project has changed three times. Construction of the project began in June 2007 by the original owner Miramar Mining Corp. (Miramar) under its subsidiary Miramar Hope Bay Mining Ltd. (MHBL). In March 2008, Newmont Mining Corporation (NMC) purchased the project and continued construction activities under their wholly owned subsidiary Hope Bay Mining Limited (HBML). NMC however ceased construction, in January 2012, and placed the project in temporary closure. In January 2013, NMC sold the project to TMAC who subsequently recommenced exploration activities in June 2013 and will continue construction with the aim of putting the project into production by 2017.

1.2 CLOSURE AND RECLAMATION PLAN HISTORY

This Interim Closure and Reclamation Plan (the Plan) presents the closure obligations and the plan for closing all facilities, and demonstrates how the closure obligations will be met.

The first Closure and Reclamation Plan for the site was prepared by AMEC (2005) and submitted as a supporting document for the Final Environmental Impact Statement (EIS).The 2005 Closure Plan described closure of the Doris North Project had it produced and milled ore in accordance with the 2005 Miramar EIS (MHBL 2005). Subsequent to this original closure plan a number of amendments and modifications to the original Type A Water Licence 2AM-DOH0713 were submitted to the Nunavut Water Board for review and approval. These amendments and modifications also required revisions to the project's Closure and Reclamation Plan.

In 2012 a new Closure and Reclamation Plan was submitted by the new owners, Hope Bay Mining Ltd., when the site was placed into temporary closure. The 2012 Plan (SRK 2012) was reflective of this status and differed from the 2005 Plan. The 2012 Plan addressed the following key areas:

- The Project never advanced to the production stage and was only an advanced exploration program including underground bulk sampling and a decline that ended in ore.
- The bulk sampling program produced waste rock and ore which were stored on surface on dedicated rock pads.
- The mill was not constructed and tailings had not been produced.

Subsequent to ownership change in 2014, the 2012 Plan was revised to reflect Operation based on TMAC's intention of advancing the Project through to production. That Plan focused on the closure of the site in accordance with the existing Type A Water Licence 2AM-DOH1323.

The update of the Interim Closure and Reclamation Plan discussed in this report was necessary due to changes in the Project requiring an amendment to the existing Water License. The differences between the current and the immediately preceding revision are detailed in Section 1.3.

A chronological account of these revisions is provided in Table 1.

Table 1: Closure and Remediation Plan Revision History

Document Title	Author	Release Date	Key Changes
Preliminary Mine Closure and Reclamation Plan Doris North Project - Hope Bay Belt Nunavut, Canada	Miramar Hope Bay Ltd. (Written by AMEC)	October 2005	Initial version of plan submitted in support of Final Environmental Impact Statement Report.
Mine Closure and Reclamation Plan Doris North Project, Nunavut	Miramar Hope Bay Ltd.	April 2007	Submitted in support of Water Licence Application.
Doris North Closure and Reclamation Plan	Newmont, Hope Bay Mining Ltd. (Written by SRK)	August 2012	Project entered Care and Maintenance phase. Closure and Reclamation of existing advanced exploration facilities (no operating mine was constructed) in accordance with Type A Water Licence 2AM-DOH0713.
Doris North Mine Closure and Reclamation Plan	TMAC Resources Inc. (Written by SRK)	March 2014	Transfer of ownership and re-activation of construction activities. Revised Plan in accordance with Type A Water Licence 2AM-DOH1323.
Doris North Mine Interim Closure and Reclamation Plan	TMAC Resources Inc. (Written by SRK)	May 2015	Updated Mine Development Plan Revised Interim Plan in accordance to Type A Water Licence 2AM-DOH1323 Amendment 1.

1.3 CHANGES FROM PREVIOUS REVISION

The current Interim Closure and Remediation Plan addresses the following project changes:

- Increase in waste rock volumes with all of the waste rock being returned underground upon closure of the mine.
- Increase in tailings volume with all of detoxified cyanide leach tailings mixed with underground waste rock and returned underground to be used as structural backfill. Flotation tailings are placed in the existing TIA.
- Change from sub-aqueous to subaerial tailings deposition in TIA.
- Construction of an Interim Dike between the North and South dams to allow the subaerial deposition of the flotation tailings.
- The Roberts Bay Discharge System will be use to convey and discharge groundwater and excess reclaim water from the TIA to Roberts Bay. The Roberts Bay Discharge System is comprised of the Roberts Bay Discharge Pipeline, constructed from Doris North Camp to the Marine Outfall Berm at Roberts Bay, and the Marine Outfall Pipeline which will continue into the bay out to the Marine Outfall Diffuser at the -40 m bathymetric contour.

- Treated sewage from the Doris North Sewage Treatment Plant is pumped to the tailings mixing box and managed with the tailings effluent stream.
- The Doris Connector Vent Raise and Access Road as well as the Doris Central Vent Raise and Access Road will be required for ventilation of the underground workings. Heating of the air will be via the Mine Air Heating Facility, located at the Primary Vent Raise.
- An expanded Laydown Area (Pad U) will be constructed, for additional laydown and temporary ore storage.
- The Roberts Bay Laydown Expansion will create additional laydown and storage space adjacent to the beach laydown area and along the northern alignment of the Primary Road.
- A non-hazardous waste landfill within Quarry #3.
- Expansion of Doris Camp to accommodate 280 persons.

1.4 WATER LICENCE REQUIREMENTS

The Project and related facilities are operated in accordance with Water Licence No. 2AM-DOH1323. Table 2 below provides a summary of the requirements for closure, as set forth in the Water Licence, and how this document addresses each of these requirements.

Table 2: Table of Concordance with Type A Water Licence 2AM-DOH1323

Licence Ref.	Licence Conditions (2AM-DOH1323)	Closure Plan Reference	Closure Plan Response/Specification
Part L. 1	Notification in writing will be submitted to the Board at least 60 (sixty) days prior any intent to achieve Recognized Closed Mine status	n/a	Compliance with licence condition will be met.
Part L. 2	Notification to the board as soon as practically possible of any intent to enter a Care and Maintenance Phase	n/a	Compliance with licence condition will be met.
Part L. 3	The Licencee shall, upon providing notice to the Board as per Part L, Item 2, review all operational plans and submit revised Plans to reflect the Care and Maintenance status, to the Board for approval in writing, within three (3) months of providing notice	n/a	Compliance with licence condition will be met.
Part L. 4	The Licencee shall provide to the Board, at least thirty (30) days advanced notification in writing, of the initial start or change of Operations. Notification maybe provided separately or in accordance with monthly monitoring report as per PART J, Item 21	n/a	Compliance with licence condition will be met.
Part L. 5	The Licencee shall submit to the Board for review, within sixty (60) days of approval of the Licence, a revised closure plan, addressing the technical comments received and based on the response submission of the Applicant on February 14, 2013	all	This document satisfies this licence condition.
Part L. 6	Submit to the Board for approval within six (6) months of the start of ore processing, an Interim Closure and Reclamation Plan prepared in accordance with the Mine Site Reclamation Guidelines for the Northwest Territories, 2007 and consistent with INAC Mine Site Reclamation Policy for Nunavut, 2002	all	It is TMAC's intent that this document will also satisfy this licence condition unless otherwise advised by the NWB.

Licence Ref.	Licence Conditions (2AM-DOH1323)	Closure Plan Reference	Closure Plan Response/Specification
Part L. 6.a	Detailed description, including maps and other visual representations, of the pre-construction conditions for each site, accompanied by a detailed description of the proposed final landscape, with emphasis on the reclamation of surface drainage over the restored area	Figures 2 through 12; Sections 2, 4 and 5	Addressed in this report.
Part L. 6.b	A description of how progressive reclamation will be employed and monitored throughout the life of the mine, plus reclamation scheduling and coordination of activities with the overall sequence of the project; details of the reclamation scheduling and procedures for coordinating reclamation activities within the overall mining sequence and materials balance	Section 8	All efforts will be made during mine operations to implement progressive reclamation, such as backfilling with waste rock.
Part L. 6.c	Implications of any water quality model re-calibration results on the Tailings Impoundment Area (TIA) discharge strategy and any adaptive management measures that may be required	n/a	Compliance with licence conditions will be met and are discussed in SRK (2015a).
Part L. 6. d	An evaluation of closure and reclamation measures for each mine component including the goals, objectives, closure criteria and the rationale for selection of the preferred measures	Section 3, 4, and 5	See referenced sections.
Part L. 6. e	A comprehensive assessment of materials suitability, including geochemical and physical characterization, and schedule of availability for reclamation needs, with attention to cover materials, including maps where appropriate, showing sources and stockpile locations of all reclamation construction material and any water related mitigation required during implementation	Section 4; Figures 7 and 8	See referenced sections and figures.
Part L. 6. f	An assessment and description of any required post-closure treatment for drainage water that is not acceptable for discharge from any of the reclaimed mine components	Section 5	No impacted water is expected from the reclaimed components. However, observations resulting from annual monitoring will be used to augment closure activities if necessary and the seepage from all reclaimed areas will be monitored post closure.
Part L. 6.g	Contingency measures for all reclamation components including action thresholds that are linked to the monitoring programs	Section 10	See referenced section.
Part L. 6.h	Monitoring programs to assess reclamation performance and environmental conditions including monitoring locations for surface water and groundwater, parameters, schedules and overall timeframes	Section 9	See referenced section.

Licence Ref.	Licence Conditions (2AM-DOH1323)	Closure Plan Reference	Closure Plan Response/Specification
Part L. 6.i	Quality Assurance and Quality Control (QA/QC) procedures for managing the demolition landfill and other waste disposal areas	Sections 5	All non-hazardous waste will be placed within the Quarry #3 Landfill. Management Plan to be submitted at least 6 months prior to starting landfilling Operation.
Part L. 6.j	The requirement that all Waste Rock classified as mineralized in accordance with the approved Waste Rock and Ore Management Plan as submitted under Part G Item 14 be returned underground as backfill through progressive reclamation procedures, unless otherwise approved by the Board in writing	Sections 3.6 and 5.6.7	See referenced sections.
Part L. 6.k	Underground mine plans and sections, including areas of backfill, the type of material placed and volumes should also be included	n/a	Underground mine plans and sections including areas backfilled will form part of the final Closure and Reclamation Plan and the Reclamation Completion Report.
Part L. 6.l	Protocol for the disposal of any contaminated soil into the underground mine at closure	Section 4.7 and 5.4.1	No HC contaminated soils will be disposed of underground. For other contaminated soils see referenced sections.
Part L. 6.m	An assessment of the long-term physical stability of all remaining project components including the north and south dams	Section 5	See referenced section.
Part L. 6.n	Detailed criteria for the final breaching of the North Dam	Section 5.9.2	The breach will be in accordance with the approved design and subsequent NWB approval.
Part L. 6.o	A revised closure and reclamation cost estimate	Section 11; Appendices A and B	See referenced sections.
Part L. 6.p	A detailed implementation schedule for completion of reclamation work	Section 12; Appendix C	See referenced sections.
Part L. 7	Submit to the Board for approval within eighteen (18) months of the start of ore processing, a Final Mine Closure and Reclamation Plan prepared in accordance with the Mine Site Reclamation Guidelines for the Northwest Territories, 2007 and consistent with INAC Mine Site Reclamation Policy for Nunavut, 2002. The Final Plan shall incorporate revisions, which reflect the pending closed status of the mine, and include the following	n/a	Compliance with licence condition will be met.
Part L. 7. a	Soil Quality Remediation Objectives along with Canadian Council of Ministers of the Environment (CCME) Guidelines and the Government of Nunavut Environmental Guideline for Site Remediation	Section 4.7	Compliance with licence condition will be met.
Part L. 7. b	Environmental Site Assessment plans in accordance with Canadian Standards Association (CSA) criteria	n/a	Compliance with licence condition will be met.

Licence Ref.	Licence Conditions (2AM-DOH1323)	Closure Plan Reference	Closure Plan Response/Specification
Part L. 7. c	Evaluation of the Human Health Ecological Risk Assessment	n/a	Compliance with licence condition will be met.
Part L. 8	If not approved by the Board, revised Plan must be resubmitted to the Board for approval within thirty (30) days of receiving notification of the Board's decision	n/a	Compliance with licence condition will be met.
Part L. 9	Complete all reclamation work in accordance with the Plan(s) referred to in this Part as and when approved by the Board in writing	n/a	Compliance with licence condition will be met.
Part L. 10	The Licencee shall carry out progressive reclamation of any components of the project no longer required for the Licencee's operations	Section 8	See referenced section.
Part L. 11	All roads and airstrip, if any, shall be re-graded to match natural contour to reduce erosion	Sections 3.2 and 5	See referenced sections.
Part L. 12	The Licencee shall remove any culverts and restore the drainage to match the natural channel. Measures shall be implemented to minimize erosion and sedimentation	Sections 3.2 and 5.8.1	See referenced sections.
Part L. 13	In order to promote growth of vegetation and the needed microclimate for seed deposition, all disturbed surfaces shall be prepared by ripping, grading, or scarifying the surface to conform to the natural topography	Sections 3.1 and 5	No active revegetation will be performed. See referenced section.
Part L. 14	Areas that have been contaminated by hydrocarbons from normal fuel transfer procedures shall be reclaimed to meet objectives as outlined in the Government of Nunavut's Environmental Guideline for Site Remediation, 2010. The use of reclaimed soils for the purpose of back fill or general site grading may be carried out only upon consultation and approval by the Government of Nunavut, Department of Environment and an Inspector	Sections 3.3 and 4.7	See referenced sections.
Part L. 15	The Licencee shall contour and stabilize all disturbed areas to a pre-disturbed state upon completion of work	Sections 1.5, 3.1, and 5	See referenced sections.
Part L. 16	The Licencee shall consult traditional land users, land owners, and other stakeholders on the proposed post-closure land use criteria. Particularly, the proposal to leave certain facilities in place and confirm the soil quality remediation objectives	Section 1.5	See referenced section.

1.5 CLOSURE PRINCIPLES

The site has 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.

With the above in mind the overall objectives of this Plan are as follows:

- Establish stable chemical and physical conditions; and
- Ensure the future use and aesthetics of the project site following reclamation activities meets the requirements of Aboriginal, Federal and Territorial governments, landowners, local communities and regulatory authorities.

These closure principles and the subordinate objectives, criteria, and strategies presented in this report have been developed in accordance with the Nunavut Mine Site Reclamation Policy (DIAND 2002) and the Northwest Territories mine site reclamation guidelines (MVLWB / AANDC 2013).

In terms of future land use, some surface infrastructure components at the site may be considered 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, airstrip, jetty, roads and rock pads can be used as a base for other projects in the area. However, for the purposes of this report it has been assumed these structures and facilities will all be removed and/or reclaimed to acceptable standards. Closure and reclamation of these facilities is also accounted for in the supporting cost estimate.

2 DESCRIPTION OF MINE FACILITIES

Figure 1 shows the geographic location of the Doris North Project. In this Plan, the Doris site is described by work area. Each work area contains a series of Facilities. Each Facility is assigned a work breakdown structure (WBS) code. Table 3 lists the facilities, work area, associated WBS code and the corresponding section of this plan that describes each facility.

The facilities found in each of these work areas have been further broken down into sub-areas and numerically listed in Table 3. The numerical codes of these work areas and facilities were used to organize the closure and remediation cost estimates. Descriptions of each area are provided in the following sections.

Table 3: Work Breakdown Structure

Work Area	Facility	WBS Code	Section	Figure
Roberts Bay Area (Figure 4)	Jetty	RB-001	2.1	4
	Roberts Bay - 20 ML Tank Farm	RB-002		
	Quarry#1 - 5 ML Tank Farm	RB-003		
	Mechanical Shop Complex	RB-004		
	Waste Management Facility	RB-005		
	Laydown Area	RB-006		
	Overburden Dump	RB-007		
	Roberts Bay Access Road	RB-008		
	Communications Tower	RB-009		
	Roberts Bay Outfall	RB-010		
Airstrip Area (Figure 5)	Airstrip	AS-001	2.2	5
	South Apron	AS-002		
	North Apron	AS-003		
Reagent Pads Area (Figure 6)	Equipment Laydown Area	RP-001	2.3	6
	Materials Laydown Area	RP-002		
	Ammonium Nitrate Storage Area	RP-003		
	Exploration Drilling Support Shop	RP-004		
Waste Management Area (Figures 7 and 8)	Land Farm	WM-001	2.4	7, 8
	Batch Plant Pad	WM-002		
	Burn Pan	WM-003		
Quarry #2 Area (Figures 7 and 8)	Quarry #2	Q2-001	2.5	7, 8
	Overburden Dump	Q2-002		
	Treated Sewage Discharge Areas	Q2-003		
Doris North Camp Area (Figures 7 and 8)	Accommodation Complex	DC-001	2.6	7, 8
	Tank Farm	DC-002		
	Permanent Power Generator	DC-003		
	Backup Power Generator	DC-004		
	Sewage Treatment Plant	DC-005		

Work Area	Facility	WBS Code	Section	Figure
	Fire Water Storage Tank	DC-006		
	Muster Station	DC-007		
	Warehouse/ Core Shack	DC-008		
	Offices & Mine Dry Complex	DC-009		
	Crushing and Milling Plant	DC-010		
	Underground Wash Bay	DC-011		
	Underground Drilling Support Shop	DC-012		
	Water Intake Structure and Pumping Facility	DC-013		
	Sedimentation/Pollution Control Pond	DC-014		
	Underground Support Mechanical Shop	DC-015		
	Fresh Water Pipelines	DC-016		
	Helicopter Support Facilities	DC-017		
	Waste Rock Pad	DC-018		
	Runoff Diversion Berm	DC-019		
	Sewage Discharge Line	DC-020		
	Sedimentation Berm	DC-021		
	Sumps	DC-022		
	Expanded Waste Rock Storage (Pad U)	DC-023		
	Expanded Laydown Area (Pad U)	DC-024		
Doris Mountain (Figures 2 and 3)	Communications Towers	DM-001	2.7	7, 8
Doris Windy Road Area (Figures 2 and 3, 9 and 10)	All-Weather Road	DW-001	2.8	2, 3, 9, 10
	Quarry A	DW-002		
	Quarry B	DW-003		
	Quarry D	DW-004		
	Explosives Storage Facility	DW-005		
TIA Area (Figures 11 and 12)	North Dam	TIA-001	2.9	11, 12
	South Dam	TIA-002		
	Interim Dike	TIA-003		
	Subaerial Tailings Area	TIA-004		
	Shoreline Protection	TIA-005		
Secondary Road Area (Figures 11 and 12)	Secondary Road	SR-001	2.10	7, 8, 11, 12
	Tailings and Reclaim Water Pipelines	SR-002		
	TIA Access Road (Chainage 0+725)	SR-003		
	Explosives Facility	SR-004		
Quarry #3 Area (Figures 11 and 12)	Quarry #3	Q3-001	2.11	11, 12
	Quarry #3 Access Road	Q3-002		

Work Area	Facility	WBS Code	Section	Figure
	Quarry #3 Landfill	Q3-003		
Underground Workings	Doris North Decline Portal	UG-001	2.12	7, 8, 9, 10
	Doris North Vent Raise	UG-002		
	Doris Connector Vent Raise	UG-003		
	Doris Central Vent Raise	UG-004		
Pipeline Area (Figures 2 through 10)	Roberts Bay Discharge System	PL-001	2.13	2 through 8

2.1 ROBERTS BAY AREA

The Roberts Bay Area (Figure 4) includes the following:

- Jetty and associated laydown and storage facilities for the Project;
- Roberts Bay Tank Farm, housing a total of up to four 5 million liter tanks (three of which have been constructed to date);
- Quarry 1 Tank Farm, containing a single 5 million liter fuel tank;
- Mechanical shop and vehicle repair complex;
- Waste management facility comprised of an incinerator, a waste storage area, and a waste sorting and processing facility;
- Laydown and vehicle parking areas;
- Overburden dump;
- Roberts Bay Access Road to the barge landing area; and
- Communications tower.

The Roberts Bay Discharge System is also traversing the Roberts Bay Area and a detailed description is provided in Section 2.13.

All structures and facilities were built on bedrock or rock fill pads.

2.2 AIRSTRIP AREA

The center of the Airstrip Area is approximately 1.5 km south of Roberts Bay and is shown in Figure 5. The area contains the main airstrip, the north and south aprons. Each of these facilities is constructed on non-acid generating rock fill pads.

2.3 REAGENT PADS AREA

The Reagent Pads Area (Figure 6) consists of a large rock fill pad constructed in two tiers (Upper Pad and Lower Pad respectively). The Upper Pad is accommodating the Equipment Laydown Area, the Ammonium Nitrate Storage Area, and the Exploration Drilling Support Shop while the lower pad is used for the Materials Laydown Area. Both tiers of the pad were constructed with non-acid generating rock bases and rock berms.

2.4 WASTE MANAGEMENT AREA

The Waste Management Area is located on the northwest corner of Doris Camp as shown in Figure 7 and consists of the Landfarm, the burn pan, and a large tent structure on a rock fill pad (formerly used for the batch plant).

2.5 QUARRY #2 AREA

The Quarry #2 Area is located on the northwest corner of Doris Camp as shown on Figure 7 and consists of a rock quarry, an overburden dump, and the old treated sewage discharge area, including a discharge pipeline.

2.6 DORIS NORTH CAMP AREA

The Doris North Camp is located approximately 5 km south of Roberts Bay and is shown on Figures 7 and 8. This is the centre of operations for the Project. It includes the accommodation complex, an office complex, and a mine dry facility linked by an arctic corridor. A primary and a backup power plant, together with warehousing and mining operations support buildings and facilities are located within the camp area.

The crushing and milling facilities will be located in a single large building located mostly on bedrock. Ore storage and temporary waste rock storage pads are located nearby the portal to the underground workings.

All buildings and structures are located on bedrock or non-acid generating rock-fill pads to protect permafrost. The rock fill pads were constructed to ensure positive drainage and prevent permanent ponding.

The area upstream of the camp is a diversion berm incorporating a geosynthetic liner to divert non-contact runoff from upslope areas. The underground decline and portal are located in the east side of the Doris North Camp area.

2.7 DORIS MOUNTAIN

Doris Mountain (Figure 7) is located approximately 400 m north of Doris North Camp. The disturbance area atop of the mountain consists of two steel girder communications towers and appurtenant communication equipment in a steel shack. All facilities are based on and anchored into the barren rock.

2.8 DORIS-WINDY ALL WEATHER ROAD AREA

This area contains a 9.7 kilometre long all-weather road providing access between the Doris North Camp and the former Windy Camp (now closed), as shown on Figures 2 and 3. Along the Doris-Windy All-Weather Road there are three quarries (A, B, and D) used for the construction of the all-weather road. The explosives storage facility is located adjacent to Quarry A and it consists of a number of Type 4 Explosives Magazines.

2.9 TAILINGS IMPOUNDMENT AREA

The TIA area is located approximately 1 km east of Doris North Camp, as shown on Figures 11 and 12. The area is comprised of three containment structures: the North Dam, the South Dam, and the Interim Dike Area. The tailings will be deposited subaerially between the Interim Dike and the South Dam with no permanent supernatant pond. The water pond created between the Interim Dike and the North Dam will be used as a reclaim pond for process water used in the mill.

Only flotation tailings will be deposited within the TIA. The detoxified cyanide leach tailings will be mixed with waste rock and returned underground as structural backfill. The flotation tailings are considered geochemically benign and can be deposited subaerially and closed using a dry cover.

2.10 SECONDARY ROAD AREA

Access to and along the TIA is by the Secondary Road, as shown on Figures 7 and 11. An access road branches off along the Secondary Road (at chainage 0+725) to provide access to the reclaim pond for deployment of the reclaim barge.

Within the TIA there will be two pipelines. A tailings deposition and a reclaim water pipeline. These two pipelines will run approximately 4.3 km from the mill at Doris North Camp to various locations within the TIA. All pipelines will be laid on rock fill along the Primary and Secondary Road alignments, or on pipe supports where necessary.

The main Explosives Storage Facility will be built along the Secondary Road near the South Dam, as shown in Figure 11. This facility will be comprised of a series of storage pads for high explosives and ammonium nitrate. The high explosives storage pads will be located west of the road, whereas the two ANFO pads will be built east of the road.

Drainage gates will be located at strategically identified topographic low points along the tailings and reclaim water pipelines. Outside of the TIA, catch basis will be located immediately downstream of the drainage gates. The purpose of the catch basins is to capture the drainage from the tailings and reclaim water pipelines should there be a shut down within the mill. Draining the pipelines will prevent the pipelines from becoming plugged either due to ice formation or settled tailings, in the event of a shut down. These catch basins will be constructed with non-acid generating rock and will consist of a base and berms lined with a geomembrane.

2.11 QUARRY #3 AREA

The source of all rock fill material for the TIA (the Secondary Road extension, the Interim Dike, and the South Dam) will be Quarry #3 (Figure 11). The quarry, located on a natural rock outcrop, will be developed in a manner that avoids collecting and impounding any water.

Once quarry operations are complete, a non-hazardous waste landfill will be constructed in the northeast corner of the developed quarry. The landfill will contain only inert waste, and any leachate generated will be contained within the TIA.

2.12 UNDERGROUND WORKINGS

Access to the underground workings will be through the Doris North Decline (Figure 7), with the portal located on the east side of Doris North Camp. This will be the only access point for all underground workings and the only ore haulage route to the mill. From the portal, the workings will extend in north-east direction, connecting to the south with the Doris Connector and Doris Central orebodies. These workings will intercept the Doris Lake talik. If needed, any explosives mixing will occur in an underground facility..

In addition, the underground works will include three vent raises. The Primary Vent Raise (Fig. 7), constructed in 2011, is located along the Secondary Road before the Doris Creek Bridge. The Doris Central and Doris Connector vent raises (Fig. 9) are located south of Doris North Camp and will be accessed by dedicated branch roads. Both these vent raises will be constructed on rock outcrops.

The Primary Vent Raise has various associated facilities like the Mine Air Heating Facility and a 60,000 L fuel tank containment facility. The other two vent raises will have a plenum and emergency shelter facilities on surface.

2.13 ROBERTS BAY DISCHARGE SYSTEM

The pipeline from Doris North Camp to Roberts Bay will be built as part of the water management facilities and will convey the combined groundwater inflow from the underground mine and excess reclaim water from the TIA Reclaim Pond to the undersea diffuser in Roberts Bay. The pipeline will originate in the mill building, and it will consist of a single heat-traced 254 mm HDPE pipe.

The pipeline will start at the Doris North Camp and will follow the Primary Road and Airstrip alignments, traversing the Roberts Bay Area and ending at the sub-sea diffuser. The pipe will be routed on rock fill pads wherever possible or placed on appropriate supports, if needed, if any sections must be routed on the tundra.

At the Roberts Bay Laydown Area, the pipeline will run in front of the Roberts Bay 20 ML Fuel Tank Farm, along the south side of the Roberts Bay Jetty Access Road and Laydown Pads, to the Roberts Bay shoreline along the south side of the Roberts Bay Discharge Access Road. The Roberts Bay Discharge Pipeline will enter the Roberts Bay marine environment through the Marine Outfall Berm, which extends from the shoreline to approximately the -4 m bathymetric contour line. From the Marine Outfall Berm, the Marine Outfall Pipeline (*aka* the Roberts Bay Discharge System on land) will extend to the -40 m bathymetric contour line and terminate at the Roberts Bay Diffuser.

3 CLOSURE OBJECTIVES AND CLOSURE OPTIONS

3.1 ROCK FILL PADS

The reclamation objective is to ensure long-term physical and chemical stability and to protect the permafrost. Leachate emanating from rock fill pads must be safe for the environment.

Two broad options were considered: removing the pads or reclaiming them in place. The chosen option was to leave the rock fill in place and regrade the pads to ensure positive drainage and prevent ponding, of water. All pads were constructed of non-acid generating clean quarry rock, thus leachate quality is not a concern. Since construction the underlying vegetation has died and the permafrost will have aggraded into the rock fill, removal of the pads is not practical because it would accelerate permafrost degradation due to lack of well-established vegetation. Active revegetation of the rock fill pads is not practical because the rock fill pads cannot support vegetation, however it is fully expected that lichens will colonise the rock surface in time.

3.2 AIRSTRIP AND ALL-WEATHER ROADS

These facilities were built by placing Run-of-Quarry (ROQ) rock in lifts directly on tundra, thus they are very similar to the rock fill pads, albeit they were designed for a different purpose. The objective for the reclamation of these facilities is the same as for the rock fill pads (see Section 3.1).

The airstrip and all-weather roads will be left in place as a permafrost protection measure, as described in Section 3.1. The surface will be crowned or graded to prevent permanent ponding. The bridges and the arch culvert will be removed for safety as there will be no long term monitoring of these structures. Roads will be breached in areas where their presence has blocked natural surface water drainage allowing the natural surface water drainage paths to be re-established.

3.3 FUEL STORAGE AREAS

The closure objective for the fuel storage areas is to ensure that the facilities are not and will not be a source of contamination to the environment or a safety hazard for humans and wildlife. In addition, the pre-disturbance terrain conditions will be re-established, where possible.

The bulk fuel storage facilities at Roberts Bay and Doris North Camp will be decommissioned and the tanks dismantled. The geosynthetic liners will be removed and the containment berms levelled to conform to the original topography as much as possible, to prevent ponding of water. The granular protective cover will be tested for the presence of unacceptable levels of hydrocarbons. If required, this material will be remediated in-situ or removed off-site for remediation.

The temporary fuel storage facilities (aviation fuel, day tanks, etc.) will be decommissioned and removed from site for reuse or disposal in a licensed facility.

3.4 BUILDINGS AND FACILITIES

The overall objective is to restore areas occupied by buildings to a condition compatible with future land use, and to ensure that the buildings and facilities are not and will not become a source of contamination to the environment or a safety hazard for human activity or wildlife.

The only practical option is to remove all buildings and structures. All buildings will be dismantled or demolished and the debris will either be burned, or placed in the permitted on-site landfill. All other facilities will be decommissioned, demolished, levelled, and the debris placed in the landfill.

3.5 WATER MANAGEMENT STRUCTURES

The overarching closure objective is to restore the natural drainage paths where possible and to prevent excessive erosion while ensuring that no long-term active care and maintenance is required. In areas where permanent discharges exist, engineered discharge points (spillways) must be physically and geotechnically stable on the long-term for safety of humans and wildlife.

To achieve these objectives, options for decommissioning, breaching, or removing each of these structures will be evaluated on a case-by-case basis. Implementation of the chosen option however will only be implemented when post-closure water quality objectives are met. Erosion protection and sediment control measures will be installed where necessary.

Existing water management structures will be maintained at the Project until post-closure water quality objectives are met. Impacted runoff at the Doris North camp will be collected and pumped to TIA or to the Roberts Bay Discharge System. Once the runoff water from the Doris Camp pads meets the water quality objectives, the collection sumps and the pipeline to TIA will be decommissioned. The Sedimentation and the Pollution Control ponds will be breached to re-establish the natural drainage path.

3.6 WASTE ROCK

According to the mine plan no waste rock will be left on the surface at closure, as the required quantities of underground structural backfill exceed the quantity of mined waste rock. Notwithstanding, only non-mineralised waste rock can be left on surface according to the current water license. Some of this material, if existing on surface, could be used for construction and backfill.

3.7 SUBAERIAL TAILINGS

The closure objectives for the TIA can be summarised as follows:

- Ensure long-term physical stability of tailings surface and tailings retaining structures;
- Dust levels are safe to humans, wildlife, and vegetation;
- Minimize the risk of catastrophic or chronic release of tailings and/or tailings water into the environment;
- Minimize the risk of Acid Rock Drainage (ARD) and metal leaching potential into the surface water system to the limits acceptable by the Canadian Council of Ministers of Environment (CCME) water quality guidelines; and
- Tailings area blends in with the topography as much as possible.

At the end of operations the tailings area in the TIA will be closed by construction of an isolation cover, consisting of a single layer of non-acid generating quarry rock. Most of the contaminated water retained in the Reclaim Pond will be pumped through the Roberts Bay Discharge System for undersea discharge. The pond will then be allowed to reflood naturally to pre-disturbance levels (elevation 28.3 masl). The North Dam will then be breached to re-establish the natural drainage path through an engineered spillway structure. The South Dam and Interim Dike will be left in place as tailings-retention structures. The Interim Dike will be breached to the tailings elevation to ensure that no water will be impounded in the tailings area.

The tailings will be deposited as a flat valley-fill structure, and will naturally blend in with the gentle topography of the area.

3.8 UNDERGROUND WORKINGS

The closure objectives for the underground workings are to prevent access into the workings from surface, control surface water infiltration into the workings, and stabilize workings as necessary to prevent surface expression of underground failures, i.e. surface subsidence.

As per the mine plan, the majority of workings will be backfilled with waste rock (including the portal). The vent raises will be capped with a concrete plug to prevent access, and appropriate signage will be posted to warn of existence of these sealed openings. The areas surrounding the decline portal and vent raises will be regraded as required to prevent water draining into the workings.

3.9 PIPELINES

All pipelines on site will be flushed, drained, and the heat tracing system will be decommissioned. Heat tracing controllers and power cables will be removed and landfilled. The pipeline will be cut into manageable sections which will be placed in the landfill. All pipeline supports will be removed and disposed of as appropriate.

3.10 QUARRY #3 LANDFILL

The objective of the closure for this facility is to have a physically stable structure, with all waste isolated from human and wildlife contact.

At closure, the only solid waste management structure remaining will be the Quarry 3 landfill. Release of contaminants will be prevented by placement of only non-hazardous waste in the facility, with all other waste being managed by other appropriate means. The landfill will be located entirely on bedrock, and will be covered with an isolation cover built of a single layer of compacted crushed quarry rock. The cover will be engineered to accommodate any settlement the waste may have in time. Appropriate drainage pathways will be engineered to prevent ponding of water in the facility.

4 FACILITY CLOSURE AND RECLAMATION STRATEGIES

In accordance with the Nunavut Mine Site Reclamation Policy (DIAND 2002) and the 2013 Northwest Territories Mine Site Reclamation Guidelines (MVLWB/AANDC 2013) the following closure and reclamation strategies will be used throughout the implementation of the closure activities described in Section 5.

4.1 COVER MATERIALS

All material used for reclamation will be sourced from existing stockpiles. Stockpiled run of quarry and crushed rock are from Quarry #2 and Quarry #3. A detailed geochemical characterization of quarry rock was previously performed, submitted and approved by NWB (SRK 2007). Where overburden soils will be used for reclamation, a sampling and testing program will be carried out to ensure no chemical or hydrocarbon contamination exist within the stockpiles. The CCME soil quality guidelines (CCME 2015) and the Nunavut Environmental Guidelines, Industrial Land Use, Coarse-Grained Soils (Government of Nunavut 2009) will provide guidance to the acceptability of the material for reclamation covers.

4.2 SALVAGE

Reusable equipment and supplies will be salvaged where appropriate from any building or facility prior to demolition and prepared for shipping off-site to a point of sale.

4.3 DEMOLITION

All utilities to structures and facilities will be decommissioned, disconnected, and dismantled while the structures will be emptied prior to demolition. Buildings will be demolished and the waste material segregated into burnable and non-burnable waste and disposed of as described in Section 4.5. No salvage value was credited in the cost estimate.

Concrete floors will be broken up and covered in place. Concrete wall foundations will be demolished flush with the existing ground and the remnants covered in place. All seacan containers will be removed.

4.4 DECOMMISSIONING AND RECLAMATION OF TANK FARMS

Permanent tank farms will be decommissioned and the tanks dismantled, with the resulting waste placed in the landfill. The secondary containment will be breached and the impermeable liner removed. The protective gravel layer will be tested to identify the type and levels of hydrocarbons present. Remediation options will be determined following the testing, to be appropriate for the type and extent of contamination.

4.5 COLLECTION AND DISPOSAL OF DEMOLITION DEBRIS AND NON-HAZARDOUS WASTE

Structures will be demolished and non-hazardous demolition waste will be segregated in two piles: wood waste and other non-hazardous waste.

Wood waste will either be chipped or burned. Wood waste suitable for burning may be transported to a burn pan location for approved open burning.. Chipped wood may be used for reclamation purposes such as being mixed with drill cuttings, overburden or other material and used to fill depressions.

All remaining non-hazardous waste will be placed in the landfill, compacted, and covered.

4.6 COLLECTION AND DISPOSAL OF HAZARDOUS WASTE

Hazardous wastes and chemicals remaining on-site will be collected and stored in suitable sealed containers suitable for storage and shipping. This includes any remaining fuel, hydraulic oil, antifreeze, batteries, and other lubricating fluids and chemicals. All materials will be packaged and manifested at the Waste Management Facility for transport to a licensed facility in accordance with appropriate Federal, Provincial, Territorial, or Municipal hazardous waste regulations, for reuse or disposal.

4.7 REMEDIATION OF HYDROCARBON CONTAMINATED SOILS

Field investigations will be completed prior to site closure by qualified personnel to define the extent of contamination. An assessment of remediation options will be conducted once the full extent and nature of the contamination is determined. Localized areas with limited contamination will be bioremediated in situ. If large contiguous areas of contamination are found, excavation and off-site removal will be considered. Excavations will be backfilled with rock, overburden, drill cuttings, wood chips and/or a mixture of these to prevent surface water ponding and ensure permafrost preservation.

The option to encapsulate impacted soils in place is also preserved should it be demonstrated that hydrocarbon risk is minimal and/or other remediation methods are ineffective or inappropriate for a given area.

The Nunavut Environmental Guidelines, Industrial Land Use, Coarse-Grained Soils (Government of Nunavut, 2009) will be used for determining if soil remediation is required.

4.8 DRAINAGE CONTROL

Rock pads will be regraded to blend into the original terrain and prevent permanent ponding of water after the structures have been removed and the area has been cleared of all debris. As some of the closure activities could be performed in the winter, the areas to be regraded should be staked during the previous summer to be easily identified during the winter reclamation work.

No new disturbance will be created during pad regrading. Any remaining depressions which cannot be regraded will be backfilled with suitable fill material.

5 CLOSURE ACTIVITIES

The overall closure activities to be undertaken in the fulfillment of closure obligations are summarized in this section. The activities are described by geographic location of the various facilities following the WBS presented in Section 2.

5.1 ROBERTS BAY AREA

5.1.1 General

The entire Roberts Bay area will be cleaned of any waste materials and debris following closure activities described in the following sub-sections. The resulting non-hazardous waste will be placed in the landfill, while the hazardous waste will be managed as appropriate and shipped off-site for disposal in a licensed facility.

The pads will be surveyed for evidence of hydrocarbon spills and field investigations will be completed as detailed in Section 4.7. The area will be graded to eliminate permanent ponding, as much as possible.

All tracks and trails on the tundra associated with the existing Roberts Bay facilities will be backfilled to prevent ponding and prevent or limit permafrost degradation.

5.1.2 Jetty and Marine Outfall Berm

These rock fill structures, which extend out into Roberts Bay, will be partially removed, to an elevation 0.3 m below the low water level. The rock fill will be placed into the surrounding water. The mooring points and buoys will be removed from site.

The surface of these rock fill structures extending onto the shore, as well as the access roads and nearby laydown areas will be regraded and crowned to ensure positive drainage.

5.1.3 Tank Farms

Both the Roberts Bay Fuel Tank Farm and the Quarry #1 Fuel Tank Farm will be decommissioned and closed as described in Section 4.4. The tanks will be pressure washed and the water resulting from pressure washing will be treated through an oil / water separator. The residual hydrocarbons will be placed in drums and disposed of in a licensed facility.

5.1.4 Mechanical Shop Complex

The shop buildings and appurtenant storage facilities will be emptied of all equipment and supplies, and re-usable items will be salvaged as described in Section 4.2. The buildings will be demolished and the debris segregated as described in Section 4.3. The area will be regraded if required, to prevent permanent ponding.

5.1.5 Waste Management Facility

All residual hazardous and no-hazardous waste will be removed from the facility as described in Sections 4.5 and 4.6. The buildings will be demolished and the debris placed in the Quarry #3 Landfill.

5.1.6 Overburden Dump and Sedimentation Berm

The Roberts Bay Overburden Dump is comprised mainly of oversize rock from the excavation of the Roberts Bay Fuel Tank Farm and pockets of overburden soils. The top of the Overburden Dump was covered with a layer of crushed rock and was used as overflow dry parking area, meaning all vehicles and equipment were drained of fuels and lubricants before being parked here. The 2H:1V side slopes are constructed of oversize rock and are stable.

All materials and waste will be collected and disposed of as appropriate. The safety berms will be breached to allow free drainage. The top surface will be regraded to ensure positive drainage.

The sedimentation berm will be breached to the original ground level to restore natural flow paths.

5.1.7 Laydown Area

The overhead electrical cables will be decommissioned and the posts removed. All waste and materials will be collected and disposed of as appropriate. The surface will be regraded for positive drainage and to prevent permanent ponding.

5.2 AIRSTRIP AREA

5.2.1 Salvage

Reusable equipment and supplies will be salvaged from the airstrip prior to demolition and prepared for shipping off-site to a third party destination or point of sale. This may include airstrip lighting, approach lighting, generator, communication equipment, mobile equipment, etc. No salvage value has been assigned to these items in the closure cost estimate.

5.2.2 Demolition

Structures on the North Apron and the airstrip signalling will be demolished and non-hazardous demolition waste will be disposed of as detailed in Section 4.5. All hazardous waste will be collected and disposed of as detailed in Section 4.6.

5.2.3 Drainage Control

The surface of the airstrip and the aprons will be regraded to ensure positive drainage.

5.3 REAGENT PADS AREA

5.3.1 Reagent Pads

Reusable vehicles, equipment, and supplies will be salvaged from both the Upper and Lower Reagent Pads and shipped off-site to a third party destination or point of sale. Unusable items will be disposed of as appropriate for non-hazardous or hazardous waste, as detailed in Sections 4.5 and 4.6 respectively. All suitable empty containers will be used for shipping materials and waste off-site.

The surface of the pads will be regraded to ensure positive drainage.

5.3.2 Ammonium Nitrate Storage Area

The geomembrane liner of the storage pad will be removed, cut into pieces and disposed of in the landfill, while the containment berm will be regraded to prevent permanent ponding.

5.3.3 Exploration Drilling Support Shops

The tent buildings will be demolished and the waste will be disposed of as appropriate. The area will be graded for positive drainage. The footprint of the shop and the ground surface in the immediate vicinity will be tested for hydrocarbons and other contaminants and appropriate actions will be taken based on the test results.

5.4 WASTE MANAGEMENT AREA

The general area of the waste management area will be regraded to ensure positive drainage. The core boxes stored on the south end of the pad will remain in place.

5.4.1 Land Farm

The solid waste contained within the Land Farm cells will be tested for contaminants. If levels exceed remediation criteria, the soil will be shipped off-site for further treatment or disposal at an appropriate facility. Alternately, soils contaminated with non-hydrocarbon substances (e.g. antifreeze or salt) will be

disposed of in the underground workings. Any water contained within the ponds will be tested, treated as appropriate, and discharged when water quality criteria are met or transferred to the TIA if criteria cannot be met.

The liner of the Land Farm will be removed, cleaned, cut in pieces and disposed of as non-hazardous waste.

The protective cover layer of crushed rock over the liner will be removed, tested, and if it meets the appropriate reclamation criteria will be used as backfill. If the testing program finds that the cover material is contaminated, it will be placed in mega bags and shipped to an off-site facility licensed to dispose of such contaminants.

The containment berm will be levelled and the area regraded to prevent ponding of water.

5.4.2 Batch Plant Pad

All waste remaining on the batch plant pad will be collected and disposed of as detailed in Sections 4.5 and 4.6. The pad area will be regraded to ensure positive drainage.

5.4.3 Burn Pan

The burn pan will be demolished and the debris disposed of in the landfill as non-hazardous waste. The residual ashes will be placed in suitable sealed containers and disposed of as appropriate, either in the landfill or a suitable offsite facility. The area will be regraded to prevent permanent ponding.

5.5 QUARRY #2 AREA

5.5.1 Quarry #2

All vertical faces in the quarry will be scaled. Safety berms will be left in place, but breached for drainage. The area will be inspected by a qualified inspector, to ensure no loaded holes remain on-site.

5.5.2 Overburden Dump

The side slopes of the overburden dump will be regraded to 3H:1V and contoured for drainage control. Erosion protection measures will be installed as appropriate. The culvert in the dump access road will be removed and a swale established to restore natural drainage.

The sedimentation berm downstream of the dump will be breached to restore the natural drainage path.

5.5.3 Treated Sewage Discharge Areas

Areas where vegetation has died and permafrost degraded at the Sewage Treatment Plant discharge point will be backfilled with a suitable fill material to prevent permanent ponding. The sewage discharge pipeline will be flushed, cut up, and removed. The resulting debris will be disposed of in the landfill.

5.6 DORIS NORTH CAMP AREA

5.6.1 Salvage

Reusable equipment and supplies will be salvaged from the camp buildings and facilities prior to demolition and shipped off-site to a third party destination or point of sale.

5.6.2 Demolition

All utilities will be dismantled and the structures emptied prior to demolition. Non-hazardous and hazardous waste will be segregated as discussed in Section 4.5 and 4.6. If possible and/or if needed, furniture, utilities, and structures will be salvaged. 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. The resulting waste material will be segregated into burnable and non-burnable waste and disposed of as described in Section 4.5. For the purposes of cost estimating none of these items are assumed to have salvage value. The following structures and facilities will be demolished:

- Accommodation Complex;
- Permanent Power Generator;
- Backup Power Generator;
- Fuel Tank Farm;
- Sewage Treatment Plant;
- Fire Water Tank;
- Muster Station;
- Warehouse / Core Shack;
- Office and Mine Dry Complex;
- Crusher and Mill Complex;
- Underground Wash Bay;
- Underground Drilling Mechanical Shop;
- Underground Support Mechanical Shop;
- Water Intake Structure and Pumping Facility; and
- Helicopter Support Facility.

5.6.3 Doris North 5 ML Fuel Tank Farm

The Tank Farm will be closed as discussed in Section 4.4 and fuel distribution system taken out of service. Prior to closure, the facility will be decommissioned and the piping disconnected. The tanks will be drained, steam-washed, cut into manageable pieces and disposed of in the landfill. The resulting wash water will be directed to an oil-water separator to remove the residual fuel.

The geosynthetic liner will be removed, cleaned, cut into pieces, and landfilled. The berms will be regraded to prevent permanent ponding.

5.6.4 Crusher, Mill, and Process Plant

The facilities directly associated with the ore beneficiation (crusher, mill, and process plant) will be cleaned of all remaining chemicals and process reagents and the resulting hazardous waste disposed of as described in Section 4.6.

The residual ore and ore dust will be removed by flushing the equipment and/or washing with high pressure water. The collected solids will be slurried and pumped to the TIA.

The steel frame building will be disassembled and disposed of as demolition waste, as described in Section 4.5. The concrete bases will be broken up and covered in place using rock fill.

The milling and processing equipment will be decommissioned, cleaned, and prepared for shipping off-site. No salvage value is assumed for this equipment.

5.6.5 Water Management Structures

The water management structures are as follows:

- Sedimentation Pond;

- Pollution Control Ponds #1 and #2;
- Sumps #1 & #2; and
- Roberts Bay Discharge System.

The ponds will be breached to be free draining. The sumps will be decommissioned and backfilled with crushed rock or soil from the Doris Overburden Dump. The liner of the Sedimentation Pond will be entirely removed and disposed of in the landfill. The liner in the downstream berm of the Pollution Control Pond will be left in place outside of the breach.

5.6.6 Pipelines

The heat traced pipelines for tailings and reclaim water, sewage effluent, and the Roberts Bay Discharge System will be sectioned and disposed of as non-hazardous waste (Section 4.5). The heat tracing cables and controllers will be removed and disposed of as appropriate.

5.6.7 Waste Rock Storage and Ore Stock Piles

According to the Water License only non-mineralized waste rock may be left on surface at the end of the mine, however according to the mine plan no waste rock will left on surface.

It is assumed that all ore will have been processed at the end of the mine. The top layer of the rock fill of the Ore Pad will be removed and disposed of in the TIA or underground. The remaining clean rock will be regraded to prevent permanent ponding.

5.7 DORIS MOUNTAIN

The Doris Mountain communications towers will be decommissioned, dismantled, and disposed of as non-hazardous waste or hauled to Roberts Bay for shipping off-site. The reusable communication equipment will be dismantled and salvaged. All other waste will be disposed of as appropriate. The concrete foundation blocks and the guy wire anchor blocks will be left in place.

5.8 DORIS-WINDY ALL WEATHER ROAD AREA

Although the Doris-Windy Road Area is not covered under the Doris North Type A Water Licence 2AM-DOH1323 closure and reclamation of these facilities has been included in this Plan, given the spatial relationship these facilities have with the Project.

5.8.1 Doris-Windy All-Weather Road

The rock fill of the all-weather road will be left in place and crowned to prevent ponding. The bridges and arch culvert will be removed.

5.8.2 Rock Quarries

Other than the first 1.5 km, the all-weather road was built with rock sourced from three quarries along the road: Quarry A, Quarry B, and Quarry D. The quarries will be decommissioned and reclaimed. All vertical faces in the quarries will be scaled. Safety berms will be left in place. The area of each quarry will be inspected by a qualified inspector, to ensure no loaded holes are remaining on-site.

5.8.3 Explosives Storage Facility (Quarry A)

This is a secondary explosives facility, with the main facility discussed in Section 5.10.3.

All explosives and fuses will be removed from the facility and disposed of as appropriate. The magazines will be removed and hauled to Roberts Bay for shipping off-site. Any equipment or materials stored in this area will be removed and disposed of as appropriate while the pads will be graded for positive drainage. The gate will be removed and disposed of in the landfill.

5.9 TAILINGS IMPOUNDMENT AREA

Tailings from the mill will be spigoted in the south end of the TIA to form a tailings beach. Tailings will be contained between the South Dam and the Interim Dike. This will allow the north portion of the TIA (between the Interim Dike and the North Dam) to be used as a Reclaim Pond. Little or no tailings are anticipated to reach the Reclaim Pond.

5.9.1 TIA Water Management

Water quality in TIA will continue to be monitored after completion of the mining and milling activities. According to the water quality model (SRK 2015a) the contaminants in the Reclaim Pond originate mainly from the process water. Once active milling operations are concluded, the tailings pore water contribution to the Reclaim Pond is less of a concern with respect to meeting discharge water quality criteria.

As a first step in the reclamation of this facility most of the impounded water will be discharged into the ocean through the Roberts Bay Discharge System, at the rate specified in the Water License (4,000 m^3/day). The pond will then be allowed to rise naturally by accumulation of run-off, while the quality of accumulated water is monitored. Once the pre-disturbance level (28.3 masl) of Tail Lake is nearly reached and the pond water is proven to be compliant with the discharge quality criteria, the North Dam will be breached and the natural flow path re-established.

Under the adaptive management approach the quality of the water in the Reclaim Pond will be continuously monitored and the predictive models refined during mine operations. This will allow contingencies to be put in place if predictions are not valid.

5.9.2 North Dam

The North Dam will be breached once the water quality in TIA returns to levels below the CCME guidelines for the protection of aquatic life (anticipated at 8 years after process plant closure). The breach will be 20 m wide, cut to the original ground elevation (of 28.3 masl) with 4H:1V side slopes. The cut in the dam will be clad in rip-rap for erosion protection. All instrumentation will be removed and salvaged or disposed of, as appropriate. The thermosyphon radiators will be dismantled, and the support superstructure cut at ground level and removed. The buried evaporator pipes of the thermosyphons and the sub-surface sections of the ad-freeze piles will be left in place.

5.9.3 South Dam

The South Dam will be left in place as the retaining structure of the subaerial tailings. No water is anticipated to be ponding against this dam. The monitoring equipment and thermosyphons will be reclaimed in a similar manner as detailed for the North Dam.

5.9.4 Interim Dike

The Interim Dike is not a water retaining structure and will be used to retain the subaerially deposited tailings, but allow the supernatant water to drain into the reclaim pond area. At closure the top of this dyke will be recontoured to the elevation of the tailings cover, to prevent any ponding of water.

5.9.5 Shoreline Erosion Protection

An area of about 3 hectares (AMEC 2005) was identified as highly susceptible to erosion due to permafrost degradation following the rise of the water level in TIA. This area will be protected against erosion by constructing a 0.5 m thick riprap blanket underlain by geotextile. Rock from the North Dam breach, Quarry #3, or approved waste rock will be used. A more detailed study will be required in the later stages of reclamation planning to define the areas susceptible to shoreline erosion based on the updated tailings storage footprint.

5.10 SECONDARY ROAD AREA

5.10.1 Secondary Road and all Access Road Alignments

The bridge over Doris Creek will be removed. The crest of all road alignments will be crowned for positive drainage. These alignments include the following:

- Secondary Road;
- North Dam Access Road;
- South Dam Access Road;
- Interim Dike Access Road; and
- Tail Lake Access Road.

5.10.2 Tailings and Reclaim Water Pipelines

The tailings and reclaim water pipelines will be flushed with water and then cut into manageable pieces and disposed of as appropriate. The heat tracing lines and controllers will be removed and disposed of in an approved manner.

5.10.3 Main Explosives Facility

The magazines will be emptied and hauled to Roberts Bay for shipping off-site. The AN/FO mixing plant will be decommissioned, the building demolished and the equipment and debris disposed of as appropriate. The containers remaining in the Ammonium Nitrate storage area will be hauled to Roberts Bay for shipping off-site, while the impermeable liner will be removed, cut into manageable pieces and placed in the landfill. The containment berms and storage pads will be regraded to prevent permanent ponding.

5.11 QUARRY #3 AREA

5.11.1 Quarry #3

This quarry is the source of the rock fill and crushed aggregates for the construction of the Secondary Road extension to South Dam and the South Dam itself. Once the dam is complete, the quarry will become the site of the non-hazardous waste landfill facility. All vertical faces in the quarry will be scaled. Safety berms will be left in place but breached for drainage. The area will be inspected by a qualified inspector, to ensure no loaded holes remain on-site.

5.11.2 Quarry #3 Access Road

The road surface will be crowned to ensure positive drainage.

5.11.3 Quarry #3 Landfill

Non-hazardous waste will be placed in two 0.85 m thick lifts and each lift will be compacted under the weight of heavy equipment. At closure, once all demolition debris and non-hazardous waste has been landfilled the landfill will be capped with a 1 m thick rock fill cover of ROQ or suitable waste rock. The final surface of the landfill will be graded similar to the foundation base grade, of 1%, to shed water and minimize infiltration. The capping material will move the active thaw layer away from the stored waste so it is expected that permafrost will partially aggrade into the landfill waste over time.

5.12 DORIS NORTH UNDERGROUND WORKINGS

5.12.1 Doris North Portal and Underground Workings

All underground utilities and installations will be removed and disposed of as appropriate. The entrance of the underground portal will be sealed with a 15 m thick rockfill plug, according to regulations. The rock used for the plug will be salvaged from rock pads or clean quarry rock. The pad in front of the portal will be regraded to promote drainage away from the portal and prevent permanent ponding.

5.12.2 Vent Raises

Three vent raises will be constructed during mine development:

- Primary Vent Raise;
- Doris Connector Vent Raise; and
- Doris Central Vent Raise

Ducts, pipes, and cables entering the vent raises will be removed. A 0.5 m thick reinforced concrete plug will be installed to seal each vent raise. A detailed engineering design will be required prior to closure to determine the risk of subsidence and determine the most suitable cap design.

Appurtenant facilities will be demolished or removed and the debris will be collected and disposed of as appropriate. The EnviroTank at the Doris North Primary Vent Raise will be decommissioned, drained, and hauled to Roberts Bay for shipping off-site. The liner of the secondary containment area will be cleaned, removed, cut into pieces, and disposed of as non-hazardous waste. The area will be backfilled and regraded to prevent permanent ponding. The other vent raises do not have fuel storage tanks.

The rock fill pads will be graded to ensure drainage away for the vent raise opening and the concrete plug. Appropriate signage will be placed warning about the existence of the plug and the sealed openings.

Access roads will be graded to prevent ponding and culverts will be removed to restore the natural flow paths.

5.13 ROBERTS BAY DISCHARGE SYSTEM

The Roberts Bay Discharge Pipeline will be flushed and decommissioned. The controllers and electrical cables of the heat tracing system will be dismantled, removed, and disposed of as appropriate. The HDPE pipe will be cut into manageable sections and hauled to the Quarry #3 landfill. The sleepers and other pipe supports will be removed and disposed of as appropriate.

The Marine Outfall Pipeline will be left in place. The Marine Outfall Berm will be partially removed, to an elevation 0.3 m below the low water level, similarly to the Jetty. The rock fill will be placed into the surrounding water. The mooring points and buoys will be removed from site. The dry-land portion of the berm will be graded to prevent permanent ponding, but will otherwise be left in place to prevent permafrost degradation of the footprint.

6 CLOSURE UNCERTAINTIES

Closure strategies employed in this interim closure plan are based on a set of assumptions and predictions representing the current understanding of the environment at the Project site and the future behavior of various infrastructure components. The interim nature of this plan indicates that many uncertainties still exist with regards to the closure options, which will be clarified once the detailed engineering of closure activities for each area or infrastructure component is completed at the final closure stage.

Throughout operations and into closure the results of the various environmental monitoring programs will be evaluated regularly to confirm the closure assumptions and validate the models used to make those predictions. If monitoring data indicates that certain structures or processes behave in a different manner than anticipated during the closure planning phase, adaptive management will be adhered to and the closure plans will be adjusted to mitigate those unforeseen effects.

At this time, specific uncertainties directly affecting the closure planning were identified regarding the following closure components:

- Water quality in the TIA Reclaim Pond is arguably the biggest uncertainty identified to date, with potentially the largest impact on the closure cost and schedule. The water quality model will be updated and refined, as site water quality data becomes available.
- Duration of water discharge from the Reclaim Pond and subsequently the natural re-flooding is also subject to uncertainty related mainly to the amount of precipitation occurring in the years these activities will occur.
- Hydrocarbon contaminated soils. Type of contamination and volume of affected soils will not be known until final closure is started. Site investigations will be commissioned in due time to gain knowledge of the contamination nature and extents.
- Final volume of the landfill is based on a conservative estimate of the volume of demolition debris at closure. While every effort will be made to minimise the voids within the landfill, the final volume is difficult to predict accurately. This translates into uncertainty with regards to the actual footprint of the facility and the volume of rock required for the final cover.

7 RESEARCH TO SUPPORT RECLAMATION

There are no direct research projects currently undertaken at Hope Bay. However, monitoring data gathered as part of the compliance monitoring program is being continuously collected and periodically reviewed by qualified specialist consultants. The data gathered on site includes the following:

- Weather data;
- Seep surveys;
- Water quality;
- Flow monitoring;
- Permafrost monitoring – temperature data and visual observations of reclaimed permafrost areas, i.e. rock covers at drill holes and Windy Camp;
- Visual observations of reclaimed area with the Hope Bay Belt (Patch Lake and Old Windy Camp areas);
- Vegetation studies study south of Doris North Camp Area;
- Dust monitoring;
- Noise monitoring;
- Wildlife surveys;
- Fish surveys and benthic fauna;
- Annual geotechnical inspections (for rock fill pad stability / road stability / permafrost stability); and
- Characterization of geochemical of waste rock and ore samples.

If any of the data is found to be indicative of problematic trends or unforeseen processes, a more detailed evaluation will be undertaken. Where appropriate, dedicated research programs will be undertaken to reduce uncertainty and evaluate the performance of specific closure methods.

8 PROGRESSIVE RECLAMATION

Progressive reclamation will be carried out wherever facilities are no longer required for the future operations of the mine. Such areas could be temporary access roads, rock fill pad areas, overburden dumps, and quarry facilities. Portions of the landfill may be developed during the operations stage, and could be reclaimed before the final closure stage. As in the past, current and historic exploration drill holes will continue to be reclaimed on an on-going basis.

Progressive reclamation work will be reported to the NWB in annual reports, and future updates to this Plan will reflect any work completed.

9 POST CLOSURE MONITORING AND MAINTENANCE

Post-closure monitoring will take place at the site until such time that the objectives of the closure and remediation activities have been met to the satisfaction of the regulatory authorities and all affected parties. The exact extent of this duration may vary given that the mine has been designed with closure in mind. Coupled with the proper implementation of best practice closure and remediation activities as described in this report, the following post closure monitoring will be required to ensure the closure and remediation objectives are met:

- The site should be visually inspected by a Professional Engineer annually for three consecutive years to ensure that 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 qualified inspector to ensure the physical integrity of the cover is maintained. Maintenance will be performed on areas that monitoring identifies as needing repairs.
- The annual seep sampling program carried out in accordance with Type A Water Licence 2AM-DOH1323 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 site specific closure criteria.
- Water from the Reclaim Pond will be evacuated by pumping to Roberts Bay for approximately two years following closure, following which the water in the pond will be allowed to recover naturally (about 5 years) to the lake elevation (28.3 masl) before the disturbance. The North Dam will then be breached and the natural flow path restored, as per Section 5.9.1.

The post-closure monitoring requirements may require additional activities following the implementation of the project's final closure and remediation plan and the subsequent Reclamation Completion Report.

In addition the monitoring requirements may again change as a result of the Performance assessment report which 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 final closure and remediation plan.

10 CONTINGENCIES

Specific contingencies were developed for some of the closure elements that have inherent uncertainties that cannot be quantified at this stage in the project. If any of the proposed closure strategies will be ineffective or no longer apply, new strategies will be developed in consultation with stakeholders.

The subsections below provide details of these contingencies.

10.1 WATER QUALITY

In the case where water quality standards cannot be met by the end of the post-closure period specified in the water management plan, the monitoring time may be extended as required. Alternatively, water treatment options could be explored once the cause of the delay is known and quantified.

10.2 SUBAERIAL TAILINGS

The current closure plan for the subaerial tailings is a cover constructed of clean rock. In the case that water quality monitoring indicates that tailings will become a source of contaminants exceeding the presently predicted effects, the contingency of a low permeability cover was considered. The final cover configuration will be determined at the later stages of closure planning.

10.3 WASTE ROCK AND ORE

According to the current mine plan there will be no ore and/or mineralised waste rock left on surface at closure. During operations the non-mineralized rock will be temporarily stored in a dump on Pad T. Several alternatives were considered as contingency for any ore and/or mineralized waste rock left on surface. One option is moving the piles to TIA for placement in the tailings area or sub-aqueous disposal in the Reclaim Pond. Another option is consolidating, contouring and covering the piles with an impermeable liner and a 0.3 m thick protective layer of crushed rock. Additional options may also be considered. All above ground storage options are subject to approval by NWB. A design and/or description of the final waste rock disposal or storage alternative will be included in the application for approval.

10.4 CLIMATE CHANGE EFFECTS

Most closure activities considered climate change to the level it is currently understood. Any changes not anticipated will be dealt with at time of closure and monitored as they develop. Financial security will be updated periodically as mandated by the regulations, to take into account any changes to the environment or operations.

11 COST ESTIMATE

The estimated closure cost for the Doris North Camp is $25.1 million in undiscounted 2015 Canadian dollars (TMAC 2015). These costs were developed using an NWB approved spreadsheet based cost estimating process that is consistent with the principles of RECLAIM version 7.0. The basis of estimate for the closure costs was summarised under a different cover (SRK 2015b).

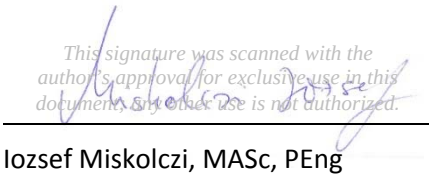
12 SCHEDULE

Closure of the Doris North site will occur upon completion of mining and milling of ore. It is anticipated that all decommissioning and closure activities can be completed in one construction season. These activities will be initiated in the first construction season following the completion of milling. If possible all components to be removed from site will be done so prior to freeze up in the first year after completion milling.

Water management activities will start in the first year following closure and continue until water quality criteria are met. Decommissioning of water management structures will require an additional construction season and it is expected that these activities cannot take place until year 8 after closure.

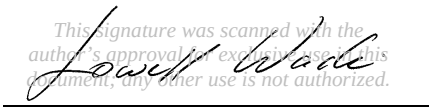
Year 2 of closure will be the initial year of the post closure monitoring and maintenance period and as discussed above will require approximately 10 years. This schedule is shown in Figure 13.

This report, *Doris North Mine Interim Closure and Reclamation Plan, June 2015, Hope Bay, Nunavut* was prepared by SRK Consulting (Canada) Inc.



Iozsef Miskolczi, MASc, PEng
Senior Consultant

and reviewed by



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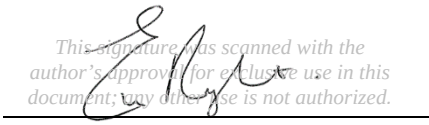
Senior Consultant



Maritz Rykaart, PhD, PEng
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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Figures

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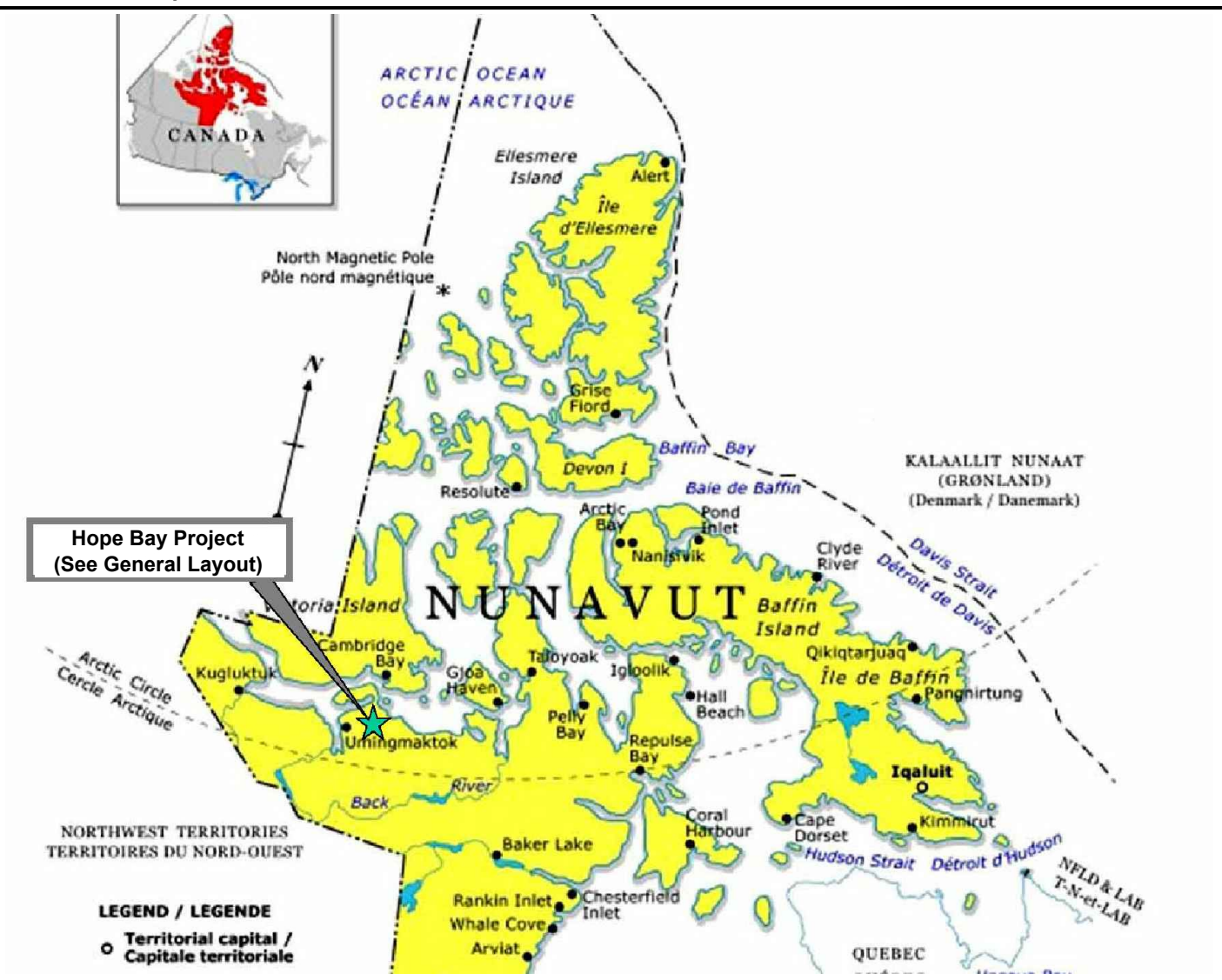
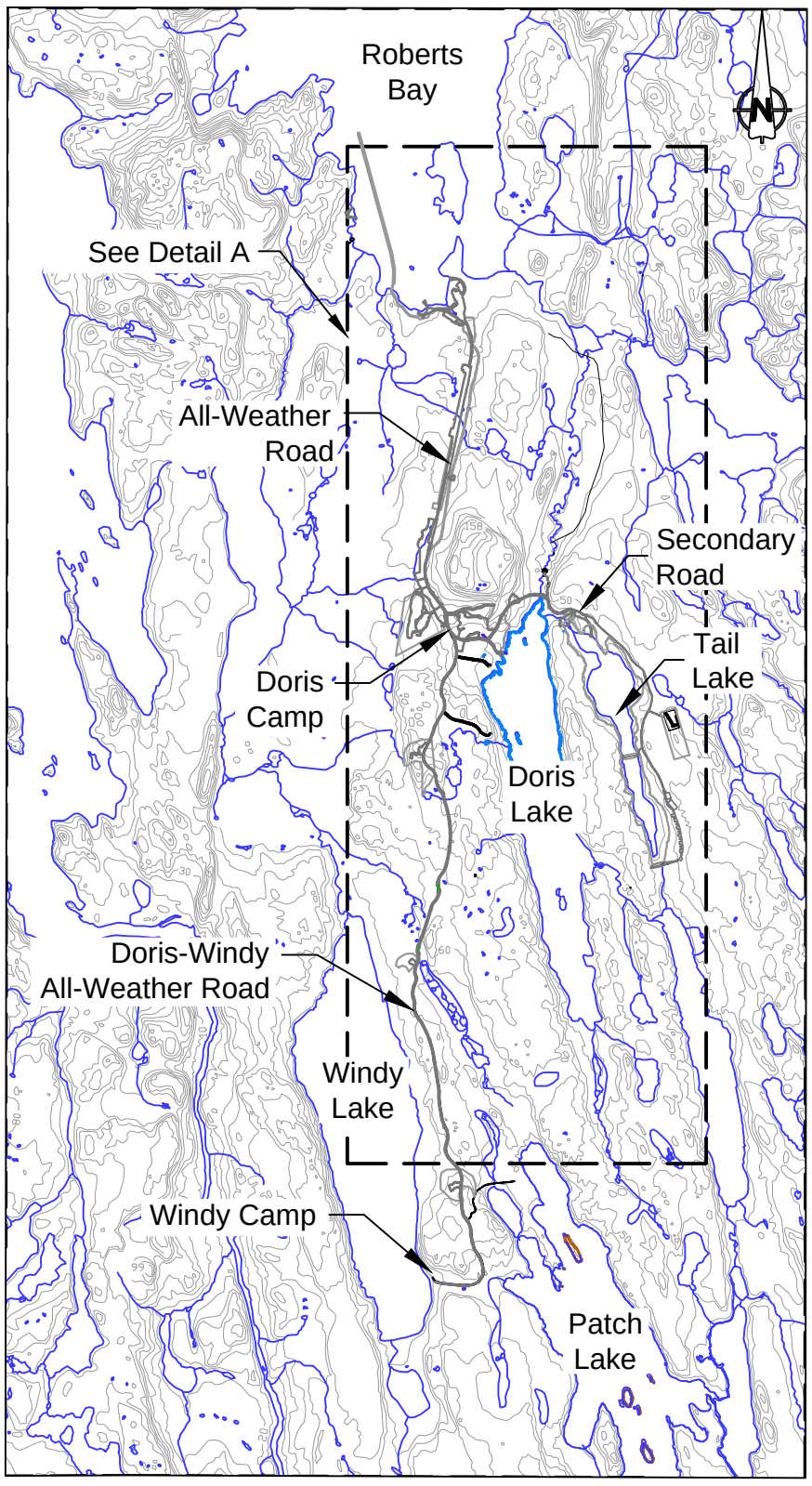


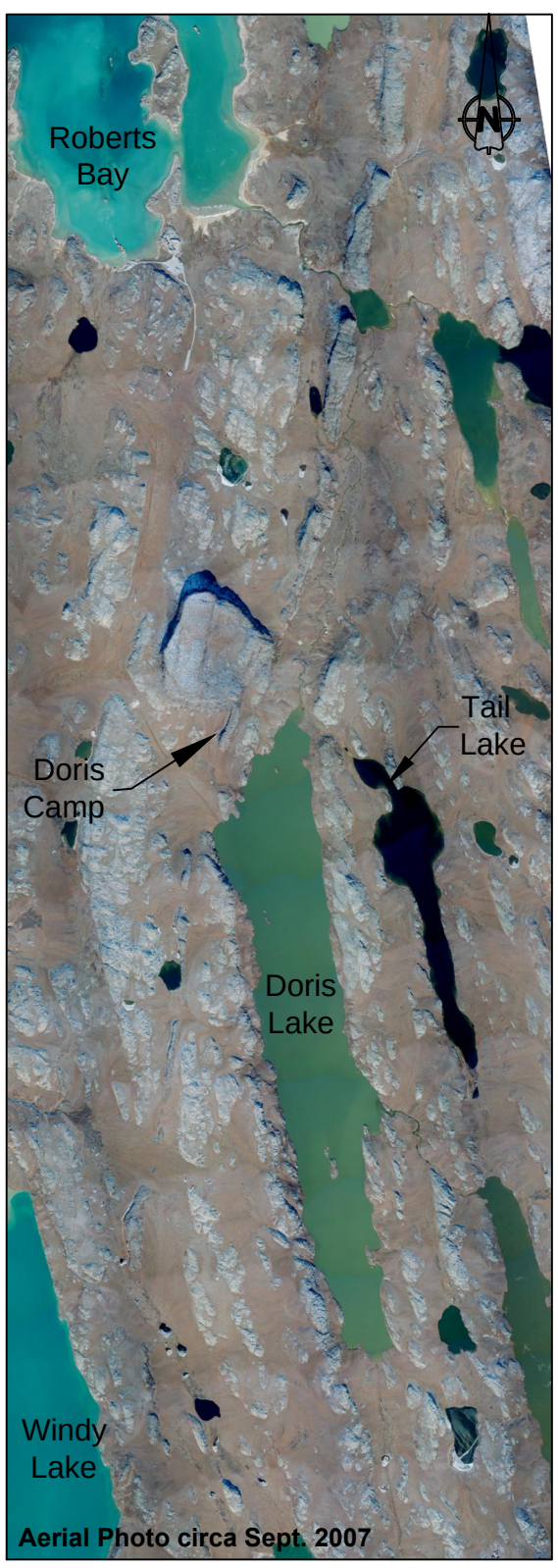
LOCATION MAP



GENERAL LAYOUT

0 1 2 3 4 5

Scale in Kilometres



DETAIL A

0 500 1000 1500 2000 2500

Scale in Metres

1. Topographic contour data for the terrain model were provided by Hope Bay Mining, and is based on 2007 Aerial Photography.
2. The coordinate system is UTM NAD 83, Zone 13

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TMAC RESOURCES

TMAC Resources Inc.

Interim Closure and Reclamation Plan

Project Location Map

DATE:	APPROVED:	FIGURE:
May 2015	IM	1

Roberts Bay

See Figure 4

PL - 001

See Figure 5

See Figure 6

See Figures 7 & 8

Doris Camp

See Figures 9 & 10

Tail Lake

See Figure 11 & 12

DW-002
(See Inset 1)

DW-005
(See Inset 1)

DW - 003

DW - 001

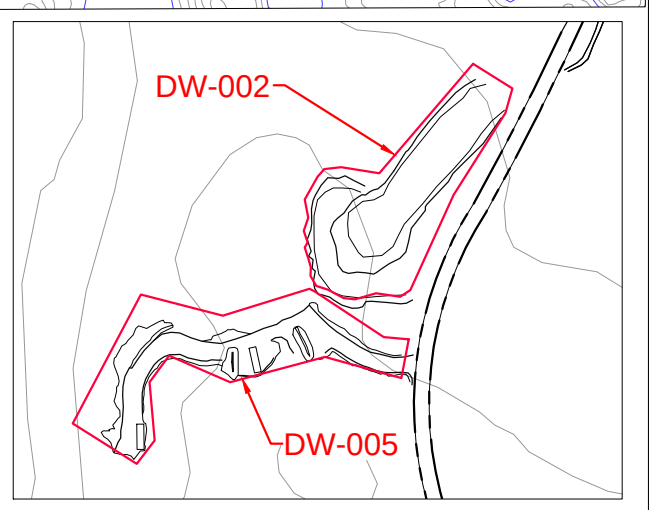
DW - 004

Windy Lake

Windy Camp

Patch Lake

Work Area	Facility	WBS Code
Doris Windy Road	All-Weather Road	DW-001
	Quarry A	DW-002
	Quarry B	DW-003
	Quarry D	DW-004
	Explosive Storage Facility	DW-005
Pipeline	Roberts Bay Discharge System	PL-001



1 INSET 1 - QUARRY A AREA

0 20 40 60 80 100
Scale in Metres

0 200 400 600 800 1000
Scale in Metres

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SRK JOB NO.: 1CT022.002.200.2100

FILE NAME: 1CT022.000_Doris_N_ClosurePlan_Rev3.dwg

TMAC RESOURCES

TMAC Resources Inc.

Interim Closure and Reclamation Plan

General Layout
Work Breakdown Structure

DATE:	APPROVED:	FIGURE:
May 2015	IM	2

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