BACK RIVER PROJECT
Marine Monitoring Plan

October 2017

BACK RIVER PROJECT
ENVIRONMENTAL MANAGEMENT PLAN

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Revision Log

Version	Date	Section	Page	Revision
1	October 2017	All	All	Supporting Document for Type A Water Licence Application, submitted to Nunavut Water Board for review and approval

Acronyms

FEIS	Final Environmental Impact Statement
KIA	Kitikmeot Inuit Association
NIRB	Nunavut Impact Review Board
NWB	Nunavut Water Board
MAD	Main Application Document
MLA	Marine Laydown Area
MMP or Plan	Marine Monitoring Plan
Project	Back River Project
Sabina	Sabina Gold & Silver Corp.

1. Introduction

The Back River Project (the Project) is a proposed gold project owned by Sabina Gold & Silver Corp. (Sabina) within the West Kitikmeot region of southwestern Nunavut. It is situated approximately 400 kilometres (km) southwest of Cambridge Bay, 95 km southeast of the southern end of Bathurst Inlet (Kingaok), and 520 km northeast of Yellowknife, Northwest Territories. The Project is located predominantly within the Queen Maud Gulf Watershed (Nunavut Water Regulations, Schedule 4).

The Project is comprised of two main areas with interconnecting winter ice roads (Main Application Document [MAD] Appendix A, base Figure 2): Goose Property (MAD Appendix A, base Figure 3) and the Marine Laydown Area (MLA) (MAD Appendix A, base Figure 4) situated along the western shore of southern Bathurst Inlet. The majority of annual resupply will be completed using the MLA, and an approximately 160 km long winter ice road will interconnect these sites. Refer to the MAD Appendix A, base Figures 1 to 5 for general site layout and locations. A detailed project description is provided in the MAD.

The purpose of this Marine Monitoring Plan (MMP or Plan) is to monitor the marine environment for effects, to assess and update predictions, and to provide the basis for informed management decisions. The Project has been designed to minimize, mitigate, and/or manage potential adverse effects on the marine environment. The MMP and other management plans are intended to support the Type A Water Licence Application for the Project.

The Plan was prepared to address commitments (Table 1-1) made by Sabina during the Nunavut Impact Review Board environmental review process related to marine monitoring.

Table 1-1. Commitments Related to Marine Monitoring

Type	Party	Identifier	Suggested Term & Condition / Commitment as revised and updated during the FEIS Addendum Review Process
Term and Condition	ECCC	FA-ECCC-T-1	The Proponent shall design and implement a marine monitoring program at the Marine Laydown Area to identify potential impacts of the project on the marine environment and inform adaptive management actions. *Commentary: The monitoring program shall be in line with the proposed monitoring in the Aquatic Effects Monitoring Plan presented in the FEIS Vol. 10 Chapter 19.*
Commitment	ECCC	FA-ECCC-C-3	In consultation with INAC, ECCC, and KIA, the Proponent commits to developing a marine environmental monitoring program, in a stand-alone plan, with a greater level of detail and rationale prior to construction, with enough lead time to address monitoring gaps.

This plan is a living document to be updated upon changes in related regulatory requirements, management reviews, incident investigations, changes to facility operation or maintenance, and environmental monitoring results, best practice updates or other Project specific protocols once construction starts through to Project closure activities. Any updates will be filed with the Annual Report to regulators.

The information presented herein is current as of September 2017. The next update will be initiated prior to the start of construction. The Plan will be reviewed as needed for changes in operation and technology, and as directed by regulatory authorities where appropriate. Completion of the updated Plan will be documented through signatures of the personnel responsible for reviewing, updating, and approving the Plan.

A record will document all significant changes that have been incorporated in the Plan subsequent to the latest review. The record will include the names of the persons who made and approved the change, as well as the date of the approval.

Sabina will maintain a distribution list providing contact details for all parties to receive the Plan including key personnel, contractors, organizations, and external agencies.

2. Scope and Objectives

The purpose of the Plan is to monitor the marine receiving environment bordering the MLA. The Plan has been designed to monitor for Project-related effects to a level of detail appropriate for the activity at the MLA, to comply with existing regulations, and to meet commitments made during the regulatory review process.

The primary Project activities that could affect the marine environment include water management infrastructure and associated discharge from the desalination plant (i.e., potential changes to water quality), and infrastructure for barge unloading activities (i.e., potential changes to water quality). Conclusions and recommendations from the monitoring program will be used to determine if existing management and mitigation measures are adequate, and provide an opportunity for ongoing adaptive management.

The core component of the Plan will be water quality, with sediment quality added if required. The Plan will operate through the life of the mine; however, this iteration of the Plan is focussed on additional baseline data collection and the development works phase.

2.1 RELATED PLANS AND DOCUMENTS

Documents within the Application for the Type A Water Licence supporting this plan include the following:

- Spill Contingency Plan (Supporting Document [SD]-17);
- Oil Pollution Emergency Plan (SD-18);
- Aquatic Effects Monitoring Plan (SD-21);
- Quality Assurance and Quality Control Plan (SD-24);
- Water Management Plan (SD-05); and
- Environmental Management and Protection Plan (SD-20).

3. Applicable Legislation and Guidelines

The Plan has been designed to comply with existing regulations including:

- *Arctic Waters Pollution Prevention Act* (1985a);
- *Canada Shipping Act* (2001);
- *Fisheries Act* (1985b);
- *Nunavut Environmental Protection Act* (1988);
- *Nunavut Land Claim Agreement Act* (1993); and
- *Oceans Act* (1996).

This version of the Plan was developed in consideration of commitments made during the regulatory review process. Refer to Table 1-1 and Appendix B-1 of the MAD for additional information.

The Plan is a living document and will be updated as necessary based on regulatory changes, Project-related changes, incident investigations, the need for changes to existing mitigation measures, and input from regulators.

It is anticipated that the Plan could be amended, or updated in the event of a spill to support monitoring of spill clean-up and remediation activities. For additional information related to transportation management refer to the Oil Pollution Emergency Plan (SD-18) and the Shipboard Oil Pollution Prevention Plan. Refer to the Spill Contingency Plan (SD-17) for additional information related to spill management, and for information related to mitigation measures for spills refer to the Risk Management and Emergency Response Plan (SD-15).

4. Sampling Plan

On an annual basis during the life of the Project, water quality samples will be collected from five locations (Table 4-1, Figure 4-1), one to two stations per location, two times per year, during open-water conditions, when there is barge activity and discharge from the desalination plant (approximately July 15 to October 15 each year). The sampling effort is consistent with length of time and relative amount of activity at the MLA.

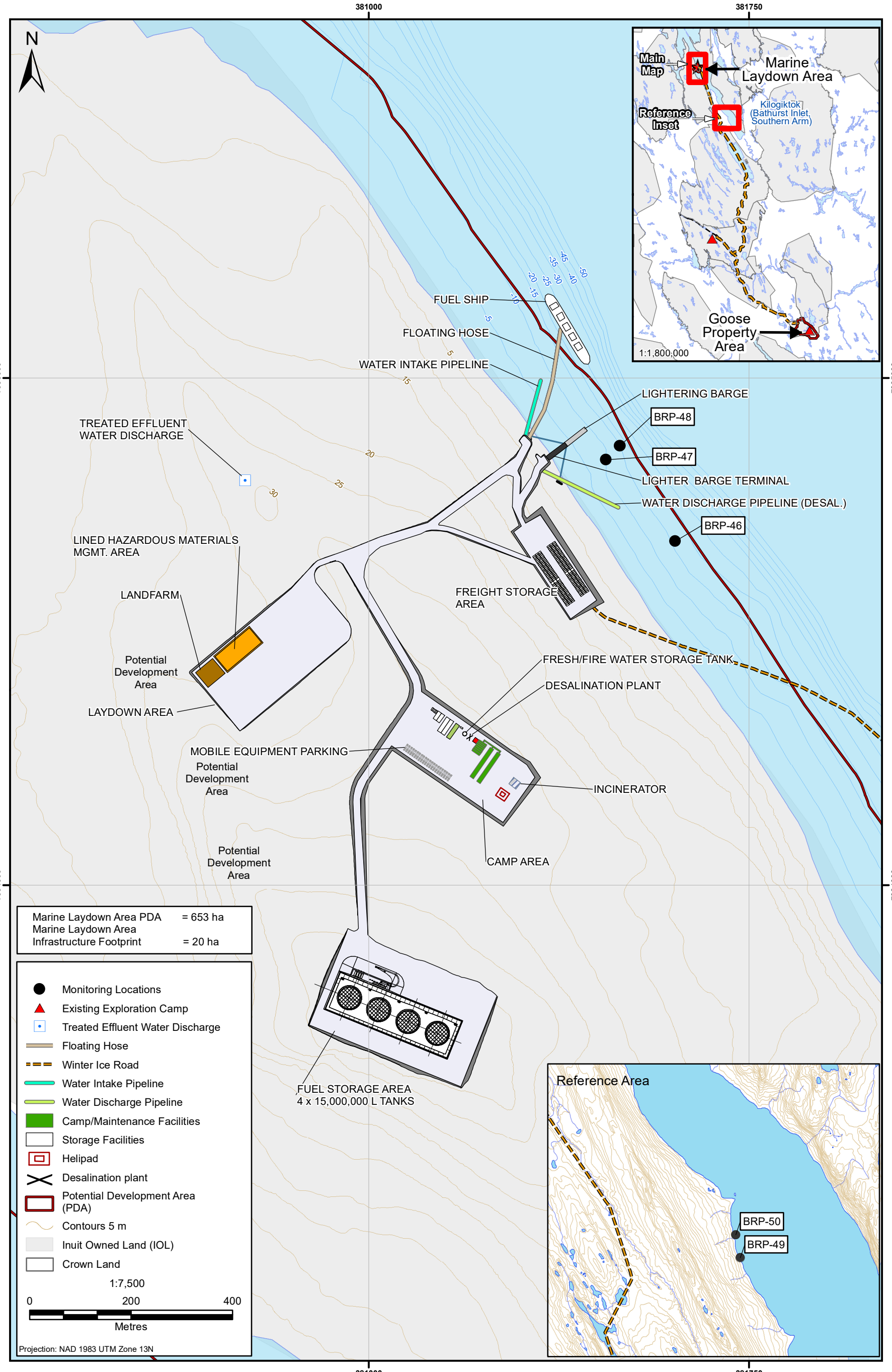
In 2017, supplemental water quality samples will be collected twice (August and September) during open-water conditions, from the five locations, and sediment quality samples will be collected once (August) from the same five locations.

Table 4-1. Sampling Locations

Location ID	Description	Target Water Depth (m)	Purpose	Frequency[1]
BRP-46	MLA mid-shore by the water discharge pipeline	13-15	Monitor marine area near the treated water discharge	Water quality sampling twice per year when there is active discharge to the marine environment
BRP-47	MLA near-shore by the barge	4-5	Monitor marine area in the barge area, near-shore environment	Water quality sampling twice per year when there is barge activity
BRP-48	MLA mid-shore by the barge	13-15	Monitor marine area in the barge area, mid-shore environment	Water quality sampling twice per year when there is barge activity
BRP-49	MLA reference near-shore	4-5	Reference for comparison to exposure near-shore sites	Water quality sampling twice per year in coordination with sampling in the water discharge and barge sampling areas
BRP-50	MLA reference mid-shore	13-15	Reference for comparison to exposure mid-shore sites	Water quality sampling twice per year in coordination with sampling in the water discharge and barge sampling areas

1 Two open-water sampling events per year for water quality; sampling of other media as part of a tiered approach based on water quality results

GIS # BR_NA_tab_MLAMonitoringStns_WL_A_Aug2017Sampling W:\BackRiver\04_Exploration\BackRiverRegion\GIS_Products\ESRI_MXD\Water_Permitting\FINAL_FIGURES\BR_NA_tab_MLAMonitoringStns_WL_A_Aug2017Sampling.mxd September 21 2017



NOTE: All roads at the MLA are service roads

Sabina GOLD & SILVER CORP.

Figure 4-1

Proposed Marine Monitoring Locations
Marine Laydown Area, Back River Project

4.1 WATER QUALITY

Field measurements (e.g., water depth, field profiles) will be recorded when samples are collected. Field profiles (measured every 1 m) of specific conductivity, pH, salinity, temperature, and dissolved oxygen will be recorded using a multi-meter (e.g., YSI 6-Series Multimeter), along with measurements of total water depth, sample collection depth, and Secchi depth (in open-water).

Water quality samples will be collected from specific sampling locations (Table 4-1; coordinates still to be confirmed) at specific depths (to be confirmed; n=2 samples) in the water column using a grab sampler (e.g., 5L Niskin water sampler).

Samples will be collected in bottles provided by an accredited analytical laboratory. The suite of parameters to be analyzed in the samples is listed in Table 4-2. Water quality samples will be analyzed by an accredited laboratory at detection limits less than aquatic life guidelines or similar to detection limits used in previous baseline studies.

Table 4-2. Water Quality Parameters

Parameter	Units	Detection Limits
General Constituents		
Hardness (as $CaCO_3$)	mg/L	0.50
pH	pH	0.10
Total Suspended Solids	mg/L	2.0
Turbidity	NTU	0.10
Alkalinity, Total (as $CaCO_3$)	mg/L	1.0
Major Ions		
Bromide (Br)	mg/L	5.0
Calcium (Ca)	mg/L	0.50
Chloride (Cl)	mg/L	50
Fluoride (F)	mg/L	1
Magnesium (Mg)	mg/L	1.0
Potassium (K)	mg/L	20
Sodium (Na)	mg/L	20
Sulfate (SO_4)	mg/L	30
Nutrients		
Ammonia, Total (as N)	mg/L	0.0050
Nitrate (as N)	mg/L	0.0050
Nitrite (as N)	mg/L	0.0010
Orthophosphate-Dissolved (as P)	mg/L	0.0010
Phosphorus (P)-Total	mg/L	0.0040
Silicate (as SiO_2)	mg/L	0.50
Organic / Inorganic Carbon		
Total Organic Carbon	mg/L	0.50
Total and Dissolved Metals		
Aluminum (Al)	mg/L	0.0050
Antimony (Sb)	mg/L	0.00050

(continued)

Table 4-2. Water Quality Parameters (completed)

Parameter	Units	Detection Limits
Arsenic (As)	mg/L	0.0020
Barium (Ba)	mg/L	0.0010
Beryllium (Be)	mg/L	0.00050
Bismuth (Bi)	mg/L	0.00050
Boron (B)	mg/L	0.10
Cadmium (Cd)	mg/L	0.000050
Cesium (Cs)	mg/L	0.00050
Chromium (Cr)	mg/L	0.00050
Cobalt (Co)	mg/L	0.000050
Copper (Cu)	mg/L	0.00050
Iron (Fe)	mg/L	0.010
Lead (Pb)	mg/L	0.00030
Lithium (Li)	mg/L	0.020
Manganese (Mn)	mg/L	0.00020
Mercury (Hg)	mg/L	0.000010
Molybdenum (Mo)	mg/L	0.0020
Nickel (Ni)	mg/L	0.00050
Rubidium (Rb)	mg/L	0.0050
Selenium (Se)	mg/L	0.0020
Silver (Ag)	mg/L	0.00010
Strontium (Sr)	mg/L	0.050
Thallium (Tl)	mg/L	0.000050
Tin (Sn)	mg/L	0.0010
Uranium (U)	mg/L	0.000050
Vanadium (V)	mg/L	0.00050
Zinc (Zn)	mg/L	0.0030
Hydrocarbons		
Oil and Grease	mg/L	1.0
Benzene	mg/L	0.0005
Ethylbenzene	mg/L	0.0005
Toluene	mg/L	0.0005
Xylene	mg/L	0.00071
F1 BTEX	mg/L	0.1
F2 (C10-C16)	mg/L	0.25
F3 (C16-C34)	mg/L	0.25
F4 (C34-C50)	mg/L	0.25

4.2 SEDIMENT QUALITY

Sediment quality samples will be collected in 2017 to supplement baseline data collected for the Final Environmental Impact Statement and to support future adaptive management responses. Sediment samples will not be collected on an annual basis but will be collected as required if triggered by through adaptive management.

Surficial sediment samples will be collected with an appropriate surface grab sampler after collection of supporting field profiles and water quality samples. The upper two to five centimetres, and the centre portion of the grab, will be targeted. At each station, up to three grabs will be collected and the material combined to form a composite sample.

Samples will be collected in containers provided by an accredited analytical laboratory. The suite of parameters to be analyzed in the samples is listed in Table 4-3. Sediment quality samples will be analyzed by an accredited laboratory at detection limits less than aquatic life guidelines or similar to detection limits used in previous baseline studies. The specific limits will be provided once the analytical laboratory has been selected.

Table 4-3. Sediment Quality Parameters

Parameter	Units	Detection Limits
Physical Tests		
Moisture	%	0.5
pH	pH	0.10
Particle Size		
% Gravel (>2mm)	%	1.0
% Sand (2.0mm - 0.063mm)	%	1.0
% Silt (0.063mm - 4um)	%	1.0
% Clay (<4um)	%	1.0
Texture	-	-
Anions and Nutrients		
Total Nitrogen by LECO	%	0.020
Organic / Inorganic Carbon		
Total Organic Carbon	%	0.050
Metals		
Aluminum (Al)	mg/kg	50
Antimony (Sb)	mg/kg	0.10
Arsenic (As)	mg/kg	0.10
Barium (Ba)	mg/kg	0.50
Beryllium (Be)	mg/kg	0.10
Bismuth (Bi)	mg/kg	0.20
Boron (B)	mg/kg	5
Cadmium (Cd)	mg/kg	0.020
Calcium (Ca)	mg/kg	100
Chromium (Cr)	mg/kg	0.50
Cobalt (Co)	mg/kg	0.10

(continued)

Table 4-3. Sediment Quality Parameters (completed)

Parameter	Units	Detection Limits
Copper (Cu)	mg/kg	0.50
Iron (Fe)	mg/kg	50
Lead (Pb)	mg/kg	0.50
Lithium (Li)	mg/kg	0.50
Magnesium (Mg)	mg/kg	20
Manganese (Mn)	mg/kg	1.0
Mercury (Hg)	mg/kg	0.0050
Molybdenum (Mo)	mg/kg	0.10
Nickel (Ni)	mg/kg	0.50
Potassium (K)	mg/kg	50
Selenium (Se)	mg/kg	0.20
Silver (Ag)	mg/kg	0.10
Sodium (Na)	mg/kg	100
Strontium (Sr)	mg/kg	0.50
Thallium (Tl)	mg/kg	0.050
Tin (Sn)	mg/kg	2.0
Titanium (Ti)	mg/kg	1.0
Uranium (U)	mg/kg	0.050
Vanadium (V)	mg/kg	0.20
Zinc (Zn)	mg/kg	1.0
Hydrocarbons		
Benzene	mg/kg	0.005
Ethylbenzene	mg/kg	0.02
Toluene	mg/kg	0.05
Xylene	mg/kg	0.1
Total Hydrocarbons (C6-C50)	mg/kg	20
F1 (C6-C10)	mg/kg	10
F2 (C10-C16)	mg/kg	20
F3 (C16-C34)	mg/kg	20
F4 (C34-C50)	mg/kg	20

4.3 QUALITY ASSURANCE AND QUALITY CONTROL

Samples will be collected following standard sampling protocol (e.g., see the Quality Assurance and Quality Control Plan; SD-24) by qualified personnel using suitable sampling equipment. Water samples for laboratory analysis will be filtered and preserved (as required), and water and sediment samples for laboratory analysis will be stored in a cool environment before shipping to the laboratory. Quality control samples (i.e., duplicates) will be collected at a quantity of 10% of all samples collected.

4.4 REPORTING

Results collected in any given year will be included in the annual report. Descriptive summary statistics will be calculated and results will be analyzed by comparison to aquatic life guidelines (CCME 1999) and baseline conditions (calculated from all data to support the Final Environmental Impact Statement and any supplemental, development works data).

5. Adaptive Management

Best management practices and environmental design criteria are expected to prevent or minimize adverse effects on the receiving environment. Ongoing monitoring will inform Sabina of the effectiveness of these strategies. If any unforeseen adverse effects are identified during the life of the Project, mitigation measures will be taken to correct them and prevent them from occurring in the future. Adaptive management is an iterative approach based on a learning process gained from monitoring, and it improves long-term management outcomes. More details on the adaptive management approach for the Project are provided in the Environmental Management and Protection Plan (SD-20).

6. References

1985a. *Arctic Waters Pollution Prevention Act*, RSC. C. A-12.

1985b. *Fisheries Act*, RSC. C. F-14.

1988. *Environmental Protection Act*, RSNWT (Nu). C. E-7.

1993. *Nunavut Agreement Act*, SC. C. 29.

1996. *Oceans Act*, SC. C. 31.

2001. *Canada Shipping Act*, SC. C. 26.

CCME (Canadian Council of Ministers of the Environment). 1999 (with updates to 2015). Canadian Environmental Quality Guidelines for the Protection of Aquatic Life – Summary Table. Available at: http://st-ts.ccme.ca/. Accessed: February 2016.