Volume 1 Annex V1-7 Type A Water Licence Applications

Package P4-12

Hope Bay Project Water and Ore/Waste Rock Management Plan for Boston Site

Water and Ore/Waste Rock Management Plan for the Boston Site, Hope Bay Project, Nunavut

Prepared for

TMAC Resources Inc.

Prepared by

SRK Consulting (Canada) Inc.
1CT022.009
January 2017

Water and Ore/Waste Rock Management Plan for the Boston Site, Hope Bay Project, Nunavut

January 2017

Prepared for

TMAC Resources Inc.
PO Box 44
Suite 1010-95 Wellington St. W
Toronto, ON M5J 2N7
Canada

Tel: +1 416 628 0216
Web: www.tmacresources.com

Prepared by

SRK Consulting (Canada) Inc.
2200–1066 West Hastings Street
Vancouver, BC V6E 3X2
Canada

Tel: +1 604 681 4196
Web: www.srk.com

Project No: 1CT022.009
File Name: HopeBay_BostonWRMP_Update_Report_1CT022.009_CH_LNB_EMR_20170113

Executive Summary

Ore and waste rock were generated as part of a 1996/1997 BHP Billiton underground exploration program at the Boston deposit. The waste rock was used to construct a camp pad, roads, and an airstrip at the Boston site. Ore was placed in stockpiles on the camp pad. As a condition of Water Licence 2BB BOS1217 (Part E, Item 8), TMAC Resources Inc. is required to develop a water and ore/waste rock management plan that addresses the acid rock drainage (ARD) and metal leaching (ML) potential of the materials at the site (NWB 2012). TMAC acquired the Hope Bay project including the Boston site in 2013 and has maintained the Boston site in care and maintenance since.

The primary objectives of the water and ore/waste rock management plan are to document the current status and conditions at the site, and to present ongoing water and materials management, closure plans and verification and monitoring plans for these materials. The plan is intended primarily for use by TMAC and its contractors to ensure that appropriate management procedures are followed.

Current Site Conditions

The main components at the site are the mine portal, camp pad, ore stockpiles, airstrip and roads. The camp pad, airstrip and roads are comprised primarily of waste rock. Approximately half of the ore extracted during the exploration programs remains in place. The remainder was used by previous owners to construct a new tank farm and as surfacing material for the camp pad, roads and airstrip.

The main geochemical issue associated with the ore and waste rock is the potential for leaching of metals under neutral pH conditions. Monitoring has demonstrated that seepage immediately down-gradient of the camp pad and ore stockpiles has elevated concentrations of sulphate, chloride, arsenic, nickel and selenium. However, prior to reaching the shoreline of the lake, concentrations of these metals are substantially lower and stable, indicating that there is considerable attenuation as these flows pass over the tundra.

Annual monitoring of the ephemeral streams downgradient of the Boston ore stockpiles and camp has been conducted during spring freshet since 2009. The results indicate that concentrations of potential contaminants of concern have been low, and trends over time are stable (SRK 2009a, 2011, 2012a, 2012b, 2014, 2015, 2016).

Management Plans

The scope of materials management is limited to the existing waste rock and ore stored on site. Ongoing management of these materials will limit further use of ore as a construction material and will limit the expansion of the camp pad. If rock is required for maintenance or construction activities, it will be obtained from the waste rock pad. Further mine development is under evaluation. If further mine development is considered, this plan will be updated at that time to reflect the change.

Seepage and runoff are not currently having an impact on the downstream environment. Therefore, they will continue to be allowed to discharge directly to the tundra. Areas that collect runoff will be

periodically pumped onto the tundra. Monitoring will continue to provide a tool to detect changes in runoff quality.

Closure Plans

If a processing facility is available at the time of closure within the Hope Bay Project site, TMAC intends to consolidate the ore, and haul it to that facility for processing. Alternatively, the ore will be consolidated, resloped and then covered with an HDPE liner to substantially reduce seepage through the ore and minimize oxidation of the sulphides and a protective 0.3 m thick cover of waste rock. Seepage monitoring will be continued throughout operations and the results of this work will be used to make the final decision on which type of cover to use.

Monitoring and Verification Plans

Continued monitoring will include rinse pH and conductivity surveys every ten years to assess whether there are any locally acidic conditions developing in the piles, seepage monitoring, discharge monitoring, and ephemeral stream monitoring.

Table of Contents

List of Figures

List of Tables

1 Introduction

Ore and waste rock were generated as part of a 1996/1997 BHP Billiton underground exploration program at the Boston deposit. The waste rock was used to construct a camp pad, roads, and an airstrip at the Boston site. Ore was placed in stockpiles on the camp pad. TMAC acquired the Hope Bay project including the Boston site in 2013 and has maintained the Boston site in care and maintenance since. As a condition of Water Licence 2BB-BOS1217 (Part E, Item 8), TMAC Resources Inc. is required to develop a water and ore/waste rock management plan that addresses the acid rock drainage (ARD) and metal leaching (ML) potential of the materials at the site (NWB 2012).

In June 2008, HBML retained SRK to complete a geochemical assessment in support of developing a water and ore/waste management plan. Data from previous investigations were reviewed, and in August 2008, two geochemists from SRK visited the site to inspect the ore and waste rock and to collect seepage and rock samples for laboratory testing. The samples were submitted for water quality analyses, ABA tests, elemental analyses, and shake flask extraction tests. A report presenting the findings of this study was prepared and issued to HBML (SRK 2009b - Supporting Document A).

The primary objectives of this plan are to document the current status and conditions at the site, and to present ongoing water and materials management, closure plans and verification and monitoring plans for these materials. The plan meets two needs, one is to fulfill requirement Part E, Item 8 in the water licence, and second and perhaps most important is for use by TMAC and its contractors to ensure that appropriate management procedures are followed.

2 Background Information

2.1 Site History

A brief summary of the site history is listed in Table 2.1.

Table 2.1: Summary of Pertinent Site Ownership History

Period	Comment
1964	Sporadic exploration in the Hope Bay area begins, resulting in several gold and silver showings including Ida Point, Ida Bay and Roberts Lake.
1970	Roberts Bay Mining explores the area for about a decade up to 1980.
1977	Noranda begins exploring for volcanogenic massive sulphide deposits. They leave the belt in 1990. Prior to 1980, Roberts Bay Mining also explored the area.
1987	Albermin Corporation stake claims in the vicinity of Aimaokatalok (Spyder) and Doris Lakes. After completing some exploration, they allow their claims to expire.
1988	BHP Minerals Canada Inc. (BHP) explores the southern portion of Hope Bay Volcanic Belt.
1991	BHP acquires a contiguous block of claims covering about 1,106 square kilometres.
1992	BHP commences exploration drilling at the Boston property.
1993	The first camp is constructed on the southwest shores of Aimaokatalok Lake by BHP.
1994	Construction of 35-person camp at Stickleback Lake. The camp is dismantled and moved to the current site.
1996 and 1997	BHP complete 2,300 m of underground development, underground exploration (drilling and sampling) and bulk sampling of the Boston deposit.
1999	BHP sells all its interests in the Hope Bay Belt to Hope Bay Joint Venture (HBJV), a 50:50 joint venture between Hope Bay Gold Corporation Inc. (formerly Cambiex Exploration Inc.), and Miramar Hope Bay Limited (MHBL), a wholly owned subsidiary of Miramar Mining Corporation (MMC).
2002	Hope Bay Gold Corporation Inc. formerly merges with MMC, and the Hope Bay site is operated under MHBL.
2007	MHBL upgrades select infrastructure at Boston to support construction of the Doris North project.
2008	Hope Bay Mining Limited (HBML), a wholly owned subsidiary of Newmont Mining Corporation (NMC) buys out all interests in the Hope Bay Belt from NMC.
2009 - 2011	NMC completed further upgrades to the Boston site, but places the site in Care and Maintenance in 2012.
2013	TMAC acquires the Hope Bay Project and conducts various exploration and environmental programs. The Boston site however remain in care and maintenance.
2016	TMAC receives Amended Doris North Project Certificate and begins construction at Doris. Boston remains in care and maintenance.

2.2 Development History

The underground development and bulk sample program was conducted over a two-year period between April 1996 and November 1997 (BHP 1998). Five separate cross-cuts were established off an access decline to give access to the B2 and B3 ore horizons. Drifts were also established to follow veins horizontally and raises were developed to follow veins vertically. Each blast round of the ore from cross-cuts, drifts and raises was processed through an on-site crusher, and was then stockpiled separately on the surface pad. Stockpiles were surveyed and tagged according to blast round ID, and sampled for detailed analysis of grade, recovery and metallurgical characteristics.

During this program, a total of 105,400 tonnes of waste rock and 26,760 tonnes of ore were mined and brought to surface. Waste rock generated from the operation was used to construct roadways, the airstrip, the camp pad, as well as the pad on which the ore is stored. Ore remained stockpiled.

2.3 Historical Waste Management Practices

Sometime after the underground development was complete and BHP Billiton had sold its interest in the property (likely between 2001 and 2007), some of the material from the ore stockpiles was used as top dressing for the roads, airstrip and camp base as well as for construction of the tank farm base and berms. SRK understands that the use of ore material for construction purposes was first formally documented in 2007 during a geotechnical site inspection of the airstrip (SRK 2008). At this time it was confirmed by site staff that ore stockpile material had been used for repairs in previous years as well. Observations during the 2008 geochemical investigation program also found that ore had been used as surface dressing over the majority of the site.

Aerial photos taken in July 2016 (Figure 2.1) and (Figure 2.2) as well as maps showing the original configuration of the ore stockpiles (Figure 2.3), illustrate the change in stockpiles configuration compared to previous years. A detailed inventory of the ore stockpile area in 2008 indicated the absent stockpiles were mostly ore material from the 1997 campaign (SRK 2009b - Supporting Document A). Volumetric calculations indicate that almost half of ore may have been redistributed to other locations on the site. A substantial portion of this material was used in the construction of the tank farm berm and the remainder has been used as surfacing material.

Under HBML’s ownership, use of material from the ore stockpiles was stopped. TMAC maintains this practice.

2.4 Current Site Configuration

The current site configuration is shown in Figure 2.4. The relative areas of each of the site components are shown in Table 2.2.

The site is situated on a ridge which comprises a peninsula extending northwards into Aimaokatalok (Spyder) Lake, as illustrated on Figure 2.4. The main camp pad spans about 325 m from north to south, and 150 m east to west and was constructed using waste rock from the underground development. The camp pad ranges in thickness from 0.6 m to 3.0 m and slopes generally north at a gradient of about 1%. The majority of the facilities, including the camp and office facilities, industrial site and laydown areas, and ore stockpiles are located on the camp pad. Roads provide access from the camp to an airstrip located south of camp, and from the camp to a boat ramp located northwest of the site. The roads and airstrip were also constructed using waste rock.

srk consulting	TMAC RESOURCES	Boston Ore and Waste Rock Management Plan
		Aerial Photograph of Boston Camp, July 2016
Job No: 1CT022.009 Filename: Figure 2.1_20170113.pptx	Hope Bay Project	Date: January 2017 | Approved: EMR | Figure: **2.1**

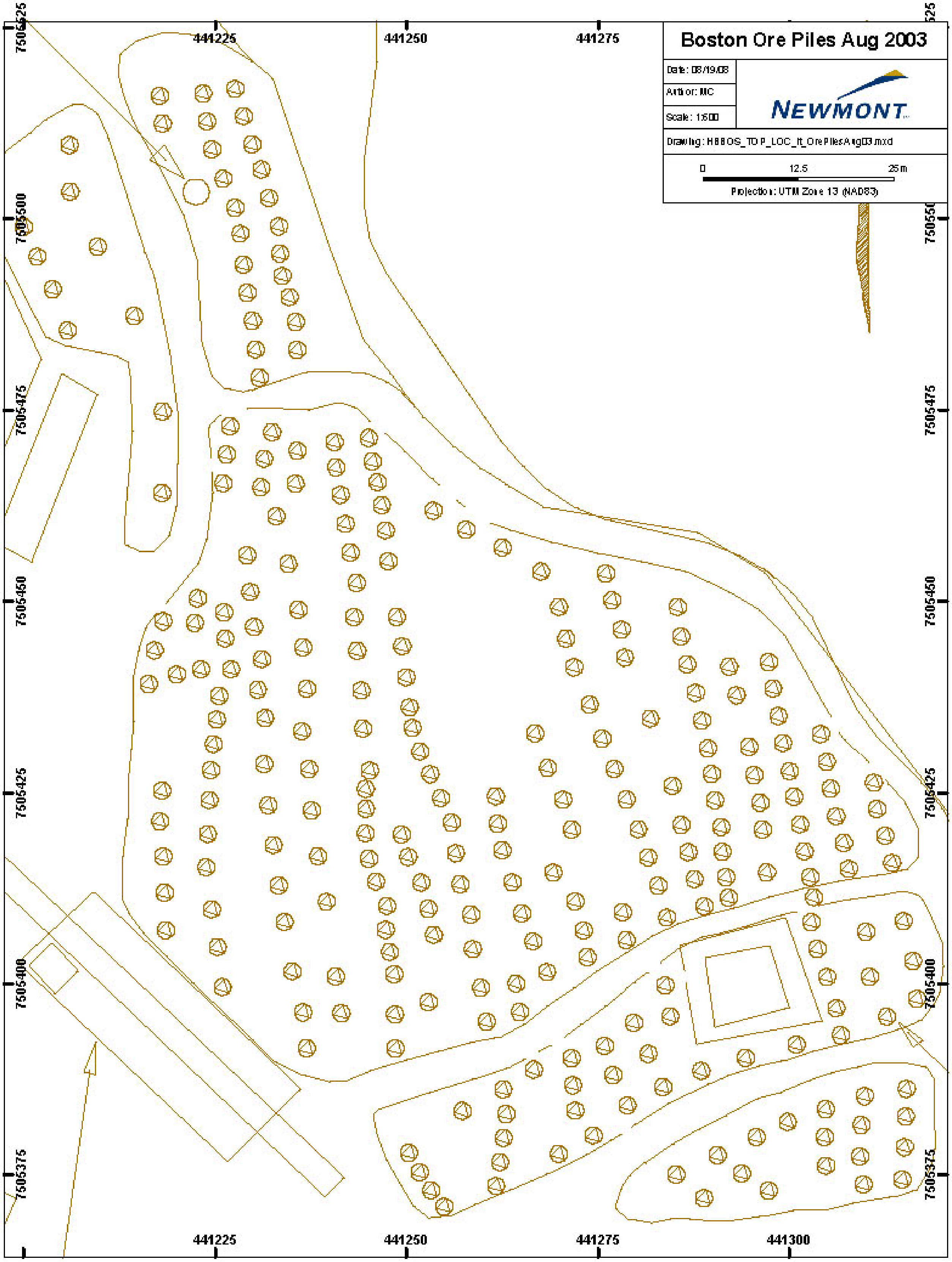
srk consulting

MAC RESOURCES

Boston Ore and Waste Rock Management Plan

Aerial Photograph of Boston Camp ore Piles, July 2016

Job No: 1CT022.009	Hope Bay Project	Date: January 2017	Approved: EMR	Figure: 2.2
Filename: Figure 2.2_20170113.pptx				



srk consulting

MAC RESOURCES

Boston Ore and Waste Rock Management Plan

Map of Previous Ore Stockpile Configuration

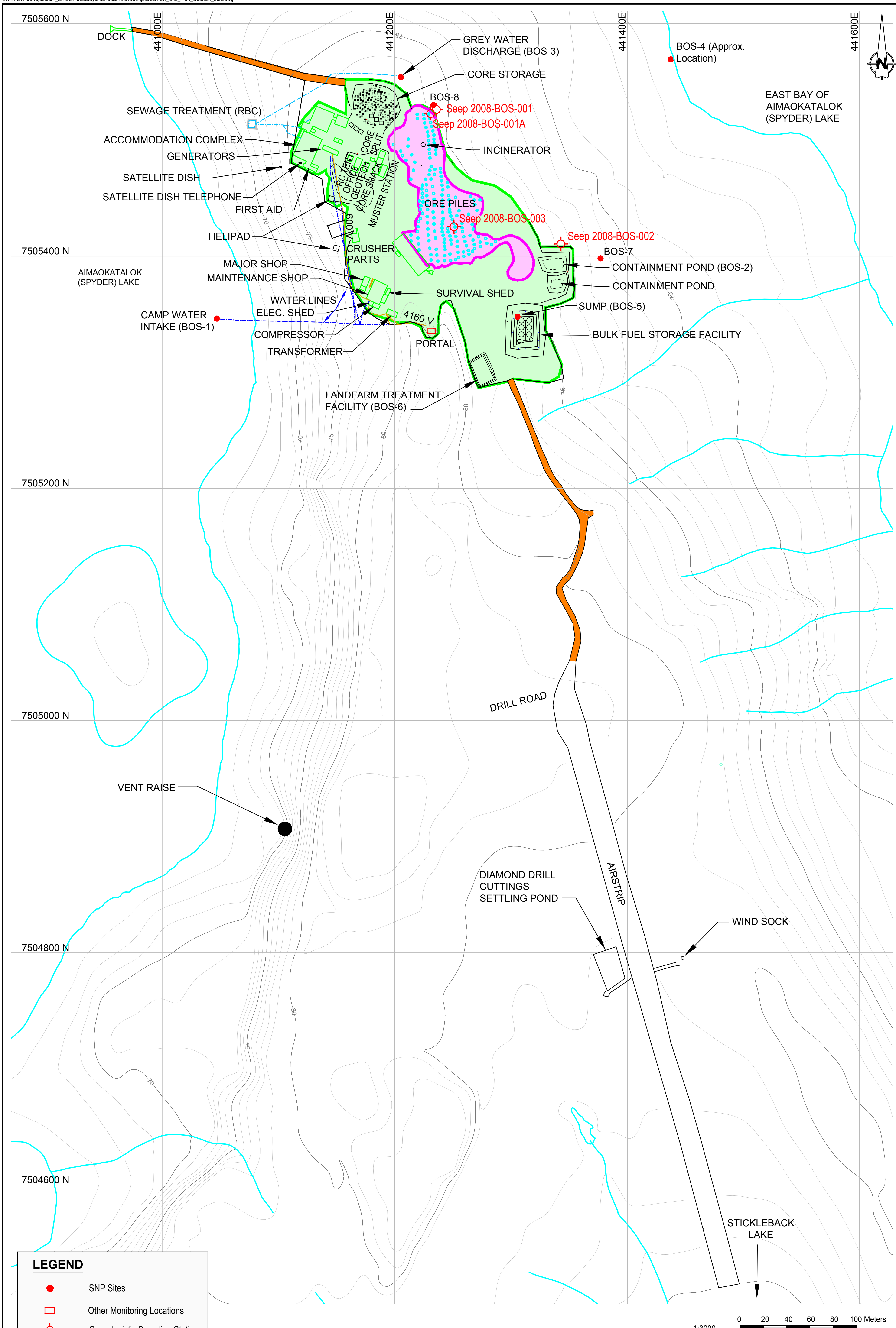
Job No:1CT022.009

Filename: Figure 2.3_20170113.pptx

Hope Bay Project

Date:	Approved:	Figure:
January 2017	EMR	2.3

\\VAN-SVR0\Projects\01_SITES\Hope.Bay\!ACAD\2016 Drawings\BOSTON_Site_Plan_Geotech_Insp.dwg



srk consulting

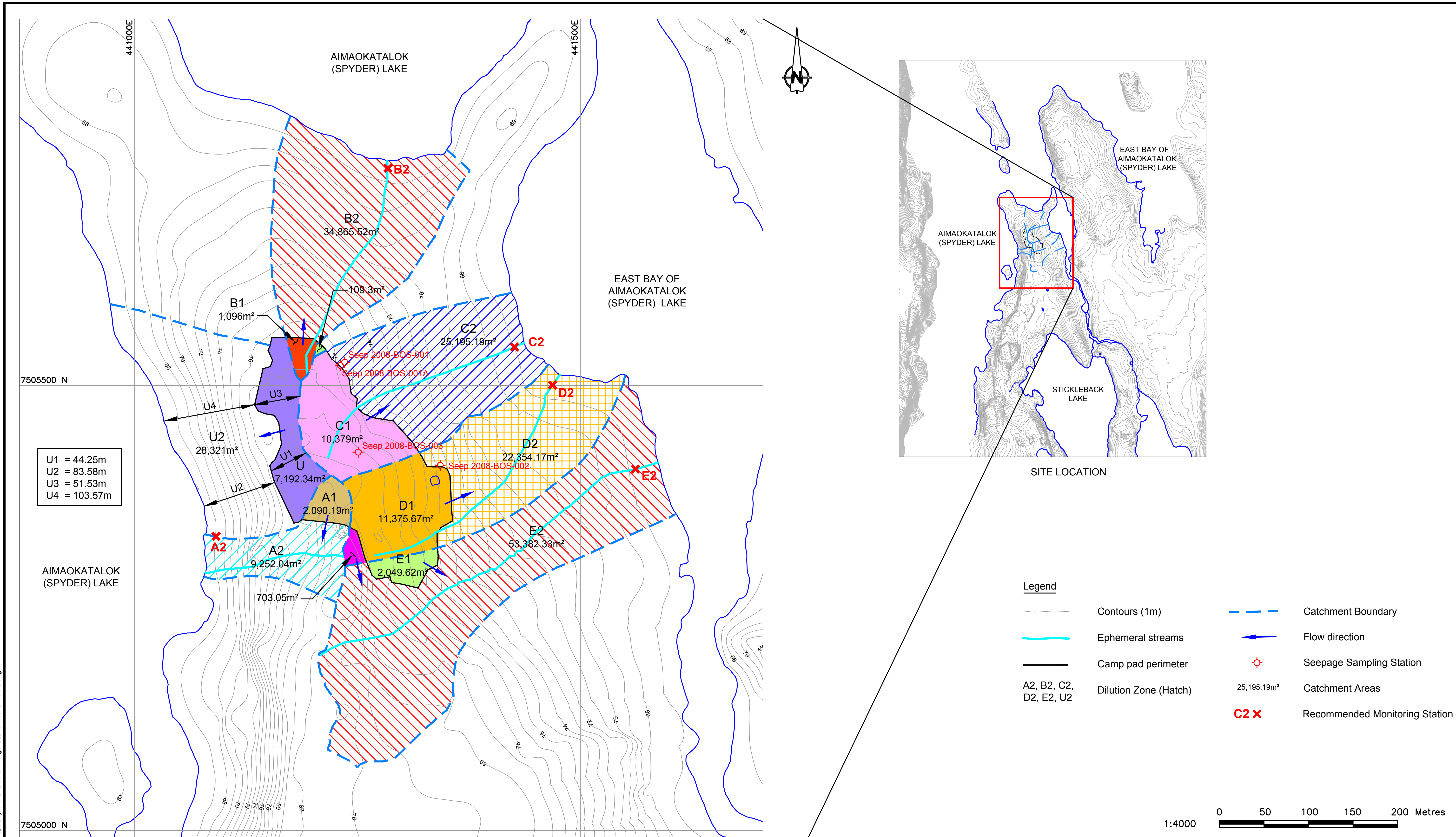
MAC RESOURCES

Hope Bay Project

Boston Ore and Waste Rock Management Plan

Current Site Layout and Water Quality Monitoring Site

SRK JOB NO.: 1CH022.009	DATE: Jan. 2017	APPROVED: –	FIGURE: 2.4
FILE NAME: BOSTON_Site_Plan_Geotech_Insp.dwg			



srk consulting

MAC RESOURCES

Boston Waste Rock Management Plan

Recommended Sites for Ephemeral Stream Monitoring

Hope Bay Project

SRK JOB NO.:	1CH022.009
FILE NAME:	Boston Catchments.dwg
DATE:	Jan. 2017
APPROVED:	
FIGURE:	2.5

Table 2.2: Surface Areas of Boston Site Components

Site Component	Area (m^2)
Camp and Industrial Areas	26,700
Ore Stockpiles	6,800
Airstrip	15,600
Roads	4,700
Total	53,800

2.5 Geochemical Characteristics of Ore and Waste Rock

There have been a number of historical field and laboratory testing programs to characterize the geochemistry of the ore and waste rock at Boston, as documented in Rescan 1999, Rescan 2001a, Rescan 2001b and SRK 2008. A detailed summary of the historical results and results from SRK 2008 are presented in SRK 2009b - Supporting Document A. In brief, the results of these studies indicate that all of the waste rock and the majority of the ore is non-acid generating and that a small proportion of the ore has an uncertain potential for acid rock drainage (ARD). However, even if localized ARD were to develop in the ore stockpiles, the presence of non-acid generating waste rock in the underlying pad is expected to maintain neutral pH conditions. Although pH conditions are expected to remain neutral, seepage monitoring indicates that concentrations of arsenic, and to a lesser extent, nickel and selenium may be somewhat elevated in comparison to CCME guidelines for aquatic life (CCME, 1999 + updates).

2.6 Historical Reclamation Plans

Throughout the development of this site, plans have been in place for closure and reclamation of the ore and waste rock. These were developed at a conceptual level on the basis of the information and opportunities available at the time they were proposed. The current closure plan was developed by SRK and updated in 2017. The earlier plans, and specifically the procedure for managing the waste rock and ore, are summarized in Table 2.3. Section 4 of this report presents a summary of the current closure plan (SRK 2017) as it pertains to waste rock and ore management.

2.7 Current Monitoring Activities

Current monitoring activities are outlined in Water Licence 2BB-BOS1217 and the existing waste rock and ore management plan (SRK 2009b). These include water quality monitoring and annual geotechnical inspections. Table 2.4, Figure 2.4 and Figure 2.5 document the routine water quality stations that contribute information on the interaction between waste rock/ore and surface water.

Table 2.3: Summary of Previous Closure and Reclamation Plans, as it Pertains to Waste Rock and Ore Management

Date	Document	Assumptions	Closure Plans
March 1995	Bulk sampling application (Rescan 1995)	Rock assumed to be non-PAG on the basis of limited test data. A precautionary approach was followed.	Stockpiled materials and 70% of the camp pad and road material were to be backfilled into the workings. The balance of the material was to be re-sloped to resemble an esker.
July 1997	Abandonment and Restoration Plan (Rescan 1997)	Rock classified as non-PAG on the basis of a more robust dataset.	Stockpiles were to be re-contoured so as to not inhibit wildlife. They were expected to provide relief to the terrain and wildlife habitat.
September 1998	Abandonment and Restoration Plan for the Boston Gold Project (Rescan 1998)	As above	As above, with the clarification that the ore stockpiles would be re-contoured.
October 2000	Estimate for Bonding Agreement (Golder 2000)	Unclear assumptions with respect to ARD potential. Other documents from this time period indicate there was greater awareness of the potential for ML.	Ore stockpiles were to be re-contoured and covered with waste rock to facilitate permafrost development.
May 2001	Abandonment and Restoration Plan (HBJV 2001)	Rock classified as having low acid generation potential.	If not processed, the ore was to be re-contoured or placed underground. Further monitoring was recommended to provide a basis for this decision.
December 2006	Boston Exploration Camp Closure and Reclamation Plan (MHBL 2006)	Considered chemically stable on the basis of ongoing runoff monitoring since the mid-1990's.	Stockpiles were to be regarded and levelled to promote runoff. Some material was to be used to seal the underground workings.
September 2007	Closure and Reclamation Plan for the Boston Advanced Exploration Project (MHBL 2007)	Ore stockpiles considered to be a valuable resource. Waste rock considered non acid generating.	Ore was to be transported to Doris for processing. Waste rock was to be used to backfill the underground decline.
June 2012	Hope Bay Project Boston Camp Revised Interim Closure Plan. Hope Bay, Nunavut (SRK 2012)	As above	Ore to be transported to Doris for processing if possible. Otherwise ore to be consolidated and covered.
May 2014	Hope Bay Project Boston Camp Revised Interim Closure Plan (SRK 2014a)	As above	As above, transfer of ownership update.
January 2017	Hope Bay Project Boston Camp Updated Interim Closure Plan (SRK 2017)	As above	Ore to be transported to Doris for processing if possible. Otherwise ore to be consolidated and covered.

Table 2.4: Routine Monitoring Stations for Discharges and Seepages from Boston Camp

Monitoring Station	Discharge Source	Description	Relevance for Ore and Waste Rock Management
BOS-2 (N67º39.489'/ W106 º 2.970')	Containment pond discharge	Ponds were originally designed to accommodate excess water from the underground. One pond is lined, but the liner needs repair and is used to hold surface water only. The other pond is unlined and is presently used to temporarily hold non-hazardous solid waste materials pending packaging for offsite disposal. Water discharge, as required, is onto tundra east of the ponds and only after fulfilling specific discharge criteria. Monitoring is performed prior to discharge only. Under the current site activities, this pond is not used on a regular basis and is therefore not monitored on a regular basis.	Sources of water reporting to this location include runoff from the camp pad or water accumulating in the fuel containment area and therefore reflect water quality associated with runoff from the ore and waste rock.
BOS-5 (N67 º39.458'/ W106 23.020')	Bulk fuel storage facility	Discharge, as required, is pumped to the lined containment pond (BOS-2), sampled and released only after fulfilling specific discharge criteria. Monitoring is performed prior to discharge only. Water is pumped in the spring and after any major rainfall.	This water interacts with the crushed ore used to protect the liner and therefore provides an indication of water quality associated with the ore.
BOS-7 (N67 º39.476', W106 º 2.955')	Landfill leachate	The landfill originally proposed for this site was never constructed due to concerns raised by the Kitikmeot Inuit Association (KIA). However, the lined containment pond is temporary storage of hydrocarbon contaminated soils. BOS-7 is now used to monitor seepage from the temporary storage area.	Seepage emerging from this area may also interact with ore and waste rock, it also provides an indication of water quality from those materials.
BOS-8 (N67 º 39.554', W106 º 3.128')	Ore stockpiles	Monitoring of seepage from the ore stockpiles and camp pad. Monitored on the tundra to the east of the ore stockpiles.	This station has always been intended primarily to provide an indication of water quality from the ore and waste stockpiles.
N/A	Portal decline	Surface water is pumped, as required, onto tundra west of portal and only after fulfilling specific discharge criteria. Monitoring performed prior to discharge only. Pumping typically occurs once in the spring, and maybe more if the camp is active.	Water accumulating at the portal consists of runoff from the camp pad. Therefore, this station provides an indication of water quality from waste rock in the camp pad.
Ephemeral stream sample points, identified as EPH A2, EPH B2, EPH C2, EPH D2 and EPH E2 (Figure 2.5)	Boston ore stockpiles and camp	Monitoring of drainage from the Boston ore stockpiles and camp pad before entering Aimaokatalok Lake, and the attenuation capacity of the tundra.	Provide an indication of whether contaminants from the ore and waste rock piles are reaching the shoreline of Aimaokatalok Lake.

2.8 Assessment of Potential Impacts to Receiving Environment

The majority of the seepage and runoff from the camp pad flows along poorly defined drainages or ephemeral streams into the small inlet at the mouth of the Stickleback/Fickleduck drainage east of the camp (referred to as East Bay) and eventually into the main part of Aimaokatalok Lake. A small component of the seepage flows directly into Aimaokatalok Lake. Flows from the airstrip report to East Bay or to Stickleback Lake and then East Bay. A water and load balance was developed to assess the potential impacts of seepage from the camp pad at key locations downstream of the site. Details of the model and results are provided in SRK 2009b - Supporting Document B.

The modelling results are summarized as follows:

- Predicted concentrations of nitrate, nitrite, arsenic, copper, iron, nickel and selenium exceeded the CCME water quality guidelines for the protection of aquatic life in the ephemeral streams. However, due to limited flows and lack of channel characteristics in these small catchments, these ephemeral streams are not considered to be aquatic habitats and the CCME guidelines are not applicable.
- Predicted concentrations of all modelled parameters were below CCME guidelines in East Bay. Concentrations of most parameters were estimated to be an order of magnitude below their respective CCME guideline, with the exceptions of arsenic and nickel. These parameters were predicted to be close to the CCME guidelines and are sensitive to the assumptions of source concentrations and contributing areas. Sensitivity analyses to evaluate the potential effects of higher source concentrations indicate that concentrations of arsenic could exceed the CCME guidelines for aquatic life in East Bay if more conservative source concentrations are used in the assessment. Similarly, sensitivity analyses show that concentrations of arsenic and nickel could exceed CCME guidelines in East Bay if loadings from the airstrip are considered in the assessment.
- Predicted concentrations for all parameters were close to background levels in the main part of Aimaokatalok Lake due to the very large inflows to this lake from the Aimaokatalok River.

Sampling of ephemeral streams down-gradient of the site (SRK 2009a, 2011, 2012a, 2012b, 2014, 2015, 2016) indicate metal concentrations are all very low, suggesting that there is considerable attenuation of these parameters occurring along the flow paths in the tundra. Concentrations of sulphate and chloride were within the range predicted by the dilution model indicating the model is valid for parameters that are less strongly affected by attenuation processes. Over time, the effectiveness of the attenuation processes may diminish, resulting in increased concentrations in the ephemeral streams. The timing of breakthrough will be difficult to establish through predictive modelling. Therefore, ongoing monitoring of both source and downstream concentrations is recommended.

The sensitivity analyses suggest that some additional efforts to reduce the amount of seepage from the ore stockpiles would help to ensure that water quality in East Bay is not affected over the longer term.

Annual Monitoring of the ephemeral streams downgradient of the Boston ore stockpiles and camp has been conducted during spring freshet since 2009. This was conducted to monitor the attenuation capacity of the tundra and to provide an indication of whether contaminants from the ore and waste rock piles are reaching the shoreline of Aimaokatalok Lake.

The results indicate that concentrations of potential contaminants of concern have been low, and trends over time are stable in the ephemeral streams downstream of the Boston ore stockpiles and camp (SRK 2009a, 2011, 2012a, 2012b, 2014, 2015, 2016). The results suggest that the tundra continues to effectively attenuate these constituents, ensuring there is no impact to Aimaokatalok Lake.

3 Proposed Management Plans

3.1 Materials Management

There are currently no plans to excavate additional waste rock or ore from Boston. As a result, the scope of materials management is limited to the existing camp pad, roads, airstrip and ore stockpiles. The objective of the materials management is to maintain the surface facilities and to minimize the footprint of the site and the ore stockpiles. Accordingly, ore is not to be used as construction material, as already mandated by TMAC, and the camp pad is not to be extended beyond its current configuration unless clean rock is available for the construction. If additional materials are required for repairs or minor construction projects, excavation of existing waste rock from the camp pad may be used.

If further expansion of the pad or additional materials are required to support future activities at this site, the waste rock management plan will be modified accordingly.

3.2 Water Management

3.2.1 Current Procedures

Water sources to the Boston camp include natural precipitation (rain and snow) and raw water sourced from Aimaokatalok Lake during periods of camp activity. Aimaokatalok Lake water is used for camp operations and is discharged via the sewage treatment plant at SNP station BOS-3. Natural precipitation interacts with waste rock and ore and flows to the tundra either as runoff from the surface of the pile or as seepage that has infiltrated through ore and waste rock in the stockpiles and underlying pad. Flowing seeps have been located at a few locations on the east side of the camp (Figure 3.1).

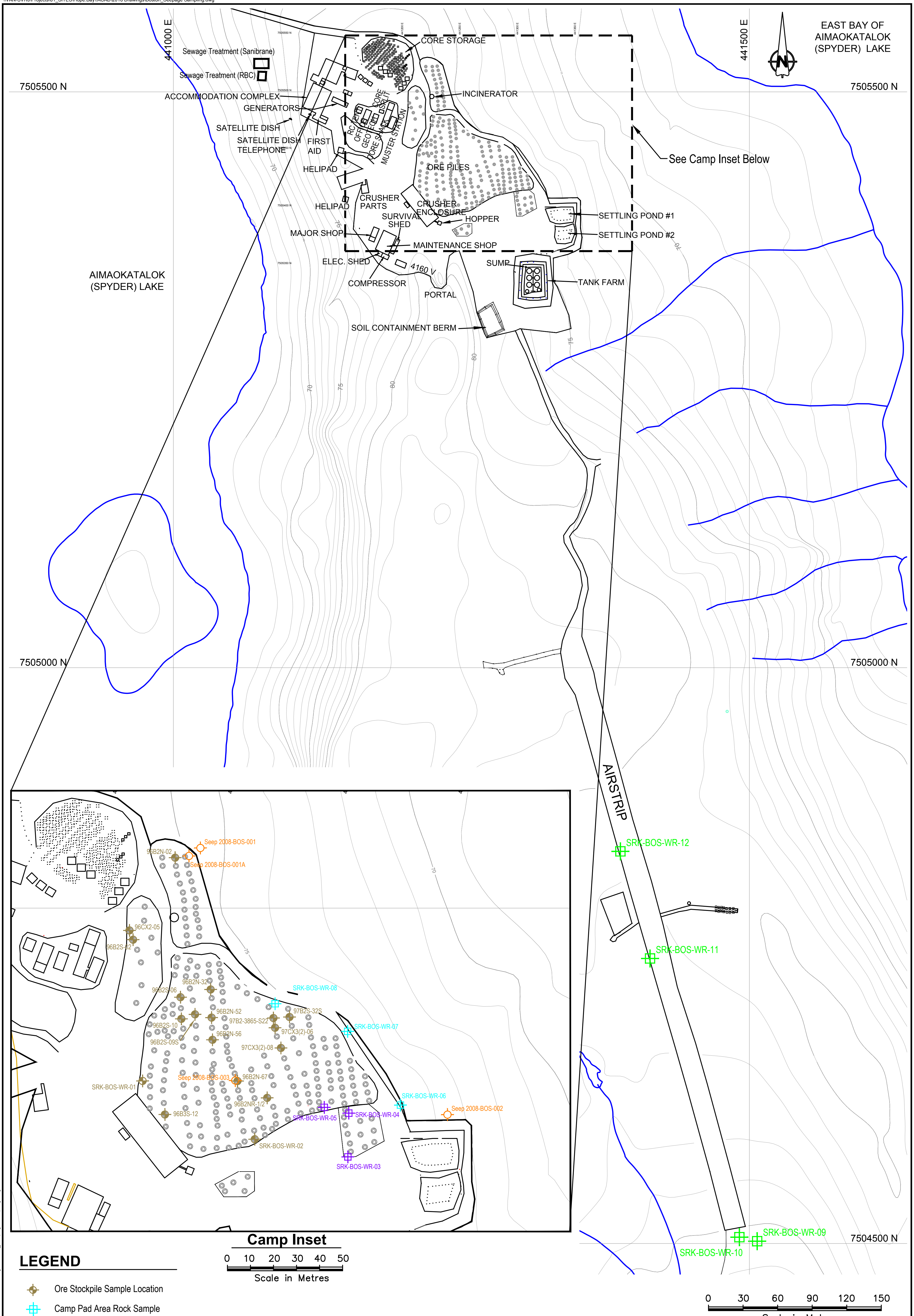
A small portion of the runoff is allowed to accumulate in containment ponds or other low areas on site. These are infrequently pumped and discharged onto the tundra. These active discharges have been documented from the following sites:

- Containment ponds (BOS-2);
- Bulk fuel storage sump (BOS-5)[1];
- Landfarm (BOS-6);
- Portal to the underground;
- Area adjacent to the helicopter pad, just south of the camp complex[2]; and
- Area between geology offices and core shack.

Water accumulating in these areas is typically monitored prior to discharge.

[1] Water is pumped to the lined containment pond (BOS-2) prior to discharge.
[2] It is anticipated that the helicopter pad area will be filled in to prevent the pooling of water and active pumping will no longer be required.

\\VAN-SVR0\Projects\01_SITES\Hope.Bay\!ACAD\2016 Drawings\Boston_Seepage Sampling.dwg



srk consulting

SRK JOB NO.: 1CT022.009

FILE NAME: Boston_Seepage Sampling.dwg

MAC RESOURCES

Hope Bay Gold Project

Rock Seepage Sampling Locations at Boston Camp Pad, Ore Stockpiles, and Airstrip, August 2008

DATE:	APPROVED:	FIGURE:
Jan. 2017	CJ	3.1

\\VAN-SVR0\Projects\01_SITES\Hope.Bay\!ACAD\2016 Drawings\Boston_Seepage Sampling.dwg

3.2.2 Proposed Modifications

Seepage, runoff and direct discharges from the camp pad are not having an impact on the downstream environment (SRK 2009a, 2011, 2012a, 2012b, 2014, 2015, 2016). Therefore, there is no need to change any of the current management procedures. However, TMAC intends to continue to clearly document the criteria and procedures used to initiate active pumping and discharges as well as record the frequency, duration and volume of water that is actively discharged at each of these locations.

If seepage concentrations increase, the need to implement further measures to control the amount of seepage or seepage concentrations will be considered. Ephemeral streams monitoring to date indicates this is not presently anticipated (SRK 2009a, 2011, 2012a, 2012b, 2014, 2015, 2016).

4 Closure Plans

The current closure plan is presented in SRK 2017.

As discussed in Section 2.8, the site is currently not having an impact on water quality in the East Bay or the main part of Aimaokatalok Lake. However, if arsenic concentrations increase, or if the ore used as surfacing material on the airstrip results in seepage concentrations that are similar in character to those currently discharging from the ore stockpiles, there is some potential for impacts to East Bay. Therefore, closure measures planned for this site should incorporate features that would reduce the amount of arsenic loadings from the site.

An assessment of potential closure options for the ore and waste rock at this site is presented in SRK 2009b - Supporting Document C. The assessment considered a wide range of potential closure options and the relative advantages and disadvantages of each. On the basis of this assessment several options were eliminated from further consideration either because they would not provide an adequate reduction in loading, or because of technical limitations. Options that were identified as worthy of further consideration are described as follows:

- Consolidation and processing of the ore to recover the gold and disposal of the tailings into an approved facility.
- Consolidation of ore, re-sloping of the ore stockpiles, and covering the stockpiles with 0.3 m of waste rock to reduce the footprint, promote runoff, and to isolate the ore from surface receptors.
- Consolidation of ore, re-sloping of the ore stockpiles and covering the stockpiles with a 1.5 m thermal cover to promote freezing.
- Consolidation of ore, re-sloping of the ore stockpiles, and placement of an HDPE or bitumen liner with 0.3 m of waste rock to protect the liner.

Consolidation of the ore is common to all of these options. Ore that has been used for surfacing would be scraped from the pad and relocated to the ore stockpile area. The stockpiles would be consolidated to 2/3 of the original area and re-sloped to promote runoff. The removal of ore from the rest of the camp pad is expected to substantially reduce the potential for ML. If an opportunity to process this material arises, consolidation would also ensure that the ore is accessible during a winter road hauling campaign. Reduction of the footprint would also make it more feasible to install covers which would further reduce the loading.

If the Doris processing facility is operating at the time of closure of Boston site, it is likely that the ore would be removed from the Boston site and processed.

If an opportunity to process the ore does not arise, the material would be closed in-situ with a cover to reduce metal loadings. There are a number of different types of covers that could be implemented at this site. The performance of these covers would be expected to differ substantially. The simple waste rock cover is unlikely to reduce loading substantially but would eliminate any risks associated with exposure of this material to terrestrial receptors. Both the thermal cover and the geo-synthetic cover would provide substantial reduction in loading, but are more costly and difficult to implement. Further monitoring of the seepage should provide improved confidence in the estimates of metal loading that could be occurring from this site and therefore the types of covers that would be required to reduce the metal loading to acceptable levels.

As per the current closure plan (SRK 2017), closure and reclamation activities for Boston Camp include:

- Demolishing and removing remaining site structures;
- Decommissioning and demolition of containment structures;
- Decommissioning the existing portal to underground workings;
- Consolidating and covering ore stockpiles;
- Reclaiming drill sites;
- Collecting and disposing of hazardous wastes;
- Collecting and disposing of non-hazardous wastes;
- Stabilizing permafrost degradation areas;
- Remediating hydrocarbon contaminated soils; and
- Drainage control and revegetation, where appropriate.

Post-closure environmental monitoring will be implemented to confirm conformance with the closure objectives.

5 Verification and Monitoring Plans

5.1 Monitoring of Solids

Geochemical characterization of waste rock and ore materials has indicated that all waste rock and most of the ore is non-acid generating (SRK 2009b - Supporting Document A). Some of the ore was classified as having an uncertain potential for ARD. To monitor the oxidation of the ore, a survey of rinse pH and conductivity will be completed every ten years. The inspection and monitoring will be conducted by a professional geochemist and would include ore in the stockpiles, and any other area that was originally constructed of waste rock but now contains ore (e.g. camp pad surface, berms, roads and airstrip). Materials will be identified as ore based on high visual sulphide levels and presence of quartz.

The last rinse pH and conductivity survey was conducted in 2008 (SRK 2009b - Supporting Document A). The next comprehensive rinse pH survey will be conducted in 2018. Ore stockpiles characterized in 2008 would be selected for the survey (Figure 5.1) to allow direct comparison of the results.

5.2 Water Quality Monitoring

The following verification and monitoring activities will be completed in addition to all water quality sampling outlined in Water Licence 2BB-BOS1217 (e.g. BOS-1 through BOS-8).

Annual Monitoring of the ephemeral streams downgradient of the Boston ore stockpiles and camp has been conducted during spring freshet since 2009a, SRK 2009a, 2011, 2012a, 2012b, 2014, 2015, 2016.

5.2.1 Seepage

Seepage monitoring provides data for the source concentrations from the waste rock and ore. According to Water Licence 2BB-BOS1217, sampling of water quality station BOS-8, and any opportunistic seeps, is required initially during spring thaw and at a minimum frequency of monthly whenever flow is observed (NWB 2012). BOS-7 will also be sampled at the same frequency because this station also monitors seepage from the ore stockpiles and camp pad (Section 2.6). The seep survey will include the north and east sides of the camp pad, and the southern end of the airstrip. Locations of the current SNP seepage monitoring stations and other seeps that have been detected in previous surveys are shown in Figure 2.4.

5.2.2 Discharges

The permit outlines protocol and discharge criteria for water that is pumped from various camp facilities onto the tundra (e.g. BOS-2 or containment pond). TMAC will also monitor other areas that collect appreciable amounts of water but that are not specifically included in the permit, such as the entrance of the underground workings, and the water that collects adjacent to the helicopter pad.

5.2.3 Streams

Ephemeral streams in the catchment of the Boston camp (ES-A through ES-E) will be monitored to establish the degree of the natural attenuation of the tundra (Figure 2.5 and Table 2.4). The monitoring will be completed during freshet.

CAMP

srk consulting

SRK JOB NO.: 1CH022.009

FILE NAME: Boston_Seepage Sampling.dwg

TMAC RESOURCES

Hope Bay Project

Boston Ore and Waste Rock Management Plan

Ore Stockpiles Recommended for Solids Monitoring Program

DATE: Jan. 2017 | APPROVED: – | FIGURE: 5.1

\\VAN-SVR0\Projects\01_SITES\Hope.Bay\!ACAD\2016 Drawings\Boston_Seepage Sampling.dwg

This report, Water and Ore/Waste Rock Management Plan for the Boston Site, Hope Bay Project, Nunavut, was prepared by SRK Consulting (Canada) Inc.

Lisa Barazzuol, PGeo
Senior Consultant

and reviewed by

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.

6 References

BHP. 1998. *Boston Gold Project Summary Document 1991-1998.* Prepared by Hope Bay Volcanic Belt and BHP World Minerals. December, 1998.

CCME, 1999 + updates. *Canadian Environmental Quality Guidelines.* Canadian Council of Ministers of Environment.

Golder 2000. Estimate for Bonding Agreement, Hope Bay Gold Project. Letter to Hope Bay Joint Venture from Golder Associates Ltd. (Burnaby), October 16, 2000.

Hope Bay Joint Venture (HBJV), 2001. Revised Abandonment and Restoration Plan – Hope Bay Joint Venture – Licence NWB1BOS9801. Letter Report to Mr. Philippe di Pizzo, Nunavut Water Board, May 2001.

Miramar Hope Bay Limited (MHBL, 2006). Boston Exploration Camp Closure and Reclamation Plan.

Miramar Hope Bay Limited (MHBL, 2007). Closure and Reclamation Plan for the Boston Advanced Exploration Project.

NWB. 2012. *Water Licence 2BB-BOS1217*. Water licence issued by Nunavut Water Board to Miramar Hope Bay Ltd. on August 2, 2012.

Rescan, 1995. Bulk Sampling Application.

Rescan, 1997. Abandonment and Restoration Plan.

Rescan, 1998. Abandonment and Restoration Plan.

Rescan Environmental Services Ltd., 1999. Acid Rock Drainage Characterization Boston Property (Waste Rock), Final Report. Report prepared for BHP Minerals Ltd. February, 1999.

Rescan Environmental Services Ltd., 2001a. 2000 Supplemental Environmental Baseline Data Report Hope Bay Belt Project. Report prepared for BHP Minerals Ltd. March, 2001.

Rescan Environmental Services Ltd., 2001b. Acid Rock Drainage Characterization - Boston and Doris Lake Properties. Report prepared for BHP Minerals Ltd. December, 2001.

SRK Consulting (Canada) Inc. 2008. *2007 Annual Geotechnical Inspection, Boston Advanced Exploration Project, Hope Bay, Nunavut*. Report prepared for Miramar Hope Bay Ltd. February, 2008.

SRK Consulting (Canada) Inc. 2009a. Ephemeral Streams at Boston Camp. Memo prepared for Hope Bay Mining Ltd. July 2009.

SRK Consulting (Canada) Inc. 2009b. *Water and Ore/Waste Rock Management Plan for the Boston Site, Hope Bay Project, Nunavut*. Report prepared for Hope Bay Mining Ltd. July, 2009.

SRK Consulting (Canada) Inc. 2011. Ephemeral Streams at Boston Camp. Memo prepared for Hope Bay Mining Ltd. April 2011.

SRK Consulting (Canada) Inc. 2012a. Ephemeral Streams at Boston Camp. Memo prepared for Hope Bay Mining Ltd. March 2012.

SRK Consulting (Canada) Inc. 2012b. Boston Ephemeral Streams Monitoring 2012. Memo prepared for Hope Bay Mining Ltd. December 2012.

SRK Consulting (Canada) Inc. 2014. 2013 Update on Boston Geochemistry. Report prepared for TMAC Resources Inc. March 2014.

SRK Consulting (Canada) Inc. 2015. Boston Ephemeral Streams Monitoring 2014. Memo prepared for TMAC Resources Inc. March 2015.

SRK Consulting (Canada) Inc. 2016. Boston Ephemeral Streams Monitoring 2015. Memo prepared for TMAC Resources Inc. March 2016.

SRK Consulting (Canada) Inc. 2017. Hope Bay Project Boston Camp Updated Interim Closure Plan. Report prepared for TMAC Resources Inc. January 2017.