Waste Rock and Ore Management Plan

Hope Bay Project, Nunavut

August 2016

PLAIN LANGUAGE SUMMARY

This Plan describes how rock that is brought to the ground surface during mining is identified and handled to minimize impacts to water quality. The rock includes ore (rock that contains gold) and waste rock (rock that does not contain gold). When ore is brought out of the mine, it is stored in piles until it is processed to take the gold out. As much waste rock as possible is left underground, however, some of it needs to be brought to surface during mining. When waste rock is brought to surface it is stored in piles. Eventually, most of this rock will be taken back into the underground mine, but where suitable, some may be used for construction.

Revision Record

Revision #	Date	Section	Summary of Changes	Author	Approver
1	2010		Approved Plan under 2AM-DOH1323	SRK	HBML
2	April 2015	Throughout	TMAC as current licensee for the Hope Bay region.	SRK	TMAC
		Throughout	Addition of Pad T for waste rock storage		
		3.3	Introduction of the low salt drilling procedure		
		Throughout	Update classification of Gabbro as Low NP basalt		
3	June 2015	Throughout	Changes to document structure for operational suitability and efficiency	TMAC (SRK)	TMAC
		Sec 1	Addition of Glossary and list of List of Acronyms, related TMAC documents, revised Plan Management responsibilities		
		Sec 2	Revised waste rock classification and segregation		
		Module A	Concordance with 2AM-DOH1323, revised Mine development plan to include placement of waste rock on Pad T, Ore storage on Pad U		
4	August 2016	Sec 2.4	Limiting backfill of ANFO spill impacted material to permafrost zones of the underground mine	SRK	TMAC
		Sec 2.6	Limiting backfill of hydrocarbon impacted material to permafrost zones of the underground mine		
		Sec 2.1 and Sec 3.2	Monitoring of the available mine void space and backfill volumes being placed underground		
		Sec 2.3	New section pertaining to detoxified tailings		
		Sec 2.1	Inclusion of monitoring for Total Cyanide as part of the surface water monitoring program		
		Sec 5	References updated		
		Sec 2.1.1	Removal of segregation into mineralized and non-mineralized		

Glossary and Acronyms

Term	Definition
ABA	Acid base accounting
ANFO	Ammonium nitrate – fuel oil mixture
AP	Acid potential
ARD	Acid rock drainage
EC	Electrical conductivity
GPS	Global positioning system
HBML	Hope Bay Mining Ltd.
ICP-MS	Inductively coupled plasma – mass spectrometry
ML	Metal leaching
Non-PAG	Non-potentially acid generating
NP	Neutralization potential
NWB	Nunavut Water Board
ORP	Oxidation-reduction potential
PAG	Potentially acid generating
pH	Hydrogen ion concentration
SNP	Surveillance Network Program
TDS	Total dissolved solids
TIA	Tailings Impoundment Area
TIC	Total inorganic carbon
TMAC	TMAC Resources Inc.

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1 INTRODUCTION

This Hope Bay Project Waste Rock and Ore Management Plan (the Plan) has been prepared by TMAC Resources Inc. (TMAC) in accordance with various water licences held by TMAC associated with developments throughout the Hope Bay region.

The Plan is intended primarily for use by TMAC and its contractors to ensure that best practices for minimizing potential environmental impacts and liabilities associated with waste rock and ore storage are understood and managed, and that the conditions of the Water Licence are met.

This Plan is structured in a manner such that one document pertaining to waste rock and ore management is approved and implemented across all TMAC Hope Bay Project sites, while still addressing site and licence-specific needs: the main document outlines TMAC's approach to waste rock and ore management as it pertains to all TMAC Hope Bay developments; subsequent modules provide details for each site and the associated water licence. In the event of a new water licence, or an existing licence amendment, the specific modules pertaining to that licence and site will be revised. This is intended for consistency and efficiency across operations and for compliance management.

1.1 OBJECTIVES

This Plan outlines the waste rock and ore management needs on surface for the Hope Bay Project. The objective of the Plan is to provide guidance and procedures required to deposit and manage waste rock and ore stored on site in accordance with the existing licences associated with development of the Hope Bay Project.

1.2 RELEVANT LEGISLATION AND GUIDANCE

The following table lists federal and territorial regulations governing the management of waste rock and ore and associated guidelines.

Table 1 Regulations and Guidelines Pertinent to the Waste Rock and Ore Management Plan

Regulation	Year	Governing Body	Relevance
Nunavut Waters Regulation	2013	Nunavut Water Board	License for mining and milling undertaking to use water and deposit of waste in relation to the construction, operation, closure and reclamation.
Mine Health and Safety Act and Regulations	2011	Workers' Safety and Compensation Commission (WSCC)	Waste dump design and operations safety requirements. Designs to be approved by Chief Inspector.
Guideline	**Year**	**Issued by**	**Relevance**
Prediction Manual for Drainage Chemistry for Sulphidic Geologic Materials, Report 1.20.1	2009	Mine Environmental Neutral Drainage (MEND)	Guidance on determining the type, magnitude, location and timing of measures required to prevent significant environmental impacts by drainage from disturbed rock.
Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories	2013	Aboriginal Affairs and Northern Development (AANDC) and the Land and Water Boards of the Mackenzie Valley	Guidance on closure and reclamation expectations.

1.3 RELATED TMAC DOCUMENTS AND PROGRAMS

Table 2 provides a list documents to be considered in conjunction with this Plan.

Table 2 Documents related to the Hope Bay Waste Rock and Ore Management Plan

Document Title	Relevance
Water Management Plan	Identifies water management areas, facilities and procedures
Quarry Management Plan	Describes management of quarried rock and associated sampling programs, including a description of the monitoring program if approved waste rock is used in construction
Hope Bay Spill Contingency Plan	Spill response procedure
Air Quality Management Plan	Outlines how fugitive dust, associated with blasting, hauling and end dumping is managed and monitored.
Low Salt Underground Brine Water Use Procedure	Describes how salt use is minimized during drilling
Explosives Management Procedure	Contingency procedure for disposal of spilled ANFO

1.4 PLAN MANAGEMENT

This Plan is reviewed annually and updated as necessary. Personnel responsible for implementing and updating the Plan identified in Table 3.

Table 3 Roles and Responsibilities

Role	Responsibility
VP Operations	• Overall responsibility for implementation of this management plan • Provide the on-site resources to operate, manage, and maintain waste rock and ore management infrastructure such as pads, stockpiles and ponds • Ensure underground practices are continually improved to reduce brine and blast residues in waste rock • Provide input on modifications to handling and operational procedures to improve operational performance
Surface Manager	• Conduct regular inspections of the pads, stockpiles and containment ponds • Facilitate Geotechnical Inspection, when required
Environment Manager	• Review and update this management plan as required • Monitor water quality in pollution control ponds • Conduct or facilitate seep sampling program on surface and underground as required • Conduct monthly and annual regulatory reporting as required
Mine Geologist	• Classify and segregate rock according to this plan • Execute construction qualification sampling program and assisting with any underground seepage monitoring • Inspect the working face on a regular basis to confirm lithology • Tag all waste rock with the intended waste designation • Instruct the mucking crew regarding waste rock and ore placement on surface

Role	Responsibility
Mucking crew	• Place waste rock and ore in the intended and designated location
Mine Engineer	• Record quantity of material sent to each of the stockpiles in daily record • Provide waste rock movement totals to Environment Manager monthly
Blaster	• Inspect blasted area • Make note of and mark blast holes with paint that may not have been completely detonated

2 WASTE ROCK AND ORE MANAGEMENT ISSUES

2.1 METAL LEACHING AND ACID ROCK DRAINAGE (ML/ARD) POTENTIAL-WASTE ROCK

The Hope Bay deposits consist of a series of gold-bearing quartz veins hosted by Archean age folded and metamorphosed mafic volcanic rocks. The waste rock produced during mining contains sulphide minerals.

Acid rock drainage (ARD) is a general term applied to any acidic leachate, seepage, or drainage arising from the weathering of undisturbed or excavated geological materials (rocks and soil) containing sulphide minerals or their weathering products. Weathering reactions intensify due to the acidity generated by the oxidation of sulphide minerals, which results in the release of elements from rocks and soil.

Under the prevailing acidic conditions (low pH), metals released from the solid phase (rocks, soil) remain in solution and this is referred to as metal leaching (ML). While most metals are mobile (remain in solution) under acidic conditions, some metals are only mobile under neutral or alkaline conditions.

The control and treatment of ARD/ML during the mine design and operating stages of the Project will enable post- closure reclamation efforts are minimized.

2.1.1 Management Response

Geochemical Characterization

Based on the geochemical characteristics of the host rocks within each of the various types of waste rock units, management recommendations are made, including the level of risk for ML/ARD, whether the material should be treated as mineralized or non-mineralized waste, what the segregation criteria is, and the frequency of monitoring that is required.

Actions to manage ML/ARD include classification, segregation, inspection and monitoring of waste rock as well as managing water associated with the waste rock piles. Each of these is presented below.

Waste Classification

Waste rock is classified as mineralized or non-mineralized. The non-mineralized rock may be stored in a separate stockpile within a designated waste rock storage area. If the material is intended for construction, confirmatory testing will be used to verify that the geochemical characteristics of the non-mineralized rock are suitable for construction use.

All mineralized waste rock will be used underground as backfill and it is anticipated that all waste rock will have been deposited as backfill at closure. Given this, mineralized waste rock is temporarily stored on surface, and there is no need for further detailed characterization campaigns.

Waste Segregation

All waste rock will be used for backfill; and therefore, there will be no segregation of mineralized and non-mineralized waste rock on the waste rock storage areas.

Backfill Monitoring

Backfill use and available mine void space will continuously be monitored to ensure that the all waste rock can be placed underground as proposed. Records of the amount of waste rock hauled to surface, the volume returned to the mine as backfill and the volumes of voids created in the mine will maintained.

Inspection and Monitoring

The operational monitoring program includes routine visual inspections and periodic sampling (during spring surveys) to confirm waste rock classification, annual inspection of material in the waste rock piles, periodic review of the routine monitoring program by a qualified geochemist, spring seep surveys, and routine monitoring of water quality in the Pollution Control Ponds as outlined in the *Water Management Plan*.

Surface Water Management

Generally, the mine sites are designed to divert non-contact water around the mine site. Accordingly, all seepage and runoff from the waste rock pile areas are directed to Pollution Control Ponds and managed according to the *Water Management Plan*.

Spring seep surveys are conducted to characterise metal leaching and confirm appropriate capture of waste rock runoff. Seep surveys are completed annually during freshet each year while waste rock is stored on a surface pad. Seep surveys are completed along all safely accessible areas along the down-gradient toe of the waste rock piles and pads below the Pollution Control Ponds and waste rock pile access roads. The surveys are completed during the latter part of the spring freshet, concurrent with other seep surveys completed elsewhere on site.

Seeps are identified by walking along the down-gradient toe of the roads, piles and pads looking and listening for signs of flowing water. Samples of seepage water are collected for analysis where seepage flow exits the pads to the surface. A survey stake is installed to mark the location of each seep sampled and the following information is recorded:

- Description of the seep location;
- Global positioning system (GPS) location of the seep;
- A photographic record of the seep;
- A description of the flow pattern and magnitude of flow; and
- Field pH, Chloride, Electrical Conductivity (EC), Oxidation reduction potential (ORP) and temperature readings.

Field pH, Chloride, EC, ORP and temperature measurements are also to be established at reference sites located in a similar geological, and physiographic setting, but away from the influence of mine related activities. These reference stations may also be shared with the quarry monitoring programs.

In the immediate area of the waste rock pile, water samples are collected from all distinct seepage locations. Where there are clusters of seeps within 50 m of each other, the one with the dominant flow will be sampled, appropriately preserved, labelled, and submitted to an accredited laboratory for analysis. The following information is recorded per sample:

- The name of the person who collected the sample;
- Date and time of sampling; and
- Date of analysis.

Following receipt of analytical results, the following are maintained on site to support annual Water Licence reporting and record keeping:

- Name of person who completed the analysis;

- Analytical methods or techniques used; and
- Results of the analyses, including pH, total dissolved solids (TDS), acidity and/or alkalinity, sulphate, total ammonia, nitrate, total cyanide, and a full suite of metals by ICP-MS.

2.2 Metal leaching and Acid Rock Drainage (ML/ARD) Potential-Ore

Similar to waste rock, ore brought to surface also has the potential for ML/ARD

2.2.1 Management Response

The ore stockpiles are located within the Pollution Containment System. Therefore, the water management procedures pertaining to waste rock storage also apply to ore stockpiles.

There are no separate monitoring requirements for the ore stockpile. The seepage and routine monitoring programs for waste rock also address the monitoring of seepage and runoff from this area.

2.3 Metal Leaching and Acid Rock Drainage (ML/ARD) Potential – Detoxified Tailings

Detoxified cyanide leach tailings (detoxified tailings) will be temporarily stored on surface and may be “potentially acid generating” (PAG)

2.3.1 Management Response

Backfill

Detoxified tailings will be filtered in the plant, and will emerge as a filter “cake,” containing no free water. The dry filter cake can be handled with conventional earthmoving equipment. This filter cake will be trucked from the filter belt stockpile within the plant to the waste rock storage area as needed. It will be placed immediately adjacent to, or on top of, waste rock material that is designated for backhaul to the mine as underground backfill. As waste rock material is loaded for use as underground backfill, detoxified tailings (when available) will be included in appropriate proportions to ensure the structural backfill requirements continue to be met.

These tailings will be moved underground on a daily basis. Due to the inherent moisture content in the material there will be no requirement for dust suppression.

Once all the mine waste rock has been exhausted, quarry rock will be developed and used for structural backfill. Detoxified tailings will be mixed with quarry rock during this period.

Surface Water Management

Detoxified tailings will be filtered in the plant with free water recirculated as a closed loop within the facility. Once filtered, the dry “filter cake”, which has a saturation of about 80%, has no free water.

2.4 Nutrient Release from Explosives

The majority of waste rock is blasted using a bulk form of ammonium nitrate (AN) and fuel oil (FO) mixture (ANFO). Nutrients may be released during mining from ANFO residue on rocks, packaging or ANFO spills. ANFO can be highly water soluble, with runoff able to release ammonia, nitrate and nitrite to the receiving environment.

2.4.1 Management Response

Surface Water Management

Water flows and seepage from waste rock and ore piles are captured in a series of ponds designed to prevent direct discharge of potentially contaminated water to the environment. Discharges from these ponds are to the Tailings Impoundment Area (TIA). All waste rock and ANFO-contaminated material will routinely be placed underground throughout operations and completely at closure.

Groundwater Management

Material from clean-up of ANFO spills will only be placed in permafrost areas to limit mobility of nutrients.

Minimization of Residual ANFO during Detonation

Any wet holes will be evident at the time of drilling and during the cleaning of each blast hole. The blaster, being responsible for the loading and firing of the holes, begins the loading process by checking the actual depth of each hole and records unusual conditions, such as water in the blast-holes.

In the event a wet hole is encountered, one of two charging methods is employed to ensure complete detonation of the explosives:

- The hole is dewatered using compressed air. This is common on the bottom (lifter) holes in underground mining.
- If the hole cannot be dewatered, or if it is seeping water, the hole will be loaded with an alternative explosive that is effective under wet conditions.

After blasting, the blaster is required by regulations to inspect the blasted area, make note of blast holes that may have experienced incomplete detonation, and mark those locations with paint. Information from the blaster's inspection will be noted in the daily operations shift log and will be communicated to all underground supervision personnel.

Material considered un-detonated or high in ANFO residue, which will contain potentially elevated level of nutrients (primarily ammonia), will be used for backfill of permafrost areas of the mine.

Minimization of ANFO Spills

To minimize the risk of spills during loading, the loader hose is pushed to the end of the hole and is slowly withdrawn as the ANFO is blown into the hole, thereby filling the hole. Once the end of the loading hose is near the top (collar) of the hole, the loader is stopped to prevent spillage of ANFO.

In the unlikely event that a spill of ANFO occurs during charging of the blast holes, the ANFO will be cleaned-up immediately upon the completion of all loading operations, in accordance with the *Spill Contingency Plan*. Spilled ANFO will be reused where possible, or deposited in a designated areas for use in backfill of permafrost areas of the mine only.

2.5 Underground Brine Water

Water is used as a lubricant for drilling, as a means of cleaning off the face and walls for geological mapping, and for dust suppression in the underground mine. Salt is added to the make-up water to lower the freeze point and thereby keep the water supply lines from freezing. This water is called underground brine water. Any excess brine water that ends up at the mine face is pumped to a settling sump and is recycled for use at the face. However, some of the water is absorbed by the blasted rock, which is hauled to the surface stockpiles.

Excessive use of salt can result in impacts to the structural integrity of infrastructure components arising from ground thaw, increased or alternative requirements for wastewater treatment and disposal, increased challenges associated with waste rock and tailings disposal and stabilization, and limitations on using the waste rock for construction.

TMAC has procedures for reducing the concentration and amount of brine that is used in the underground mine. These procedures are outlined below. As discussed previously, the *Water Management Plan* provides details on the collection and fate of seepage and runoff from this area.

2.5.1 Management Response

TMAC follows a *Low Salt Underground Brine Water Use Procedure* to minimize the amount of calcium chloride use in the mine, and therefore minimize the amount of salt that is entrained in waste rock and ore. The procedure includes:

- locating brine mixing tanks in the mine or within an enclosure to control temperatures, and thereby limit the amount of salt used in the brine;
- using hose nozzle atomizers and/or foggers to reduce the amount of water used for dust suppression; and
- recycling brine water during drilling activities, bolt inflation, and washing activities.

2.6 Fuel and Lubricants

Any fuel or lubricant spills, including leaks from mobile equipment, have the potential to become mixed with the waste rock; and therefore effect the quality of water entrained in the waste rock. Therefore, prevention and management of spills is particularly important for ensuring that the waste rock can be used for construction activities outside of the Pollution Containment System.

2.6.1 Management Response

If re-fuelling of mobile equipment is required in the mining or waste deposition areas, it will be conducted at a location and time that will ensure that any spill of fuel or lubricants will be effectively contained and clean-up can be easily accomplished.

Every operator is required to inspect their light or heavy equipment at the beginning of every shift. In the event that leaks are detected, the vehicle will be taken out of service and must be repaired prior to resuming use.

In the unlikely event that a spill occurs, clean-up of the spilled material will be initiated immediately as per the requirements specified in the *Spill Contingency Plan*.

Hydrocarbon contaminated rock will be placed in a designated area of the mineralized waste rock piles, for use in backfill of permafrost areas of the mine only.

2.7 Dust

Fugitive dust can arise from blasting, haul traffic and end dumping. Fugitive dust poses a potential risk to human and ecological health through both ingestion and deposition.

2.7.1 Management Response

The Air Quality Management Plan outlines procedures for managing fugitive dust including:

- watering traffic surfaces and active end dumping areas;
- controlling vehicle speeds; and
- applying approved dust suppressants to high traffic areas.

2.8 Geotechnical Stability

The stability of the waste rock piles is an important consideration for traffic safety and for containment of the waste rock.

The waste rock piles are designed such that the foundation pad extends 2.5 to 3 m beyond the toe of the waste rock pile. The outer edge of the pads also have a safety berm that will prevent any large boulders from rolling off of the pad during construction. The waste rock piles have been designed with slopes of 2H:1V, and will be constructed in lifts, which will result in a configuration that provides a high degree of geotechnical stability. Stability calculations confirm that there are no stability concerns associated with stockpile design.

2.8.1 Management Response

Based on a factor of safety of 1.0, a minimum safe distance from the crest of the waste rock pile (1.2 m) should be maintained for haul trucks dumping waste rock close to the crest of the waste rock pile.

3 MONITORING AND EVALUATION

3.1 BACKFILL MONITORING

Backfill volumes will be tracked together with the mine plan, which contains available mine void space at any given time in the mine life. This record indicates progress towards ensuring that all mine waste is placed underground prior to the completion of mining.

Backfill volume tracking will include tracking of waste rock, detoxified tailings and quarry rock placement underground. Quarry rock placement underground is required during the latter stage of mine development where a deficit of mine waste rock is predicted.

3.2 ANNUAL INSPECTIONS

Material in the waste rock piles is inspected by the mine geologist on an annual basis. The purpose of the inspection is to confirm the geotechnical stability of the waste rock pile and to inspect for potential acid generation. Results of the inspections are provided in an annual report to the Board.

Annual visual inspections of all pads, berms and containment ponds by TMAC staff are completed to determine if the facilities are operating as designed and to assess maintenance requirements as described in subsequent Modules.

Construction

To use non-mineralized rock from the underground workings for construction, testing is required to demonstrate that salt, ammonia and metals levels are within acceptable limits. Testing includes field contact tests and shake flask extraction tests to assess the amount of soluble salt, nutrients and metals present in the rock. Samples are collected at a frequency of one sample composite for every 20,000 tonnes of rock. The composites are prepared by mixing a minimum of five - 1 kg samples over an area of 100 square metres, and then sieving to recover the -1 cm size fraction. A – 1 kg split of the -1 cm material is submitted to a commercial testing laboratory for shake flask extraction tests. A portion of the remaining -1 cm material is then further sieved to recover the -2mm fines, and the fines are subjected to field contact tests.

The criteria for using non-mineralized diabase for construction outside of the Pollution Containment System will be as follows:

- ABA test results show sulphur concentrations of less than 0.2%
- Shake Flask Extraction tests show ammonia and metal levels below discharge criteria for the site, as specified in the water licence.
- Shake Flask Extraction tests show chloride levels below 150 mg/L.

Once adequately characterized and confirmed suitable for use, waste rock suitable for construction is delineated. Only then are construction personnel to load and move the material to areas that have been approved for construction.

Post-Construction

If qualified waste rock is used for construction outside of the water control area, an annual seep survey will be carried out in the first 3 years following construction. This will be completed during the freshet and will be reported to the Board in the annual report. Should the material show evidence of acid runoff, the Board and TMAC will determine the best course of action.

Table 4 Hope Bay Waste Rock and Ore Management Plan and Monitoring Summary

Aspect	Monitoring Activity	Monitoring Type	Data Management and Reporting
Mining Operations, including Waste Rock Deposition and Backfill	Pre-blast inspection by blaster	Identify "wet holes" and clean spilled ANFO	Maintain field notes
	Post-blast inspection by blaster	Confirm there were no misfires	Maintain field notes
	Visual inspection of face and muck pile by mine geologist	Confirm rock types and tag for deposition as appropriate	Maintain field notes. Maintain record for Annual Reporting
	Sampling of underground waste rock by mine geologist	ABA on a minimum of one sample per 10,000 tonnes of rock	Maintain field notes. Manage data. Assess material for suitability in construction. Report findings in Annual Reporting
	Amount of material mined and placed in mineralized and non-mineralized areas of the pile, amount of material used for construction, and amount of material used for backfill is recorded by the mine engineer.	Material quantities (cubic m and tonnes)	Maintain record for Annual Reporting
	Annual inspections and review of regular monitoring program by mine personnel	Visual inspections	Maintain field notes. Discuss findings with site geologists. Report findings in Annual Report
	Annual seep survey of materials on surface by Environmental personnel	Water samples submitted for pH, total sulphate, total ammonia, nitrate, alkalinity, and metals by ICP-MS	Maintain field notes. Report findings in Annual Report
	Monthly Water Licence monitoring by Environmental personnel	Water samples submitted for analysis of parameters specified in the Water Licence	Maintain field notes. Report findings in Monthly or Annual Reports to NWB as required
Infrastructure Construction and Post-Construction	Amount of non-mineralized rock used for construction, and location of placement tracked by Surface Manager	Material quantities (tonnes)	Maintain records for Annual Reporting
	Geochemical inspections and sampling of infrastructure areas constructed using waste rock by Environmental personnel	As per Quarry Management and Monitoring Plan	As per Quarry Management and Monitoring Plan
	Annual seep survey by Environmental personnel	As per Quarry Management and Monitoring Plan	As per Quarry Management and Monitoring Plan

3.3 Documentation and Reporting

All documentation related to waste rock classification, segregation, confirmatory sampling, material hauled from underground, and post-blast and waste rock storage facility inspection records are maintained on site.

Annual reporting required under the water licence will include reporting of waste rock tonnages placed on the designated waste rock storage areas by classification of mineralized and non-mineralized as part of the annual report to the Board. Tonnages both above and returned to underground are tracked and reported, together with the available void space in the mine. Annual geochemical monitoring and waste rock storage assessment is included in the annual report.

TMAC will combine all other results from the inspections and monitoring programs related to waste rock and quarry rock in an annual "Waste Rock and Quarry Monitoring Report". The monitoring report would be prepared and submitted no later than March 31 of the year following the monitoring activities, and would include all data collected prior to December 31 of the preceding year (i.e., within six months of the collection of samples, as prescribed in the Water License).

This brief factual report will address the requirements specified in the Water Licenses and Quarry Permit Agreements. The report will include, but not necessarily be limited to:

- A summary of the geochemical inspections;
- Results of the seep surveys;
- Results of geochemical sampling and analysis, if any;
- A summary of all mitigation activities undertaken as a result of monitoring; and
- A summary of the backfill volumes and available mine void space.

4 Contingencies

4.1 Inappropriate Material Identified

In the unlikely event that the results of the seep monitoring program or the confirmatory sampling program indicate the presence of material with an elevated potential for ML/ARD has been used in construction, further investigations will be undertaken to define the extent and assess the potential impacts of the material. If warranted, and after discussion with the appropriate regulatory agencies, the material may be excavated and hauled to the waste rock pile for eventual disposal underground.

4.2 PAG Quarry Rock Encountered

In addition to waste rock, it is possible to encounter acid-generating material from quarries. While extensive geochemical characterization and testing occurs and quarry rock is very well understood, the potential to encounter PAG rock remains. To date, none of the quarry monitoring programs or characterization data from the quarry sites has identified PAG rock. The quarry monitoring programs are described in the TMAC *Quarry Management Plan*.

Waste rock pads are designed with sufficient capacity to accommodate any PAG rock from quarries. An extra 10% of the total volume expected from the underground mine is adequate to handle future storage requirements.

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WASTE ROCK AND ORE MANAGEMENT PLAN

MODULE A: 2AM-DOH1323 (DORIS)

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A1. Introduction

The Doris North Waste Rock and Ore Monitoring Plan has been prepared in accordance with Type A Water License No. 2AM-DOH1323. The water license sets out a number of conditions related to the management of waste rock and ore at the Doris North site and is valid until August 15, 2023. All of the terms and conditions set out in the licence have been considered throughout the development of the Plan.

A1.1 Geological Context

The Doris ore deposits consist of a series of gold-bearing quartz veins hosted by Archean age folded and metamorphosed mafic volcanic rocks. There is a large diabase intrusive located in the vicinity of the Doris deposits.

The Doris deposits will be mined using underground mining methods. All of the waste rock will be classified and managed as “mineralized” waste rock. It is expected that all waste will be required for structural support underground under the current mine plan and so will be managed as mineralized. At closure, the backfilled waste rock, including the minor amounts of material with ML/ARD potential will be flooded and/or frozen, which will provide an effective means of controlling ML/ARD.

Doris geochemistry is presented in detail in the following documents:

- *Kinetic Testing of Waste Rock and Ore from the Doris Deposits, Hope Bay*. Report prepared for TMAC Resources Inc. by SRK Consulting (Canada) Inc., June 2015.
- *Kinetic Testing of Waste Rock and Ore from the Doris Deposits, Hope Bay – Supporting Data. Report prepared for Hope Bay Mining Ltd. by SRK Consulting (Canada) Inc., June 2015.*
- *Static Testing and Mineralogical Characterization of Waste Rock and Ore from the Doris Deposit, Hope Bay*. Report prepared for TMAC Resources Inc., May 2015.
- *Static Testing and Mineralogical Characterization of Waste Rock and Ore from the Doris Deposit, Hope Bay – Supporting Data*. Report prepared for TMAC Resources Inc., May 2015.

A1.2 Surface Facilities

The permitted surface facilities in the camp and mill area are shown in Figure A1. The site is currently divided into a series of adjoining rock pads that provide a foundation for all of the facilities in this area. The existing and future pads on the eastern half of this area (Pads D, F, G, H/J, I, Q and T) are located within the Pollution Containment System, which drains to a Pollution Control Pond at the southern edge of the pad complex and collection sumps located at the southeast corner of the pad area. Pad U has a dedicated PCP as it is located adjacent to the existing Pollution Containment System. Water collected at these locations is discharged to the Tailings Impoundment Area (TIA).

The mill is located on Pad D. Pads Q, H/J, U and possibly T if needed will be used to stockpile ore prior to milling. Pad T is current main Temporary Waste Rock Pad. Pads I, F and G have been and may continue to be utilized for temporary waste rock storage.

C:\01_SITES\Hope Bay\Doris North\Pad T\1CT022.001_PadU&T Fig 1.dwg

LEGEND

New Infrastructure Pads

Safety Berms

NOTES

1. The co-ordinate system is UTM NAD 83, Zone 13.
2. All dimensions are in metric units, unless specifically mentioned.

0 10 20 30 40 50
Scale in Metres

srk consulting

SRK JOB NO.: 1CT022.002.200.1600

FILE NAME: 1CT022.001_PadU&T Fig 1.dwg

TMAC RESOURCES

Hope Bay Project

Waste Rock & Ore Management Plan

General Arrangement

DATE:	APPROVED:	FIGURE:
June 2015	LW	1

A1.3 Overview of Previous Doris North Underground Development

In 2010 and 2011, approximately 2,670 m of lateral and 76 m of vertical underground development were completed at the Doris North Mine by Hope Bay Mining Ltd. (HBML). This development resulted in production of approximately 189,000 t of waste rock, including 86% non-mineralized and 14% mineralized waste rock. Additionally, 329 m of ore development occurred resulting in the production of 9,400 t of ore.

Throughout this period, HBML placed the rock according to the approved interim management plans described in Revision 01 of the Waste Rock Management Plan (SRK 2010a), which included segregation of mineralized and non-mineralized waste rock within the footprint of the Temporary Waste Rock Pad (on Pad I; Pads F and G were temporarily used as laydown areas), and placement of ore on Pads Q and H/J (2).

No underground development occurred during 2012-2014.

A1.4 Mine Development Plans

Access is provided via the Doris North Portal situated to the east of the mill area, an approximately 1,800 m long decline tunnel, and then a series of tunnels, cross cuts and spiral ramps that provide access to the ore. The ore is extracted by both long-hole and cut and fill methods from a series of stopes that follow the gold-bearing quartz veins.

The current production schedule showing production rates for waste rock and ore, backfill rates for waste rock, and requirements for waste rock storage over time is provided in Table 1. As shown, the majority of the waste rock will be produced during the initial years of mining. Once the mill is operating, the rate of ore production and backfill rates will increase, and there will be relatively low volumes of new waste rock produced. As with any mine plan, these production volumes may change in response to changing conditions in the underground mine.

Table A1 Current Mine Development Plan

Mining Year	Calendar Year	Material (tonnes)					
		Doris Hinge and North			Connector and Central		
		Ore Mined	Waste Rock On Surface	Ore Processed	Ore Mined	Waste Rock On Surface	Ore Processed
-6	2011	9,400	183,000				
-21	2015		220,000				
-1	2016	160,000	220,000				
1	2017	410,000	290,000	365,000			
2	2018			214,400	530,000	470,000	150,600
3	2019				730,000	140,000	730,000
4	2020				460,000		730,000
52	2021				15,000		124,400

Waste Rock and Ore Management Plan

Module B: 2BB-XXXX (Madrid)