Sabina
GOLD & SILVER CORP.

The BACK RIVER PROJECT

Final Environmental Impact Statement

Volume 10: Management Plans

November 2015

Document Structure

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Back River Project Fact Sheet

November 2015

Location

- Located in the western Kitikmeot Region of Nunavut at approximately 65° north latitude and 106° west longitude. About 400 km south of Cambridge Bay and 525 km northeast Yellowknife.
- Primary communities: Kugluktuk, Cambridge Bay, Gjoa Haven, Kugaaruk, and Taloyoak.
- The closest community areas to the Project are Kingaok, located approximately 160 km north of the Goose Property, and Omingmaktok, located approximately 250 km northeast of the Goose Property.

Reserves

- Four mining areas within the Goose Property: Umwelt, Llama, Goose Main, and Echo.

Mobilization and Construction Phase

- The project could commence as early as 2016 and take four years to mobilize and construct.
- Up to a $695 M initial capital investment.

Operational Phase

- Open pit and underground mines at each of the four Goose deposits.

Production

- Ore production: 19.8 million tonnes of mill feed over the life of mine.
- Projected annual 350,000 ounces of gold for about up to 10 years.

Processing

- Processing plant throughput of 6,000 tonnes per day.
- Standard gravity separation and cyanide leaching circuit.
- Tailings storage facilities in Goose Potential Development Area but purpose-built TSF on Crown land.

Transport

- Gold doré bars shipped out by aircraft.

Access Roads

- All-weather roads within Goose and MLA properties.
- Winter ice road between Goose and MLA properties.
- Winter ice road connection to George Exploration Camp.

Re-supply

- Marine supply via open water seasonal shipping (approximately 3 to 5 vessels per year).
- Year-round by aircraft.
- Winter ice road to connect the Goose and MLA properties.

Environment

- Extensive baseline studies including terrestrial environment, wildlife (particularly caribou), marine environment, freshwater environment, air quality, human environment, and resource utilization.
- Traditional knowledge (TK) information collected and analyzed through an Inuit-owned major study – *Naonaiyaotit Traditional Knowledge Project*.
- Baseline and TK information will form the foundation of Environmental Impact Statement and provide information for development of mitigation and management plans.

Employment

- Fly-in/fly-out operation.
- Direct construction employment up to 1,500 person-years over a four year period.
- Direct operations employment up to 6,970 person-years over a 10 year period.

Social and Economic Benefits

- Inuit Impact Benefits Agreement to be finalized with the Kitikmeot Inuit Association.
- Employment opportunities at the site.
- Opportunities for local businesses.
- Royalties and taxes to governments.

Closure and Post-closure Phase

- Closure will ensure that the former operational footprint is both physically and chemically stable in the long term for protection of people and the natural environment.
- Post-closure environmental monitoring will continue until it has been verified that reclamation has successfully met closure and reclamation objectives.

BACK RIVER PROJECT

FINAL ENVIRONMENTAL IMPACT STATEMENT
Supporting Volume 10:
Management Plans

November 2015
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BACK RIVER PROJECT
Environmental Management Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions)
Chapter 1	All Sections	George	Removal of reference to the George Property
	All Sections	Edits	Numerous syntax edits
	2.1	Figures	Updates to figures based on FS Design
	2.0	Introduction	Updated EMS introduction
	3.1	Policy Statement	Updated policy statement to reflect Sustainable Development
	5.1	Roles and Responsibilities	Updated to reflect FEIS management plan approach
	14	EMP Utilization Table	Updated to reflect commitments list requirements

BACK RIVER PROJECT
ENVIRONMENTAL MANAGEMENT PLAN

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Glossary and Abbreviations

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

AANDC	Aboriginal Affairs and Northern Development Canada
DFO	Fisheries and Oceans Canada
EC	Environment Canada
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMS	Environmental Management System
EPP	Environmental Protection Plan
GN	Government of Nunavut
IQ	Inuit Qaugimajatuqangit
KIA	Kitikmeot Inuit Association
NIRB	Nunavut Impact Review Board
NWB	Nunavut Water Board
PDCA	Plan, Do, Check, Adjust
QA/QC	Quality Assurance/Quality Control
TC	Transport Canada
VEC	Valued Ecosystem Component
VSEC	Valued Socio-economic Component

1. Introduction

This volume describes how Sabina Gold & Silver Corp. (Sabina) intends to implement a range of environmental monitoring and management measures throughout the life of the Back River Project (the Project). These measures demonstrate how Sabina will avoid, or minimize to an acceptable level, the potential negative environmental effects identified in this Final Environmental Impact Statement (FEIS).

Specific environmental management plans (EMPs) outline the potential impacts, objectives, targets and indicators, key management measures, and the monitoring, reporting, auditing and review requirements. Each EMP is focused on a specific activity or issue and these are provided as chapters to this volume. These plans will be used to provide the overarching direction for environmental and socio-economic management for the Project and form the basis for the ongoing development of further detailed environmental documentation through permitting at the different phases of the Project. They have been developed through the EIS process and, where applicable, are in accordance with regulatory requirements and are designed to meet the expectations of agencies and the community.

Sabina's Sustainable Development Policy and the associated Environmental Management System provide the framework through which the EMPs will be delivered. The EMS is the system through which Sabina will ensure that the conditions set at the time of authorization, and legal requirements are met. They will also ensure that standard operating procedures reflect legal requirements pertaining to the Project.

The EMS will offer flexibility for each EMP to respond to changes in the mine execution plan, the regulatory regime, the biophysical and socio-economic environments, technology, research results, and the understanding of traditional knowledge, or any other situations that arise. Threshold values and indicators will be established and will be used to trigger management actions that are outlined in each EMP. A system of accountability will also be implemented.

Future refinements to these EMPs will include detailed construction level environmental documentation for plans, processes and procedures that will be prepared either directly by Sabina's Environmental Department or by specialist consultants and contractors in conjunction with Sabina.

2. Sabina's Environmental Management System

The company has developed an Environmental Management System (EMS) that provides Sabina with a tool for managing the effects of its activities on the environment, as well as providing a structured approach to planning and implementing environmental protection measures. Planning for the EMS started with the development of the DEIS, which identified existing (baseline) conditions, assessed potential effects of the Project, developed conceptual mitigation strategies, and developed specific mitigation measures to execute these strategies.

This revised version reflects updates and improvements to the Project design, comments from DEIS reviewers, and the inclusion of relevant commitments from the NIRB PHC Decision Report (December 2014). It is anticipated that this version of the EMS will be revised again based on management reviews, incident investigations, regulatory changes, or other Project-specific protocols. The EMS will be included in Sabina's future Type A Water Licence Application, and may be updated prior to application submission pending comments from review of the FEIS. The plan may be updated again

prior to construction if instructed to do so by the NWB during the licensing process. The plan will be reviewed on a regular basis to incorporate any lessons learned, major changes to facility operation or maintenance, and environmental monitoring results. Any updates will be filed with the Annual Report submitted under the Type A Water Licence.

Significance criteria have been developed that assist in identifying priority aspects, establish management criteria, and activity-specific mitigation measures. For social issues and effects, a key factor for determining significance is ongoing feedback from public consultation. These efforts will be used to communicate progress, and involve the public where necessary, on environmental performance.

The strategies and measures outlined in this volume have been developed and anchored on an effective adaptive management philosophy. As part of continual improvement, the management plans herein will be revised periodically to accommodate new and amended legislation, evolving industry standards, emerging community concerns, or changes to the project's design or schedule. By taking an adaptive management approach, rigorous plans can be developed early based on the best information available before project detailed engineering and construction. After the detailed engineering design phase, these plans can be adjusted, if needed, and monitoring implemented to measure whether the actions in the management plans are working as designed.

Monitoring will be the principal mechanism to provide feedback to continually gauge the effectiveness of environmental performance. Operational control is facilitated through the contractor job-specific standard operating procedures (SOP), work instructions, on-the-job instruction, tailgate meetings where required, contract requirements, and service agreements. The effectiveness of physical operational control will be reviewed according to preventative maintenance and review procedures and schedules.

The EMS has been based on a continual improvement model as defined in the internationally recognized standards ISO 14001:2004, Environmental Management System. The current model is shown in Figure 2-1.

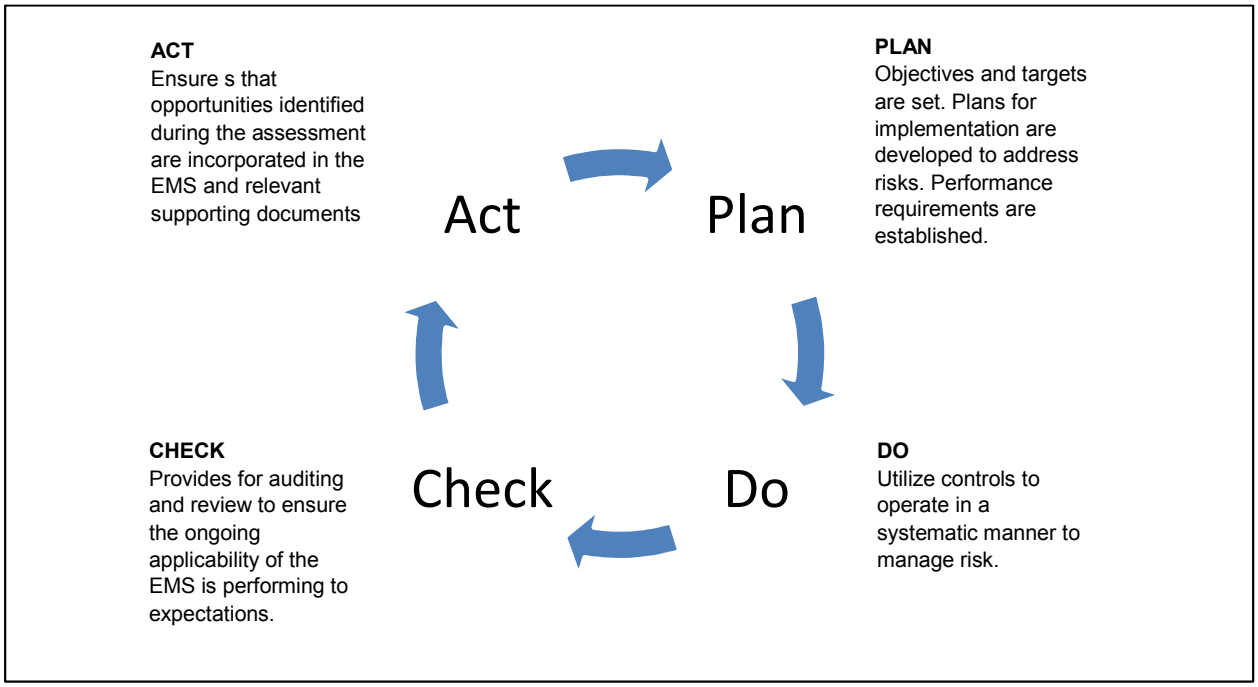

Figure 2-1. Continual Improvement Model

Throughout all phases of the cycle, community engagement will be an integral part of decision making. As well, the application of the Precautionary Principle will be a fundamental consideration in any action.

The EMS is structured around 10 core elements with associated sub-elements (Table 2-1). Each of the elements is addressed in additional detail below. The EMS elements are interrelated and each one is essential for the effective operation of the process as a whole. As well, environment, health and safety are interrelated and in the EMS process each element describes an essential part of the overall management of matters relating to all three components.

Table 2-1. Core Elements of Sabina's Environmental Management System

Element	Title
1	Sustainable Development Policy and leadership
2	Planning
3	Organization and resources
4	Documents and records
5	Risk management
6	Regulatory requirements
7	Implementation, monitoring and measurement
8	Emergency and crisis management
9	Monitoring and audit
10	Management review

The final section of this chapter outlines the follow up and adaptive management programs that will be conducted through all phases of the mine life. These provide an overview of the monitoring plans for the biophysical and human environment required of operating mines. It is expected that these plans will be modified and refined through discussions with regulatory authorities and during the permitting phase.

Ownership of the EMS resides with Sabina's management team, who will make provision for the resources necessary to assure the successful implementation and sustainability of the process.

3. Element 1: Sustainable Development Policy and Leadership

Sabina is committed to environmentally responsible and socially acceptable exploration and mining practices. The Company is dedicated to creating and maintaining a safe environment for both the land it occupies and the people that drive its success. Sabina also subscribes to the principles of sustainable development in mining. While mining cannot occur without an impact on the surrounding natural environment and communities, the company's responsibility is to limit negative environmental and social impacts and to enhance positive impacts. The executive and management team will demonstrate to employees, contractors, government and the community that the company regards excellence in environmental performance a priority.

Sabina is committed to managing environment, health and safety issues to the highest standards and has set out its commitment in the form of a sustainable development policy. The policy, approved by

Sabina's Executive Directors, clearly states Sabina's commitments to continuous environmental performance improvement.

Sabina considers leadership accountability and transparency to be key components in the successful implementation of the environmental management process. The commitment of Sabina's executive and management team will demonstrate to employees, contractors, government and the community that the company regards excellence in environmental performance a priority.

3.1 SUSTAINABLE DEVELOPMENT POLICY

Sabina Gold & Silver Corp. regards itself as a responsible explorer and mineral developer. We are committed to fostering sustainable development throughout all stages of our activities. We constantly strive to conduct our operations in a manner that balances the social, economic, cultural and environmental needs of the communities in which we operate. To build on this commitment Sabina will:

- Meet or strive to exceed all relevant legislated sustainable development requirements in the regions where we work.
- Ensure appropriate personnel, resources and training is made available to implement our sustainable development objectives.
- Establish clear lines of responsibility and accountability throughout the Company to meet these objectives.
- Implement proven management systems and procedures to facilitate our sustainable development objectives. A priority will be placed on developing and implementing management structures related to the environment, health and safety, emergency response and stakeholder engagement.
- Act as responsible stewards of the environment for both current and future generations. We will make use of appropriate assessment methodologies, technologies and controls to minimize environmental risks throughout all stages of mineral development.
- Work closely with local communities and project stakeholders to understand their needs, address their concerns and provide project-related benefits to create win-win relationships. Our goal is to earn and maintain a social licence to operate at all our operations while building partnerships.
- Pursue economically feasible projects in order to generate shareholder profitability and support long-term positive socio-economic development in the regions where we work.
- Utilize a precautionary approach as it applies to potential effects from our activities. Work with employees, contractors and stakeholders to promote a culture of open and meaningful dialogue to ensure that any known or suspected departures from established protocols are reported to management in a timely manner.
- Regularly review this policy to ensure it is consistent with Sabina's current activities and the most recent legislation.
- Continually improve our performance and contributions to sustainable development including pollution prevention, waste minimization and resource consumption.
- Implement programs at each of our operations to monitor and report compliance and proactively address potential deficiencies in our policies and procedures.

The objectives of our Sustainable Development Policy cannot be accomplished without the active involvement and commitment of many dedicated individuals. As such, we will regularly communicate this policy and its outcomes to our employees, contractors and relevant stakeholders. Together, we can foster a culture of sustainable development at Sabina.

4. Element 2: Planning

Planning is an essential part of the EMS as it assists Sabina in fulfilling its Sustainable Development Policy. Sabina will establish, implement and maintain documented objectives and targets consistent with the requirements of each EMP. The objectives and targets will be set alongside business targets during the business planning process to give a clear indication of the importance placed by Sabina on EMS performance. Programs will be developed to ensure that these objectives and targets are achieved.

The following subsections detail the key elements to our planning.

4.1 PRECAUTIONARY APPROACH

The Precautionary Principle stipulates that lack of certainty regarding threats of environmental harm should not be used as an excuse for not taking action to avert that threat. It also recognizes that delaying action until there is compelling evidence of harm will often mean that it is then too costly or impossible to avert the threat. The use of the Precautionary Principle promotes action to avert risks of serious or irreversible harm to the environment.

Sabina integrates the application of the Precautionary Principle throughout the design of the Project. This approach forms the basis for project design criteria, the effects assessment volumes of the FEIS, the alternatives assessment and management practices.

Sabina is fully committed to acting as a socially responsible steward of the environment throughout the lifetime of the project. To this end, the precautionary approach will be integrated into decision making on all aspects of implementation. In the absence of scientific consensus regarding risk to the public or the environment of a specific action, that action will be assumed harmful unless and until further conclusive scientific evidence determines that no harm shall result.

In gathering data to achieve scientific consensus, Sabina has conducted extensive research to establish baseline data, and where data is not yet available, incorporated examples from other similar, established operations. Extensive consultations with local stakeholders ensures that local and traditional knowledge will be fully evaluated and incorporated in order to support the goal of achieving scientific consensus.

Where there is uncertainty or some plausible risk, conservative approaches, together with a dynamic process of adaptive management will be implemented. A flexible approach will be supported by the design of monitoring programs to address all areas of uncertainty, provide a process for mitigation, and to further support the ongoing collection of scientific data.

4.2 TRADITIONAL KNOWLEDGE

Sabina recognizes that Traditional Knowledge (TK) is an “indispensable element both as baseline information and as an Inuit lens through which impact analyses can be better understood and can also result in a more active and meaningful community engagement” (NIRB EIS Guideline – April 2013).

Volume 3, Chapter 4 summarizes the efforts undertaken by Sabina to incorporate TK into the Project development. As detailed in Chapter 26, Section 7 of this volume, Sabina has proposed community engagement methods to ensure integration of TK and public feedback throughout the life of the project. The Socio-economic Monitoring Program in Chapter 23 details the approach and methods through which outcomes will be monitored and reported.

4.3 PROJECT DESIGN CONSIDERATIONS

A number of considerations in project design, operational safeguards, and contingency plans have been incorporated to mitigate potential impacts. Highlights of the mitigation measures incorporated into Project design include:

- Minimize project footprint, thus minimizing the loss of habitat and reduction of habitat effectiveness.
- Contain the Project mining activities within the Goose watersheds.
- To the extent possible, avoid known archaeological sites and prioritize avoidance of important (unique and/or old) sites.
- Maintain at least a 31 meter buffer from streams and waterways.
- Use of winter ice roads for access to the Goose Property and MLA.
- Maintain a buffer zone from important bird nesting areas.
- Maximize sourcing of aggregate and borrow materials from open pits.
- Select water sources in which Project water withdrawals will minimize the potential for drawdown and effects to fish habitat and the aquatic environment.

Construction activities will utilize the existing Project infrastructure and footprint to the greatest extent practical to minimize land disturbance and improve the overall efficiency of construction activities. Where possible, permanent support infrastructure will be built at the onset of construction, to be used during both construction and operation phases of the Project. In many instances, temporary infrastructure will be constructed or positioned at Project sites for the duration of the construction phase only. This temporary infrastructure will be removed at the completion of the construction phase.

4.3.1 Climate Change

Sabina recognizes the importance of climate change and a discussion of climate change and its potential impact on the project is presented in Volume 9. The design incorporates measures to cope with potential effects of climate changes. These considerations and adaptive measures were identified in two recent studies commissioned by the Government of Nunavut:

- Golder Associates, Vulnerability Assessment of the Mining Sector to Climate Change – Task 1 Report, March 2012.
- Journeaux Associates, Engineering Challenges for Tailings Management Facilities and associated Infrastructure with Regard to Climate Change in Nunavut, March 2012.

4.3.2 Ecosystem Integrity

Comprehensive baseline studies have been undertaken to characterize the various biophysical components of the Project. A range of mitigation measures have been identified that will enable

Sabina to minimize effects on the receiving environment. These mitigation measures are presented in Volume 4 through 8 of this FEIS.

- Volume 4 for the atmospheric environment.
- Volume 5 for the terrestrial environment.
- Volume 6 for the freshwater environment.
- Volume 7 for the marine environment.
- Volume 8 for the human environment.

For instance, potential impacts to fish due to current and future activities include directly removing or altering fish habitat by drilling, dewatering, pipe and culvert installations, and indirectly through affecting water quality or sediment quality. The main mitigation measure employed to prevent serious harm to fish will be avoidance. A range of specific and generally accepted techniques for sediment control, site isolation, timing/sequencing, reclamation and rehabilitation will be used to avoid serious harm, prevent the introduction of deleterious substances to watercourses, and to minimize adverse effects of disturbances to fish habitat. Potential effects associated with in-water works will be minimized through adherence to Best Management Practices as outlined in the Site Water Monitoring and Management Plan, Aquatic Effects Management Plan, the Mine Closure and Reclamation Plan, and DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat.

The EMS and management framework defines the sequence of policy, planning, implementation and operation, checking and corrective actions, and, management review processes that must be established to ensure that the Back River Project is executed in an environmentally acceptable manner.

4.4 ENVIRONMENTAL MANAGEMENT PLANS

Sabina will update environmental management plans on an annual basis to target specific issues and ensure that responsibilities for individual actions are clearly assigned. Development of these plans is carried out on the basis of a continual-improvement cycle and will define objectives that are clearly measurable and achievable. The development of EMPs will be formalized and will be scheduled to coincide with the budget planning cycle.

4.5 SCOPE

The scope of the EMS applies to all operations and consists of the following issues as they relate to health and safety and environmental management:

- Mining: all aspects of the evaluation of the ore reserve; design of mining approaches and considerations in the management of mine.
- Mill: crushing and processing of the ore, maintenance and deposition of tailings.
- Finance, Procurement, Warehouse, Information Technology and Administration.
- Site safety and security.
- Human Resources: employee recruitment and training, medical services, catering and personnel.
- Environment: monitoring, waste management, project site reclamation.
- Worker health: workplace exposures and occupational disease.
- Community health: community exposures and other determinants of health and well-being.

4.6 OBJECTIVES AND TARGETS

Environmental, health and safety objectives and targets for the Project have been identified in the individual EMPs contained in this volume. Key objectives will be to:

- Protect worker health.
- Prevent incidents or workplace accidents and injuries.
- Maintain productivity by directly or indirectly enhancing social conditions to positively affect the well-being of workers.
- Provide a safe and healthy workplace for all employees, contractors and visitors.
- Ensure all people understand that “no task is so important that time cannot be taken to complete work safely.”
- Identify and make provisions to address the needs of all individuals with respect to health and safety; in a manner that one’s ability to perform work is not compromised.
- Recognize that social responsibility and environmental management are among the highest corporate priorities.
- Establish and maintain relationships with internal and external stakeholders.
- Maintain information on legislative requirements and environmental and social aspects associated with the organization’s activities.
- Assign clear accountability and responsibility for environmental protection and social responsibility to management and employees.
- Facilitate environmental planning through project life cycle.
- Provide a process for achieving targeted performance levels.
- Provide appropriate and sufficient resources, including training, to achieve targeted performance levels on an ongoing basis.
- Evaluate environmental performance and social responsibility against Sabina’s sustainable development and other policies, objectives and targets and seek improvement where appropriate.
- Establish a management process to audit and review the Sabina EMS and to identify opportunities for improvement of the system and resulting environmental performance.

Objectives and targets will be reviewed regularly through the operations phase to ensure that there is continuous improvement in environmental performance.

4.7 DAILY TASK CONTROL

Sabina will ensure that the planning required for daily task management benefits from risk identification (e.g., through job hazard analysis and environmental effects assessments), feedback from employees, tailgate meetings, work reviews, and other permitting reviews.

5. Element 3: Organization and Resources

Sabina will identify and provide the resources required to implement, maintain and improve the EMS and environmental commitments. Similarly, key contractors will be required to demonstrate to Sabina's satisfaction that each has appropriate resources and have an appropriate organizational structure to meet environmental commitments and Project conditions. Responsibilities and accountabilities for the provision of environmental performance are assigned to all personnel throughout the organization by means of management plans, procedures and position descriptions.

5.1 ROLES AND RESPONSIBILITIES

Environmental management at the Back River Project is the responsibility of all site personnel, including employees and contractors. This philosophy will be communicated to all that go to the Project site.

A Health, Safety, and Environment (HSE) team will be established to lead environmental management at the site. Community and government relations will also be the responsibility of the HSE team. Corporately, these aspects of the Project will be led by a Vice President, Environment & Sustainability, who reports to the Chief Executive Officer and the Board of Directors.

At the Project sites, the General Manager will be responsible for environmental management, supported by an HSE team and reporting to the Vice President, Environment & Sustainability. An HSE Manager will be responsible for the day-to-day environmental management activities. The conceptual HSE team roles and responsibilities are described in Table 5.1-1. These will evolve with the development of the corporate and Project-specific organization philosophies.

Table 5.1-1. HSE Team Roles and Responsibilities

Position	Roles and Responsibilities
Vice President, Environment & Sustainability	• Corporate responsibility for environmental management, as well as community and government relations
General Manager	• Overall responsibility for health, safety, and environmental management at the Project sites (mine, winter ice road and MLA) • Reports to the Vice President, Environment & Sustainability
HSE Manager	• Responsible for day-to-day environmental management as well as health and safety compliance and monitoring • Reports to the General Manager
Environmental Superintendent	• Reports to and supports the HSE Manager • Oversees environmental inspections, monitoring and record-keeping at site • Coordinates the efforts of Environmental Coordinator / Technicians • Coordinates specialized consultants and studies • Assists with emergency response, as described in the Risk Management and Emergency Response Plan. This includes contacting the Emergency Response Coordinator (ERC) for major incidents and report spills to NWT-NU 24-hour Spill Report Line • Primary contact with lands and waters inspectors • Prepare and submit follow-up documentation required by appropriate regulators.
Environmental Coordinator/Technicians	• Reports to and supports the Environmental Superintendent • Carry out day-to-day environmental inspections, monitoring and record keeping activities

(continued)

Table 5.1-1. HSE Team Roles and Responsibilities (completed)

Position	Roles and Responsibilities
Community Affairs Manager	• Reports to and supports the Vice President, Environment & Sustainability • Responsible for managing and coordinating Community Liaison Officers (CLOs) and community engagement activities. • Primary point of contact for community organizations
Community Liaison Officer(s) / Inuit Training & Employment Coordinators	• Reports to and supports the Community Affairs Manager • Carries out day-to-day community engagement activities, including liaising with community organizations and individuals • Provides support to community members seeking training and employment • Coordinates site worker arrivals and departures from site
Health & Safety Superintendent	• Reports to and supports the HSE Manager • Oversees health and safety inspections, monitoring and record-keeping at site • Coordinates the efforts of Health & Safety Officers • Assists with emergency response, as described in the Risk Management and Emergency Response Plan • Primary contact with mine safety inspectors; prepares and submits any required follow-up documentation required by mines inspector • Oversees documentation of internal health and safety record-keeping • Implements actions in response to health and safety infractions and incidents
Health & Safety Officers	• Reports to and supports the Health & Safety Superintendent • Conducts routine health and safety inspections • Provides health and safety training and information to workers

5.2 TRAINING, AWARENESS, AND COMPETENCE

Sabina and contractor personnel will undertake environmental awareness training to provide an understanding of Sabina's Sustainable Development Policy, the environmental aspects and sensitivities of the proposed activities, and the EMS. All employees will be appropriately trained and qualified to carry out their duties under the scope of the EMS. The three key aspects of training are general environmental, cultural awareness and job specific training. This will be undertaken through onsite/offsite staff inductions and targeted training programs for specific activities or positions. Environmental training programs will be developed and implemented prior to the commencement of the construction and operations phases of the Project. Contracts awarded for the construction, commissioning, operations or decommissioning phases of the Project will detail specific requirements for contractors in respect of environmental training needs.

5.3 COMMUNICATION

Effective internal and external communication processes, including responding to public concerns, are an integral part of effective environmental management. The environmental requirements of the EMS will be communicated through site communication meetings, Health, Safety and Environment committee meetings (executive and employee), toolbox meetings, training, inductions, as well as through the distribution of plans, procedures and work instructions. Procedures have been implemented in this volume for receiving, documenting and responding to communications from external sources on environmental matters, including accidents, incidents and emergency response.

5.4 CONTRACTOR MANAGEMENT

Sabina pre-evaluates candidate contractors and service providers to assess their technical capabilities, their experience, and their commitment to health, safety, environmental protection and quality assurance. The preparation of an EMP will be required for long-term or higher risk third-party

contracts. No work will be permitted to commence on site until all appropriate documentation has been approved by Sabina.

A process will be established to ensure that effective communication channels are established between Sabina and its major contractors and service providers. This communication may include regular "toolbox" or other meeting topics, and will be used to discuss any relevant issues, including critical interfaces, permits to work, risk assessments, process changes, and performance monitoring and evaluation.

6. Element 4: Documents and Records

Sabina will maintain documented programs and procedures to address hazards and risks, regulatory requirements, and operating standards identified in the EMS elements.

Detailed environmental documentation, for example plans, procedures and processes, will be developed for the Project to assist in the successful implementation of the EMS.

6.1 DOCUMENT CONTROL

Sabina has implemented a document control system which will be utilized for all Project documents. The information will be maintained in a suitable medium, in both printed and electronic form, to provide direction to related documentation and to describe the core elements of the management system and how these elements interact.

6.2 CONTROL OF ENVIRONMENTAL RECORDS

Sabina will ensure that all environmental records will be legible, identifiable and traceable to the activity, product or service involved. Environmental records will be stored and maintained in such a way that they are readily retrievable.

7. Element 5: Risk Management

Sabina has developed a risk management process to describe the methods and responsibilities to be used to ensure that risk management is planned and executed effectively. The Risk Management Process ensures the systematic assessment and management of risk. The risk assessment methodology applied in this FEIS is described in Volume 9, Chapter 3.

Change in the work environment can pose particular risks and the mining industry clearly recognizes the risks that can arise from temporary and permanent changes to organization, personnel, systems, processes, procedures, equipment, products, materials or substances, laws and regulations. Work cannot proceed unless a "management of change" process is completed. All proposed changes will therefore be managed by implementing the following steps:

- Identify the change.
- Assess the risk associated with the change.
- Establish responsibility to manage the change.
- Develop a plan of action.

If an alteration is approved by the Sabina management, then the relevant EMPs will be revised or an addendum added to reflect the agreed-upon change.

8. Element 6: Regulatory Requirements

Sabina will implement a compliance framework to manage and monitor its regulatory obligations and ensure that performance expectations are met. In its Sustainable Development Policy, the company has committed to meet or exceed all relevant laws, regulations and standards for the protection of the environment.

Sabina will ensure that it achieves full regulatory compliance by the following means:

- Implement awareness training for its employees and contractors.
- Actively use and maintain a regulatory compliance matrix.
- Conduct regular audits of its systems and activities to monitor compliance.

A summary of the government approvals and legislative requirements applicable to the Project is provided Appendix V1-5 of the FEIS.

9. Element 7: Implementation, Monitoring, and Measurement

The following details the key elements of the implementation, monitoring and measurement component of the EMS.

9.1 WORK PROCEDURES

Procedures will be developed to minimize the exposure to actual or potential hazards associated with the work to be performed. The need for procedures will be identified by reviewing processes, activities, tasks and assessing their potential impact on personnel, assets and the environment.

9.2 REGULATORY COMPLIANCE MATRIX

Administering Agency	Legislation	Permit Type and No.	Commitment	Status	Responsibility

As future permits are received, Sabina will review the terms and conditions. A Regulatory Compliance Matrix will then be populated and maintained to capture the permit conditions and compliance requirements from the permits received. The spreadsheet will be reviewed as required to update status, incorporate new conditions and edit or remove conditions that have changed or no longer apply.

The matrix can be used to display conditions that are specific to timing, type of condition, or responsible party. These can be applied by Project phase to further develop environmental performance checksheets used in daily monitoring activities. A template of the matrix is provided below and will be populated prior to construction.

9.3 PERFORMANCE MONITORING

Proactive and reactive key performance indicators (KPIs) will be developed by Sabina to monitor performance against EMS objectives and to promote continual improvement. The KPIs will be tracked and monitored by using environmental checklists. These will be developed for the project as a whole to ensure that there is alignment and consistency in achieving performance goals. Performance statistics based on the checklists will be compiled and distributed to internal and external stakeholders as appropriate. Environmental indicators and monitoring programs associated with the aspects or activities of the Project will be refined as the project develops.

9.4 INCIDENT NOTIFICATION, REPORTING, AND INVESTIGATION

Sabina has developed and implemented an incident management and investigation procedure. The intention of this procedure is to ensure that all incidents, including "near misses," no matter how minor, are recorded, investigated and reported, where applicable. This will achieve the following objectives:

- At risk behaviours will be identified.
- Deficiencies in workplace conditions will be identified.
- Improvements to methods and equipment will be identified.
- Failures in management systems and controls will be identified.
- Lessons will be learned.
- Regulatory-authority and industry reporting obligations will be fulfilled.
- Management systems will be regularly improved.

This procedure follows clear and documented guidelines to ensure that all incidents are uniformly, methodically and effectively investigated to a degree commensurate with their potential severity. The objective is to establish the facts, determine the root cause(s) and to take the appropriate action to prevent a recurrence of the event.

All incidents, investigations and corrective and preventive actions will be inputted to an incident reporting database and tracked until closure.

9.5 ASSET INTEGRITY

Sabina will emphasize the importance of ongoing asset integrity in contributing to a safe and environmentally sound operation. Asset integrity is a key component in the prevention of major accident events. Systems will be established to ensure the ongoing integrity of plant and equipment. These systems will include maintenance, inspection, testing, calibration and certification of equipment at frequencies appropriate for the level of risk associated with the equipment and/or as determined by manufacturers' requirements.

10. Element 8: Emergency and Crisis Management

Plans and procedures for all foreseeable emergency threats associated with Sabina's operations are detailed in the subsequent chapters of this volume. A rapid and effective response to emergency situations can significantly reduce any impact on personnel safety, the environment and nearby communities. This response is achieved by implementing prevention, preparation, response and recovery strategies.

Potential for accidents and emergencies have been identified utilizing the hazard identification and risk assessment tools discussed in Chapter 3, the Risk Management and Emergency Response Plan. Operating procedures will be further developed in order to keep control of such situations and to reduce the risk of environmental impact. Procedures that are directly related to spills and environmental incident response are presented in relevant EMPs (e.g., the Spill Contingency Plan and the Hazardous Materials Management Plan).

Emergency management strategies include identification of resources (personnel and equipment), key roles and responsibilities, and the procedures to be followed if these plans are activated. Relevant personnel will receive sufficient training to ensure that they have the skills and competence to respond to an emergency.

In addition to emergency management plans, a Project Oil Pollution Emergency Plan (OPEP) has been prepared (Chapter 6) to ensure that Sabina can respond rapidly and effectively to an oil spill at the Marine Laydown Area.

Third parties such as Sabina's contractors will also advance external plans. For example, Section 27 of the *Vessel Pollution and Dangerous Chemicals Regulations* requires the owner of every Canadian oil tanker of 150 tonnes gross tonnage or more and other Canadian vessels of 400 tonnes gross tonnage or more transporting oil as fuel or cargo to submit four copies of the vessel‘s Shipboard Oil Pollution Emergency Plan (SOPEP) to Transport Canada. All Plans must be vessel-specific. Transport Canada pollution prevention officers, who have also been appointed as marine vessel safety inspectors, will examine the SOPEPs for Canadian vessels. Each SOPEP must also provide guidance to help the ship's master meet the demands of a catastrophic discharge, should one occur.

11. Element 9: Monitoring and Audit

Review audits, both internal and external will be conducted to ensure:

- That there is compliance with regulatory requirements, Project approval conditions, and licence conditions.
- That the identified objectives of the Project are being achieved.

A formalized audit schedule will be developed in future iterations of the EMS to further define the scope and frequency of audits.

12. Element 10: Management Review

In order to maintain continual improvement, formal reviews of the suitability and effectiveness of the Management Process and its associated implementation documents will be scheduled periodically.

Management reviews will be based with the following considerations:

- Audit and incident investigation outcomes;
- Changes in organization and/or operational practices;
- Changes in statutory environmental requirements;
- Ensuring that assessments of targets and performance standards have been met; and
- Analysis of the continuing adequacy of the EMS.

Implementation documents (e.g., management plans, procedures and monitoring programs) will be reviewed periodically to assess their effectiveness and to ensure that they remain applicable to current operations.

Management review outcomes, including observations, conclusions and recommendations, will be documented and tracked through to completion.

13. Overview of Environmental Management Plans

The development and implementation of the EMPs in this volume are key tools for the environmental protection and management measures necessary to avoid, reduce or mitigate the potential effects of the Project on the environment. Figure 13-1 shows where the EMPs are placed in relation to other EMS documentation.

Certain EMPs are more progressed (e.g., OPEP) than others at this time, with some plans at a conceptual stage of development pending regulatory review (e.g., AEMP). Refinements to EMPs will be developed as permitting and water licencing progresses in advance of construction and operations, in order to manage the identified potential impacts on the social, marine, and terrestrial VECs and VSECs assessed for this Project.

In addition to these plans, work instructions and procedures will be developed to support the EMPs and ensure that they are effectively implemented. A greater level of detail on the technical input and practical application of the management and control measures will become available as the Project moves towards the construction phase. These further details will be used in an ongoing program of improvement and refinement of EMP documentation to ensure that the objectives are achieved. These EMPs will serve as a guide and framework for the development of more detailed construction EMPs and, in due course, operations EMPs.

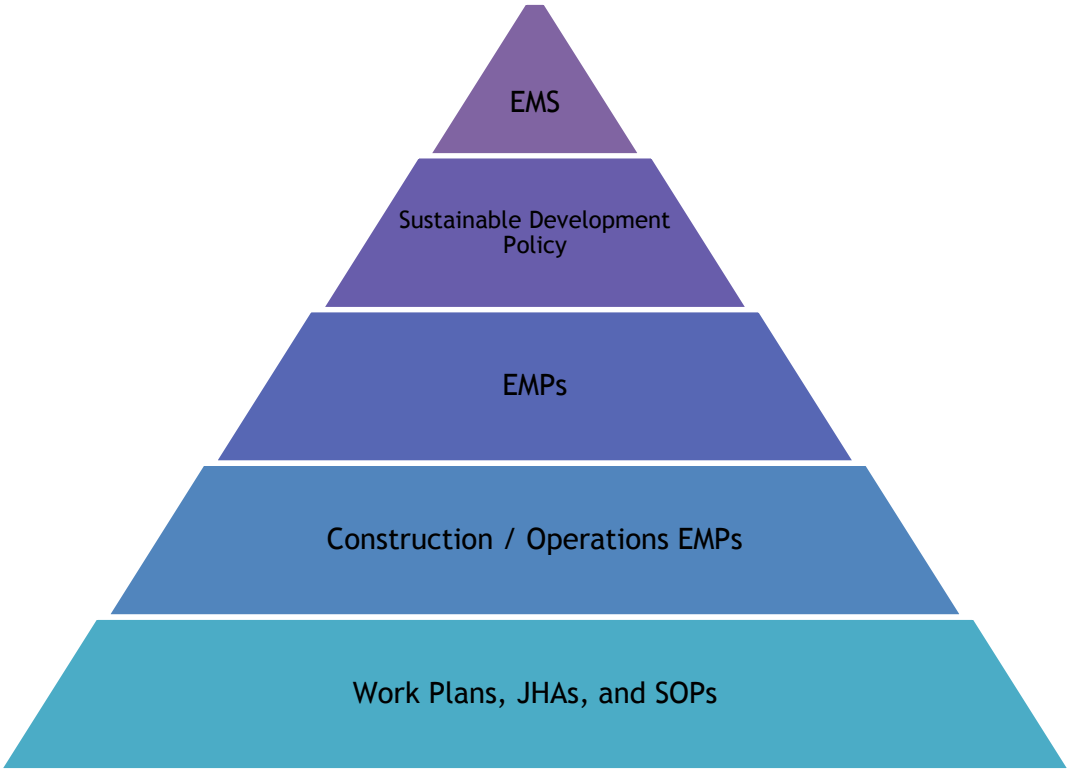

Figure 13-1. Hierarchy of Environmental Management

13.1 OBJECTIVES AND TARGETS FOR MANAGEMENT PLANS

For each of the EMPs, Sabina has set out environmental objectives and targets with consideration of the following:

- Sabina's Sustainable Development Policy.
- Environmental aspects and impacts.
- Relevant Nunavut and federal standards.
- Legal and other requirements.
- Measurable objectives.
- Opportunities for continual improvement.

Environmental objectives, targets and indicators are described below to promote consistent application and to ensure that all interested parties interpret them in the same way:

1. An 'environmental objective' is a specific environmental goal. Each EMP will have high-level objectives that will be consistent with Sabina's Sustainable Development Policy and the commitments set out in the FEIS.
2. In order to gauge the extent to which environmental objectives have been achieved, 'threshold values' or narrative statements are outlined in the EMPs for specific indicators that, if reached, will trigger specified management responses.
3. Setting target thresholds in the EMPs will be based on an environmental indicator that is a significant physical, chemical, biological, social or economic variable and can be measured in a defined way for management purposes.

An example of an indicator is the number and diversity of organisms in a waterbody, as they can illustrate whether an aquatic ecological system is functioning normally or not. To be effective, an indicator must be relevant, representative, and able to show investigators details about the system of interest. The indicator results must be easy to comprehend, even at a non-technical level. It must be reliable, so that the information it provides is measurable. It must also be timely, so that the information is made available while there is still time to take action.

13.2 BIOPHYSICAL AND SOCIO-ECONOMIC PLAN IMPLEMENTATION

Plans contained in this volume will include all Project components such as the Construction, Operation and Closure phases. Different project components will require utilization of different combinations of management plans. Table 13.2-1 illustrates how the current EMPs are applied across the various phases of the Project.

Sabina will review and approve construction-level EMPs prior to the commencement of activities, and subsequently operations-level documents to ensure that they meet all commitments made in the EIS as well as any subsequent legislative requirements or conditions. Follow-up and Adaptive Management

Follow-up monitoring is an essential tool for ensuring that a project is implemented as planned, that mitigation measures are effective, and potential adverse impacts are avoided or minimized. It is through monitoring that an unanticipated adverse environmental impact can be discovered and prevented through adaptive management.

13.3 MONITORING

The requirements for monitoring the effects on the biophysical environment will be an integral part of the Project Certificate terms and conditions, the Type A Water Licence, land leases, and other authorizations, permits, or licences.

The EMPs in this volume each contain a monitoring program (Section 7), where appropriate. The objectives of the monitoring program are to:

- Track performance of mitigation measures implemented.
- Identify environmental changes in the receiving environment.
- Validate environmental effects predictions.

Appropriately qualified personnel and resources will be allocated to conduct monitoring in a systematic and scientifically defensible manner. Monitoring initiatives will be periodically reviewed and modified to ensure continued suitability and value. Reviews will consider the:

Effectiveness of monitoring design to assess environmental performance requirements;

- Timing, frequency and relevance of the monitoring strategy; and
- Closing date for individual programs.

Reporting will be conducted promptly in accordance with frequency requirements defined in permits and authorizations. Deviations from an expected outcome will be investigated and corrective actions will be implemented.

Table 13.2-1. Utilization of FEIS EMPs to Project Phases

Chapter	Document	Mobilization and Construction	Operation & Ongoing Maintenance	Temporary Closure/Care and Maintenance	Final Closure	Post-Closure
1	Environmental Management Plan (including EMS and follow-up)	x	x	x	x	x
Risk Management and Emergency Response Plans						
3	Risk Management and Emergency Response Plan	x	x	x	x	
4	Fuel Management Plan	x	x	x	x	
5	Spill Contingency Plan	x	x	x	x	
6	Oil Pollution Emergency Plan	x	x	x	x	
Biophysical Monitoring & Mitigation Plans						
2	Environmental Protection Plan	x	x	x	x	
7	Site Water Monitoring and Management Plan	x	x	x	x	
8	Ore Storage Management Plan		x	x		
9	Mine Waste Rock Management Plan	x	x	x	x	
10	Waste Management Plan	x	x	x	x	
11	Incineration Management Plan	x	x	x	x	
12	Hazardous Materials Management Plan	x	x	x	x	
13	Explosives Management Plan	x	x	x	x	
14	Road Management Plan	x	x	x	x	
15	Shipping Management Plan	x	x	x	x	
16	Borrow Pits & Quarry Management Plan	x	x	x	x	
17	Air Quality Monitoring and Management Plan	x	x	x	x	
18	Noise Abatement Plan	x	x	x	x	
19	Aquatic Effects Management Plan	x	x	x	x	
20	Wildlife Mitigation and Monitoring Plan	x	x	x	x	
21	Fish Offsetting Plan	x	x		x	
22	Tailings Management Plan	x	x	x	x	x

(continued)

Table 13.2-1. Utilization of FEIS EMPs to Project Phases (completed)

Chapter	Document	Mobilization and Construction	Operation & Ongoing Maintenance	Temporary Closure/Care and Maintenance	Final Closure	Post-Closure
Socio-economic Management Plans						
23	Socio-economic Monitoring Plan	x	x	x	x	
24	Business Development Plan	x	x	x	x	
25	Occupational Health & Safety Plan	x	x	x	x	
26	Community Involvement Plan	x	x	x	x	
27	Cultural & Heritage Resources Protection Plan	x	x	x	x	
28	Human Resources Plan	x	x	x	x	
Mine Closure						
29	Mine Closure and Reclamation Plan		x	x	x	x

13.4 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 (Figure 13.4-1) is an iterative approach based on a learning process gained from monitoring, and it improves long-term management outcomes. As part of the adaptive management framework, monitoring provisions may include:

- Measuring the condition of the system with selected indicators (e.g., numbers, size and health of fish populations, and water quality in external receiving bodies).
- Identification of goals and setting performance criteria and standards such as target numbers of fish in offset habitat, water quality at or below predetermined thresholds.
- Measures for evaluating root causes and the extent of deficiencies to make a decision on what actions to take (e.g. do nothing, implement corrective actions, or change the goal).

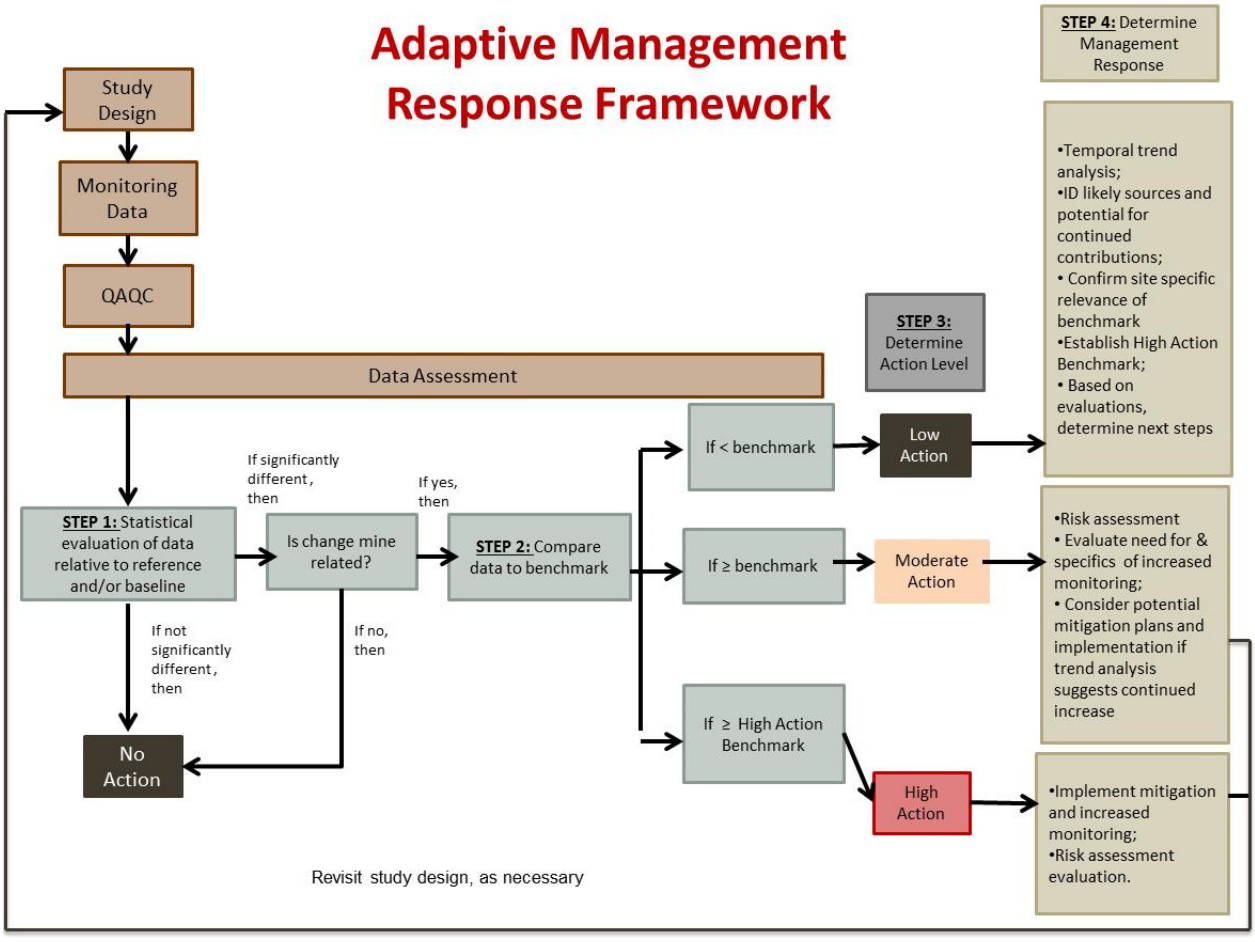

Figure 13.4-1. Adaptive Management Response Framework

For each VEC being monitored, if the indicator (monitored parameter) approaches a predefined threshold, then adaptive management would trigger a response. This may include increase monitoring frequency, studies to identify root causes, and/or specific action or mitigation measures to address these concerns.

Figure 13.4-1 (adopted from Baffinland's Mary River Project) provides an example of an adaptive management framework that could be applied to a number of situations or activities, along with triggers for various actions, and management responses. The concept of alert and action levels shall be applied to a wide range of environmental concerns including this example targeting fish and fish habitat:

- Predicted water quality in external receiving waterbodies and tributaries.
- Survival, growth and health of fish in monitoring sites.
- Trophic status and capability of target lakes to support and sustain populations.

The adaptive management approach includes "feedback loops" based on the data results so that changes to the study design can be made if there is a need to modify monitoring. This approach is methodical and includes prescribed actions to assist in minimizing impacts to the environment.

The EMS fully supports changes and updates as part of an adaptive management process, by providing regular review of the adequacy of the Sustainable Development Policy, management programs and operational controls in light of concerns or other outcomes. EMS elements can then be updated, as needed, based on results and associated training programs and then enhanced to improve the level of environmental protection. In this way, continual improvement of the Project EMS and mitigation programs will be assured.

Details of the proposed monitoring plans will be refined through discussions with regulatory authorities, communities, and other stakeholders as review of the Project proceeds.

2. Environmental Protection Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Environmental Protection Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions)
Chapter 2	All sections		Minor updates

BACK RIVER PROJECT
ENVIRONMENTAL PROTECTION PLAN

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1. Environmental Protection Plan

It is Sabina's objective to apply appropriate and effective management practices to advance environmental management to all areas of operations related to the Back River Project. Sabina will prepare an Environmental Protection Plan (EPP) prior to commencement of construction for all project phases and it will be integrated into procedural documents. It will be written in accordance with the environmental management system (EMS) and other chapters contained in this volume. The EPP will describe conceptual environmental protection measures to limit the disturbances to identified VECs and VSECs from Project's activities. It will provide activity specific, plainly written, environmental protection procedures to help ensure a high level of environmental protection throughout the life of the Project.

The EPP provides a practical way to facilitate field implementation of environmental regulations, practices, and procedures required to eliminate or reduce potential environmental effects. The EPP will be a "living document" and updated as the Project advances through its life cycle of Mobilization and Construction, Operation, Closure and Post-Closure. The knowledge acquired during the early stages of the Project will thus be retained and passed on through the successive phases of the Project. Many additional procedures will be developed and added to the EPP at the onset of early construction activities.

Compliance will be confirmed by management, occupational health and safety, and environmental staff, as well as government departments and agencies tasked with regulatory compliance monitoring. This is largely accomplished by means of appropriate distribution and communication of the EPP on-site during work plan development and pre-activity reviews.

A proposed table of contents for the EPP is presented below in Table 1-1. The content will vary depending on the phase of the development of the Project. Many of the specific EPP documents will be developed by contractors as construction commences.

Table 1-1. Outline of the Environmental Protection Plan (EPP)

Section 1	Introduction	Contents List and Revision Control, serving as the Table of Contents, listing the latest revisions for each Operational Standard.
Section 2	Purpose of the Plan	Outlines the purpose and organization of the EPP, Sabina's environmental commitment, corporate resources and regulatory requirements.
Section 3	Activity-Based Operational Standards	This provides operational standards for a variety of specific activities anticipated to occur in the Project. Each Operational Standard provides an overview, environmental concerns, and general environmental protection procedures associated with that activity to meet regulatory requirements, corporate commitments, and/or best practices. Within the Operational Standards, further reference will be provided, if warranted, to relevant operating procedures and work instructions that have been developed to address identified risks.
Section 4	Documentation	Provides the inspection and recordkeeping forms that will be used by Project personnel to verify adherence or audit compliance to the Operational Standards.
Section 5	Revisions	Includes a Request for Revision, which allows for users to recommend changes or additional Operational Standards to facilitate continuous improvement.
Attachments	Supporting Material	Maps, drawings, forms, etc.

3. Risk Management and Emergency Response Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Risk Management and Emergency Response Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 3	1.4	Introduction	Sustainable Development Policy inserted
	2	Roles & Responsibilities	Added bulleted roles and responsibilities to doc.
	Table 4.1-1	Likelihood table	Added likelihood of events occurring
	Table 4.1-2	Consequence Severity table	Added consequence severity table
	Table 4.1-3	Risk Matrix table	Added risk matrix table
	4.1.1	Risk mitigation strategies	Risk Mitigation
	4.2	Natural Hazards	Added to Natural Hazard section
	Table 4.3-1 & 4.3-2	Major accidents and malfunctions	Summary table added
	Table 4.3-3	Summarizing mitigation measures	New table added

BACK RIVER PROJECT
RISK MANAGEMENT AND EMERGENCY RESPONSE PLAN

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Glossary and Abbreviations

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

DEIS	Draft Environmental Impact Statement
ERC	Emergency Response Coordinator
ERT	Emergency Response Team
FEIS	Final Environmental Impact Statement
HMMP	Hazardous Materials Management Plan
MLA	Marine Laydown Area
NIRB	Nunavut Impact Review Board
OHF	Oil Handling Facility
OPEP	Oil Pollution Emergency Plan
PPE	Personal Protective Equipment
RCMP	Royal Canadian Mounted Police
RMERP	Risk Management and Emergency Response Plan
SCP	Spill Contingency Plan
SDS	Safety Data Sheets
TDGR	Transportation of Dangerous Goods Regulations
WHMIS	Workplace Hazardous Materials Information System

1. Introduction

1.1 OVERVIEW

The purpose of this Risk Management and Emergency Response Plan (RMERP) is to outline Sabina Gold & Silver Corp.'s (Sabina) approach to risk management and to ensure that an adequate level of emergency preparedness is available for the construction, operation and closure of the Back River Project (the Project). It represents one plan in a series of Environmental Management Plans (EMPs) that have been prepared for the Project Final Environmental Impact Statement (FEIS).

This RMERP has been prepared in accordance with Section 9.4.1 of the EIS Guidelines issued by the Nunavut Impact Review Board (NIRB) for the Back River Project (NIRB 2013). This Plan was prepared in conformance with current Federal and Territorial statutory requirements.

This is a living document to be updated upon changes in related regulatory requirements, management reviews, lessons learned, incident investigations, best practise updates or other Project specific protocols once construction starts through to Project closure activities.

The information presented herein is current as of June 2015. At this stage, certain aspects of the RMERP remain conceptual. The next update will likely be based on detailed engineering design prior to the start of construction.

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

1.2 SCOPE AND OBJECTIVES

The scope of this Plan includes the MLA in southern Bathurst Inlet, the Goose Property, and the connecting winter ice roads. Potential emergency situations associated with access to the Project by air are also included.

The RMERP is designed to provide an assessment of the potential risks associated with the Project and establish an organizational structure and procedures for effective response to emergencies.

The Plan addresses potential risks from natural hazards as well as accidents and malfunctions which could result in emergency situations (i.e., medical, spills, fire).

1.3 PLANNING AND IMPLEMENTATION

Planning for the RMERP started with the development of the DEIS and continued with the FEIS, which identified existing (baseline) conditions, assessed potential impacts of the Project, developed conceptual mitigation strategies and developed specific mitigation measures to execute these strategies.

Risk management and emergency preparedness and response will be tracked, reviewed, and updated through ongoing maintenance of the Plan. The Plan strategies and procedures will be refined over time. These updates will incorporate relevant feedback from the public, obtained during public consultation.

1.4 SUSTAINABLE DEVELOPMENT POLICY

Sabina Gold & Silver Corp. regards itself as a responsible explorer and mineral developer. We are committed to fostering sustainable development throughout all stages of our activities. We constantly strive to conduct our operations in a manner that balances the social, economic, cultural and environmental needs of the communities in which we operate. To build on this commitment Sabina will:

- Meet or strive to exceed all relevant legislated sustainable development requirements in the regions where we work.
- Ensure appropriate personnel, resources and training is made available to implement our sustainable development objectives.
- Establish clear lines of responsibility and accountability throughout the Company to meet these objectives.
- Implement proven management systems and procedures to facilitate our sustainable development objectives. A priority will be placed on developing and implementing management structures related to the environment, health and safety, emergency response and stakeholder engagement.
- Act as responsible stewards of the environment for both current and future generations. We will make use of appropriate assessment methodologies, technologies and controls to minimize environmental risks throughout all stages of mineral development.
- Work closely with local communities and project stakeholders to understand their needs, address their concerns and provide project-related benefits to create win-win relationships. Our goal is to earn and maintain a social licence to operate at all our operations while building partnerships.
- Pursue economically feasible projects in order to generate shareholder profitability and support long-term positive socio-economic development in the regions where we work.
- Utilize a precautionary approach as it applies to potential effects from our activities. Work with employees, contractors and stakeholders to promote a culture of open and meaningful dialogue to ensure that any known or suspected departures from established protocols are reported to management in a timely manner.
- Regularly review this policy to ensure it is consistent with Sabina's current activities and the most recent legislation.
- Continually improve our performance and contributions to sustainable development including pollution prevention, waste minimization and resource consumption.
- Implement programs at each of our operations to monitor and report compliance and proactively address potential deficiencies in our policies and procedures.

The objectives of our sustainable development policy cannot be accomplished without the active involvement and commitment of many dedicated individuals. As such, we will regularly communicate this policy and its outcomes to our employees, contractors and relevant stakeholders. Together, we can foster a culture of sustainable development at Sabina.

1.5 COMPLEMENTARY PLANS AND DOCUMENTS

To avoid overlap and inconsistencies with other biophysical management plans, Sabina has referenced where appropriate the following management plans:

- Fuel Management Plan (FMP; Volume 10, Chapter 4).
- Spill Contingency Plan (SCP; Volume 10, Chapter 5).
- Oil Pollution Emergency Plan (OPEP; Volume 10, Chapter 6).
- Waste Management Plan (WMP; Volume 10, Chapter 10).
- Incineration Management Plan (IMP; Volume 10, Chapter 11).
- Hazardous Materials Management Plan (HMMP; Volume 10, Chapter 12).
- Explosives Management Plan (ExMP; Volume 10, Chapter 13).
- Road Management Plan (RMP; Volume 10, Chapter 14).
- Shipping Management Plan (SMP; Volume 10, Chapter 15).
- Occupational Health and Safety Plan (OHSP; Volume 10, Chapter 25).
- Shipboard Oil Pollution Emergency Plan (SOPEP; to be provided in the future by Shipping Company).

1.6 APPLICABLE LEGISLATION

Both federal and territorial legislation exist to address risk management and emergency response. Operational policies and procedures that fulfill conditions in applicable legislation will be further developed as the Project proceeds.

Table 1.6-1 summarizes the primary Federal and Territorial legislation applicable to emergency response in Nunavut.

Table 1.6-1. Legislation Applicable to the Risk Management and Emergency Response Plan

Act	Regulations	Guidelines
Federal		
Canadian Labour Code (R.S.C., 1985, C. I-2)	Canadian Occupational Health and Safety Regulations (SOR/86-304)	-
Arctic Waters Pollution Prevention Act (R.S.C., 1985, c. A-12)	Arctic Shipping Pollution Prevention Regulations (C.R.C., c. 353)	-
Canadian Environmental Protection Act (R.S.C. 1999 c.33)	Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations (SOR/2008-197) Environmental Emergency Regulations (SOR/2003-307) Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2002-301) Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149)	Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products (CCME, 2003) Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil (CCME, 2008)
Fisheries Act (1985, c. F-14)	Metal Mining Effluent Regulations (SOR/2002-2222)	-

(continued)

Table 1.6-1. Legislation Applicable to the Risk Management and Emergency Response Plan (continued)

Act	Regulations	Guidelines
Explosives Act (1985, c. E-17)	Ammonium Nitrate and Fuel Oil Order (C.R.C., c.598) Explosives Regulations (C.R.C., c. 1516)	Guidelines for Bulk Explosives Facilities – Minimum Requirements (NRCan 2014) Quantity Distance Principles User's Manual (NRCan 2013) National Standard of Canada CAN/BNQ 2910-500/2015 – Explosives – Magazines for Industrial Explosives (BNQ 2015)
National Fire Code of Canada (2010)	-	-
Transportation of Dangerous Goods Act (1992, C. 34)	Transportation of Dangerous Goods Regulations (SOR/2015-100)	2012 Emergency Response Guidebook (Transport Canada and U.S. Department of Transportation, 2012)
Territorial Lands Act (R.S. 1985, c. T-7)	Northwest Territories and Nunavut Mining Regulations (C.R.C., c. 1516) Territorial Land Use Regulations (C.R.C., c. 1524) Territorial Lands Regulations (C.R.C., c. 1525)	- -
Hazardous Products Act	*Controlled Products Regulations*	Workplace Hazardous Materials Information System (WHMIS)
Territorial – Nunavut		
Environmental Protection Act (RSNWT (Nu) 1988, c E-7)	Spill Contingency Planning and Reporting Regulations (NWT Reg (Nu) 068-93) Used Oil and Waste Fuel Management Regulations (NWT Reg 064-2003) The removal of hazardous materials will require the registration with the Government of Nunavut, Department of Environment (DOE) as a waste generator as well as carrier (if applicable) prior to transport	Government of Nunavut (GN) Environmental Guidelines for the Management of: • General Management of Hazardous Waste in Nunavut (GN, 2010a) • Waste Paint (GN, 2010b) • Mercury-Containing Products and Waste Mercury (GN, 2010c) • Industrial Waste Discharges into Municipal Solid Waste and Sewage Disposal Facilities (GN, 2011a) • Waste Batteries (GN, 2011b) • Waste Solvent (GN, 2011c) • Waste Antifreeze (GN, 2011d) • Used Oil and Waste Fuel (GN, 2012) • Biomedical and Pharmaceutical Waste (GN, 2014) Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil (CCME, 2008)

(continued)

Table 1.6-1. Legislation Applicable to the Risk Management and Emergency Response Plan (completed)

Act	Regulations	Guidelines
Mine Health and Safety Act (SNWT (Nu) 1994, c. 25)	Mine Health and Safety Regulations (NWT Reg (Nu) 125-95)	-
Workers' Compensation Act (RSNWT, 1998, c. W-6)	Workers' Compensation General Regulations (Nu Reg 017-2010)	-
Explosives Use Act (RSNWT (Nu) 1988, c. E-10)	Explosives Regulations (RRNWT (Nu) 1990, c. E-27)	-
Fire Prevention Act (RSNWT (Nu) 1988, c. F-6)	Fire Prevention Regulations (RRNWT (Nu) 1990, c. F-12)	-
Motor Vehicles Act (RSNWT (Nu) 1988, c. M-16)	Large Vehicle Control Regulations (RRNWT (Nu) 1990, c. M-30)	-
Public Health Act (RSNWT (Nu) 1988, c. P12)	Camp Sanitation Regulations (RRNWT (Nu) 1990, c. P-12)	-
	General Sanitation Regulations (RRNWT (Nu) 1990, c. P-16)	-
Safety Act (RSNWT 1988, c. S-1)	General Safety Regulations (RRNWT (Nu) 1990, c. P-16)	-
	Work Site Hazardous Materials Information System Regulations (RSNWT 1988, c. 81 (Supp))	-
Transportation of Dangerous Goods Act (1990, RSNWT (Nu) 1988, c. 81 (Supp))	Transportation of Dangerous Goods Regulations (1991, NWT Reg (Nu) 095-91)	-

2. Roles and Responsibilities

The initial stage of any emergency incident and resultant response is critical. An effective and timely response is essential to prevent an emergency situation from escalating to a higher level. Therefore, all relevant personnel must be fully aware of their individual duties and responsibilities as presented in this Plan.

Figure 2-1 summarizes Sabina's generalized emergency response organization chart. This structure will be refined in future iterations of this plan. The same organization chart applies to spill response, and therefore updates to this organization chart are to be incorporated into an update of the SCP.

Duties of the Emergency Response Team during an emergency are:

- Report to the scene of the incident.
- Work closely with the Incident Commander to determine appropriate response strategy for their respective work area.
- Contact departmental resources via radio as required during the emergency response.
- Direct ERT members in their respective tasks as required.
- Participate in a post-emergency debriefing session.

Specific responsibilities and duties inherent to personnel involved in emergency response are outlined below.

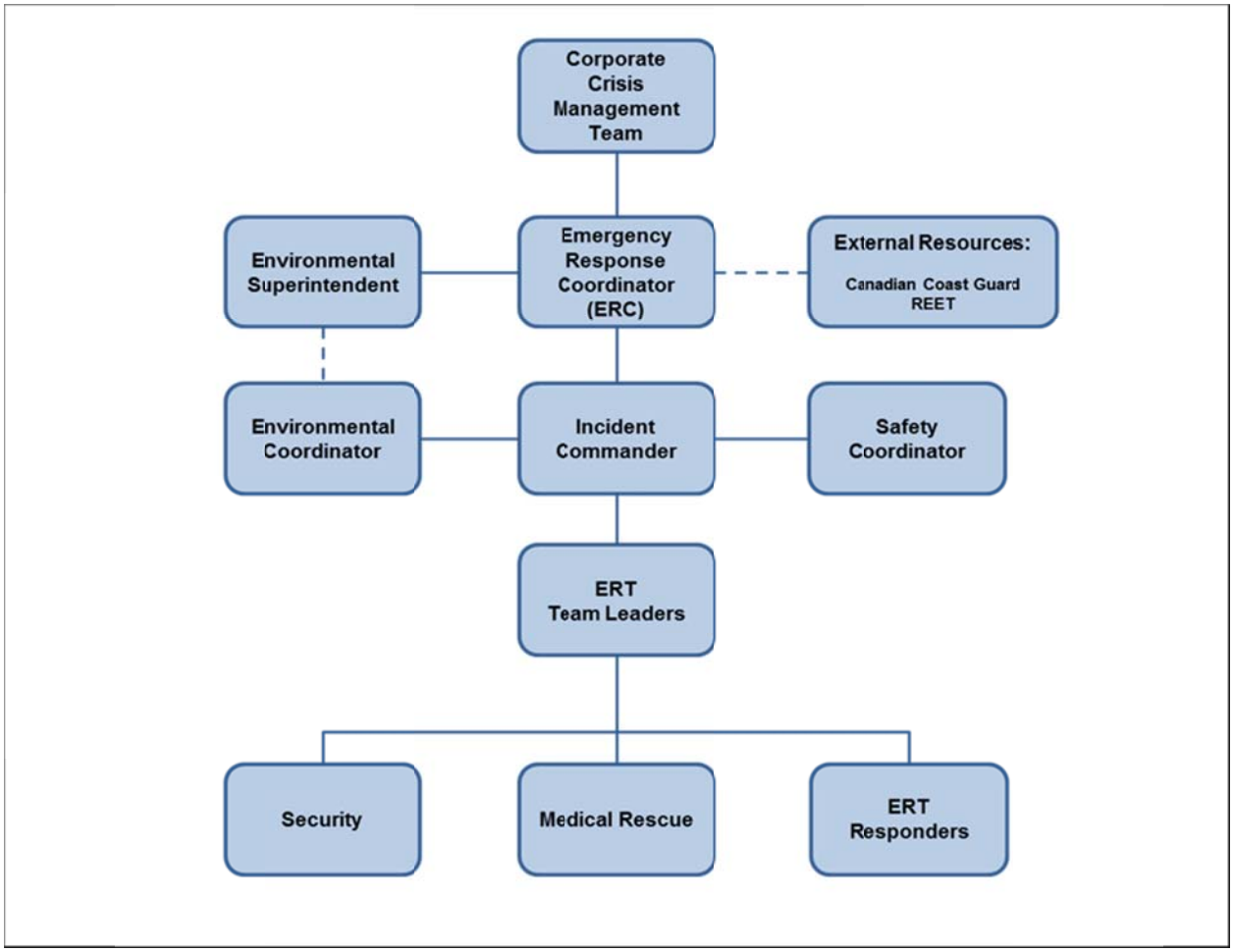

Figure 2-1. Sabina Emergency Response Organization Chart

2.1 EMERGENCY RESPONSE COORDINATOR

For the purpose of the RMERP, the Emergency Response Coordinator (ERC) is the General Manager or his designate. The ERC's duties during an emergency are:

- To ensure coordination of Emergency Response Team (ERT) support systems.
- Upon being notified of an emergency, initiate response activities and assess the situation based on current information from the Incident Commander.
- Activate the emergency response process and escalate according to severity of the incident.
- Coordinate all activities. In the event the ERC leaves his post, the ERC will designate an individual to coordinate in his absence.
- Ensure that the appropriate area manager/s has been notified.
- Provide internal notification as applicable based on the level of emergency.
- Provide instruction to ensure that appropriate external resources are notified.

- Receive information from the Incident Commander and ensure appropriate resources are made available.
- Provide support for the acquirement of additional supplies and resources as requested by the Incident Commander.
- Contact departmental resources via radio as required during the emergency response.
- Provide internal notification of the "all clear."
- Ensure the coordination and establishment of an emergency debriefing session.
- Review incident log and post response incident report.
- Post incident debrief with Incident Commander.
- Provide necessary information to the Communications Officer for a media statement release if required.
- Complete a report on the events surrounding the incident.
- Coordinate collection of all incident notes, reports, statements and log of events.
- End the event in a project tracking system.

2.2 ENVIRONMENTAL SUPERINTENDENT

The duties of the Environment Superintendent during an emergency are:

- For major incidents contact the ERC and report to the Command Centre.
- Assist the ERC in evaluating the initial situation and assessing the magnitude of the emergency.
- Assist in developing an overall plan of action.
- For spills, report to NWT-NU 24-hour Spill Report Line at 867-920-8130.
- Report to the ERC and provide recommendations on resource requirements (additional manpower, equipment, material) to respond to the emergency.
- Provide liaison with management to keep them informed of response activities.
- Document all actions and decisions.
- Collect photographic records of the event and response efforts.
- Participate in post-emergency debriefing.
- Assist in the accident/incident investigation process.
- Document the cause of the emergency and effectiveness of the response effort, and recommend the appropriate measures to prevent a recurrence.
- Ensure that all involved departments complete reporting process.
- Prepare and submit follow-up documentation required by appropriate regulators.

2.3 INCIDENT COMMANDER

The Incident Commander is the site lead administrator for the ERT, responsible for ensuring the necessary emergency response equipment and adequate level of training for ERT members. The Incident Commander directs the ERT at the scene as ERT Leader. In the absence of the Incident Commander, a senior team member will be designated in his place.

The duties of the Incident Commander during an emergency are:

- Muster accordingly and brief team members.
- Report to the scene of the emergency.
- Take charge of the scene.
- Evaluate the details of the emergency as presented by those on scene.
- Assess the immediate situation, confirm the level of emergency and notify the ERC.
- Maintain contact with the ERC and provide support in coordination of the response.
- Direct ERT members in their respective tasks as required.
- Contact departmental resources via radio as required during the emergency response.
- Request internal/external resources as required.
- Advise ERT on aspects of internal/external support as they are received.
- Develop a written log of events indicating instructions given, action taken and outcomes achieved.
- Announce the 'all clear' to the ERC when the emergency has ended.
- Lead the post-emergency debriefing session.
- Ensure that all ERT equipment is returned to original order and/or replaced to ensure future rapid response.
- Provide assistance with ongoing investigation.
- Prepare a written report on response activities.

2.4 EMERGENCY MEDICAL PERSONNEL

Duties of Emergency Response Personnel during an emergency are:

- Respond when required as directed by the Incident Commander.
- Responsible for all decisions of medical-related situations on site.
- Responsible for assessing, administering, and delegating emergency medical care.
- Advise the Incident Commander of the number and condition of any ill/injured personnel.
- Advise the ERC of off-site resources required.
- Maintain a log of events, actions, and outcomes.
- Participate in a post-emergency debriefing session.

2.5 COMMUNICATIONS OFFICER

The Communications Officer manages the collection and dissemination of all information relating to an emergency, including:

- Government agencies, including those that may be involved in responding to any emergency
- Communities (Hamlets, community groups and individuals)
- Media

The Communications Officer will be part of the Corporate Crisis Management Team identified on Figure 2-1, and most likely will be a corporate executive such as the Vice President, Environment & Sustainability, or a designate.

The Communications Officer or designate will control radio use and restrict it to emergency response only. The Communications Officer will also direct the collection and management of all written information, photographs, drawings and video recordings generated during the emergency. This includes the following records:

- A record of the chronology of events
- Log of telephone calls
- Log of written statements regarding the emergency (emails, press releases, etc.)
- A list of personnel on-site at the time of the emergency along with emergency contact information, in case it is needed

All other communications of an emergency by other Project personnel will be prohibited, to limit possible uncontrolled dissemination of misinformation.

2.6 SECURITY

Security personnel or designates are key in an emergency response in that they will receive an initial notification of an emergency and provide first communications to essential personnel and secure the area.

Their duties in an emergency are:

- Report muster and evacuation status to the Incident Commander and await further instruction.
- Provide traffic and personnel control at scene as directed by the Incident Commander.
- Assist in controlling access to the emergency area.
- Maintain open radio communication (via radio or telephone intercom system).
- Keep a written record of events throughout incident.
- Relay notification of 'all clear" order when directed by Incident Commander.
- Maintain Security of the scene as directed by the ERC or Incident Commander.
- Direct all off-site inquiries regarding the emergency to the ERC or designate.
- Participate in a debriefing session for the emergency response.

2.7 ENVIRONMENTAL COORDINATOR

The Environmental Coordinator will liaise with the Incident Commander to advise on the direction of environmental response efforts once the scene has been assessed by the Incident Commander and all medical and/or fire emergencies are under control.

In an emergency the Environmental Coordinator will:

- Directly proceed to the scene of the incident.

- Make recommendations for response methods and resources based on area sensitivities and incident severity through the Incident Commander as necessary.
- Make recommendations for additional resources through the Incident Commander as necessary.
- Participate in post-emergency debriefing.
- Maintain a log of events, actions, and outcomes.

2.8 SAFETY COORDINATOR

The duties of the Safety Coordinator during an emergency are:

- Contact the ERC.
- Respond to the scene and make direct contact with the Incident Commander.
- Establish perimeters around the area of the emergency and direct appropriate resource personnel responsible for traffic flow.
- Assist with identifying and assessment of potential hazards of the ERT response and notify the Incident Commander.
- Ensure appropriate personal protective equipment for involved ERT and non ERT personnel.
- Note pertinent information that may be relative to the investigation.
- Secure the area in coordination with site security.
- Participate in post-emergency debriefing.
- Assist in the accident/incident investigation and complete report.

2.9 TRAINING

Sabina will ensure that personnel involved in emergency response have received prior training and the requisite skills to safely minimize risks and respond to emergencies.

The personnel directly linked to emergency response operations will receive training to familiarize themselves with the RMERP, ExMP, SCP, OPEP, and HMMP on a regular basis according to their duties and responsibilities. All completed training will be recorded in the training register and kept up to date by the ERT.

The personnel directly linked to emergency response operations, contract employees and the other responders identified in this Plan should take part in the yearly training program. Training will be conducted to ensure adequate numbers of responders are available for all levels, times, and work shifts.

2.9.1 Site Orientation

On site orientation will be provided to all personnel to ensure employees are aware of:

- The RMERP, ExMP, SCP, OPEP, and Fire Action Plan.
- Applicable legislation.
- Environmental receptors (i.e. surface water and sensitive areas).
- First Responders' duties in case of an emergency.
- Location of muster Points and First Aid Stations.

- The location of emergency response equipment, such as:
  - Fire extinguishers and firefighting equipment.
  - Safety Data Sheets (SDS) and Spill Report Forms.
  - Spill Response Kits.

2.9.2 Role Specific

Specific training will be provided to all employees whose job function may have a higher probability of experiencing an emergency, to ensure understanding of:

- WHMIS and TDGR.
- Specialized handling and emergency/spill response procedures related to specific chemicals (e.g., explosives, cyanide, fuel).
- Risk management - identify and avoid conditions which may lead to an emergency situation.
- Hazards associated with sources of ignition (smoking, electrical sparks) near a fuel source.
- How to use emergency response equipment.

For employees involved in fuel handling, additional training would be provided regarding appropriate refueling techniques and drum handling procedures. Personnel not trained to handle chemical spills shall not attempt to clean up spill; they are to contact the ERT for clean-up assistance.

2.9.3 Emergency Response Team

Members of the ERT will be provided a higher level of training to allow for safe and adequate response. This training includes:

- Information provided as part of the Role-Specific Training.
- First Aid training.
- Fire extinguishers and water pump locations and use.
- Details of the SCP and the Fire Action Plan.
- How to identify, evaluate and mitigate hazards by using appropriate personal protective equipment (PPE).

2.9.4 Emergency Response Exercises

Emergency response exercises will be conducted on occasion to validate on site capabilities, practice the internal and external notification processes and evaluate the management of the response through the decisions and actions of the ERT participating in the exercise(s).

The exercises will involve the application of realistic hands-on scenarios where the ERT will deploy the appropriate equipment to respond to the specific scenario developed for the exercise. The exercise may be broken down into two or more sessions to ensure adequate coverage.

Records of all emergency response exercises will be kept on file and posted to provide access for those who were unable to attend.

3. Emergency Contact Information

Contact information for all Sabina staff members involved in emergency response is presented in Table 3-1 and will be updated in future iterations of this Plan. External contacts that may provide additional assistance as necessary are presented in Table 3-2 and Table 3-3. Key government contacts are provided in Table 3-4. These contacts are reviewed and updated with every review of the RMERP.

Table 3-1. Emergency Response Team Contact Information

Title	Name	Telephone No.
Emergency Response Coordinator	TBD	TBD
Environmental Superintendent	TBD	TBD
Incident Commander	TBD	TBD
Environmental Coordinator	TBD	TBD
Safety Coordinator	TBD	TBD
Operations Superintendent	TBD	TBD
Emergency Medical Personnel	TBD	TBD
Team Leaders	TBD	TBD
Communications Officer	TBD	TBD

Table 3-2. External Emergency Response Contacts

Emergency Situation	Agency Contact	Telephone No.
Medical emergency / medivac	Kitikmeot Regional Health Centre	867-983-4500
	Cambridge Bay Heath Centre	867-983-4500
	Stanton General Hospital	1-800-661-0867
	Air Tindi	867-669-8200
Poisonous substance ingestion	Poison Control Centre	1-800-268-9017
Search and Rescue	Cambridge Bay RCMP	867-983-0123
	Kitikmeot Search and Rescue	867-983-5100
Fatality	Cambridge Bay RCMP	867-983-0123
Workers' Safety and Compensation Commission	Incident and Injury Reporting	1-800-661-0792
Hazardous material spill	Emergency/ Spill Report Line	867-920-8130
Crime	Cambridge Bay RCMP	867-983-0123
Wildlife management	Department of Environment – Cambridge Bay	867-983-4164

Table 3-3. External Emergency/Spill Response Contractors

Expediting Company	Contact Name	Telephone No.
Shell Canada, Mobile Environmental Response	TBD	867-874-2562
Explosives Supplier (TBD)	TBD	TBD
Kitnuna	TBD	867-983-2331
Nuna Logistics Ltd.	TBD	867-682-4667
DuPont (Fuel Dye)	TBD	905-821-5660
Frontier Mining (Sorbents)	TBD	867-920-7617
Acklands (Sorbents)	TBD	867-873-4100

Table 3-4. Key Government Contacts

Agency/Organization	Contact	Telephone No.
Aboriginal Affairs and Northern Development Canada	Water Resources Officer	867-222-6490
	Resource Mgmt. Officer	867-975-4296
	A/Manager of Field Ops	867-975-4548
Canadian Coast Guard	TBD	1-800-265-0237
Department of Fisheries and Oceans	fisheriesprotection@dfo-mpo.gc.ca	1(855) 852-8320
Environment Canada	Manager of Enforcement	867-669-4730
	NWT/NU 24-hour Spill Report Line	867-920-8130
Government of Nunavut Environmental Protection	Director Environment	867-979-7800
Kitikmeot Inuit Association (KIA)	Director Environment and Lands	867-982-3310
Nunavut Water Board	Executive Director	867-360-6338
	Manager of Licensing	
RCMP (Kugluktuk)	On Duty Officer	867-982-2111
RCMP (Yellowknife)	On Duty Officer	867-669-1111
WSCC (Yellowknife)	Chief Inspector of Mines	867-669-4430

4. Risk Assessment and Management

4.1 RISK ASSESSMENT METHODOLOGY

A comprehensive evaluation of the potential risks from natural hazards and accidents and malfunctions is essential in order to meet legislated regulations, as well as Sabina's health, safety, and environmental objectives. The process of identifying and managing risk, as well as the appropriate mitigation measures in the event of accident or malfunction, is ongoing and involves:

- Identification of hazards;
- Assessment of the risk;
- Evaluation of existing controls;
- Implementation of additional risk controls, if required; and
- Monitoring and review.

Management of risks and contingency planning are integral to Sabina's approach to the Project. While there exists the possibility of natural hazards and accidents and malfunctions, Sabina's goal is to minimize risks and consequences that might affect people and the environment. Management systems, including adaptive management practices, will be designed to mitigate most risks and limit consequences. Personnel training, education, regular inspections, monitoring and maintenance of equipment are all utilized to further reduce risk. Engineering Hazard Assessment Tables 4.1-4, 4.1-5 and 4.1-6 following within this section provide hazard assessments prior to mitigations being applied. Appropriate mitigation measures are also presented within these tables.

Sabina's risk assessment methodology consists of a four-step process:

1. Identify hazards – itemize all possible natural and human-made hazards that could impact the site of operations;
2. Evaluate likelihood or frequency (probability) - the degree of risk posed by each hazard (Table 4.1-1);
3. Evaluate consequences (severity) - select the category which best describes the effects of a credible mishap on personnel, environment, and facilities, assuming that emergency planning and management controls are in place (Table 4.1-2); and
4. Evaluate risk – for each hazard, select its risk category based on probability and consequences (Table 4.1-3).

Table 4.1-1. Likelihood

Likelihood	Description in Context of Full Operating Life of the Facility	Frequency
Almost Certain	Consequence expected to occur in most circumstances	High frequency of occurrence - occurs more than once per year
Likely	Consequence will probably occur in most circumstances	Event does occur, has a history, occurs once every 1 to 10 years
Possible	Consequence could occur at some time	Occurs once every 10 to 100 years
Unlikely	Consequence may occur at some time	Occurs once every 100 to 1,000 years
Rare	Consequence may occur at some time	Occurs once every 1,000 or more years

Table 4.1-2. Consequence Severity

Consequence	Definition
Critical	*Major uncontrolled event or inefficiency with uncertain and perhaps prohibitively costly remediation.* Health and Safety: Fatality. Production: More than six month production loss or expenditure. Cost: >$500,000,000 damage or additional costs. Environmental Impact/Compliance: Very serious environmental impacts with impairment on landscape/ marine ecology. Long-term, widespread effects on significant environment. Corporate Image: Corporate image tarnished internationally. Community Affairs: Noncompliance with existing community agreement. Extreme and widespread community concerns with international exposure/influence.
Major	*Significant event or inefficiency that can be addressed but with great effort.* Health and Safety: Lost-time injury(s) potentially resulting in permanent disability. Production: Three to six months production loss or expenditure. Cost: $100,000,000 to $500,000,000. Environmental Impact/Compliance: Serious environmental impacts with impairment on ecosystems. Relatively widespread long-term effects. Regulatory approval withdrawn for a few months. Corporate Image: Corporate image tarnished in North America. Community Affairs: High local community concerns with national exposure/influence.

(continued)

Table 4.1-2. Consequence Severity (completed)

Consequence	Definition
Moderate	*Moderate event or inefficiency that might need physical attention and certainly engineering review.* Health and Safety: Lost-time injury (no permanent disability). Production: One to three months production loss or expenditure. Cost: $1,000,000 to $100,000,000 damage or additional costs. Environmental Impact/Compliance: Some impairment on ecosystem function. Displacement of species. Moderate short-term widespread effects. Regulatory orders with significant cost implications. Corporate Image: Corporate image tarnished in Nunavut. Community Affairs: Moderate local community concern with potential permanent damage to relations.
Minor	*Minor incident or inefficiency that might require engineering review and is easily and predictably remediated.* Health and Safety: Injury (no lost time). Production: Less than one month production loss or expenditure. Cost: $100,000 to $1,000,000 damage or additional costs. Environmental Impact/Compliance: Minor effects on biological or physical environment. Minor short-term damage to small areas. Corporate Image: Corporate image not affected, written complaint or concern dealt with internally. Community Affairs: Minimal local community concern with no lasting damage to relations.
Insignificant	*Minor incident or inefficiency of little or no consequence.* Health and Safety: No injury or lost time. Production: One to two weeks production loss or expenditure. Cost: <$100,000 damage or additional costs. Environmental Impact/Compliance: No lasting impacts. Low-level effects on biological or physical environment. Limited damage to minimal area of low significance. Corporate Image: Corporate image not affected or verbal complaint dealt with internally. Community Affairs: No community concern

Risk was derived from the average of probability and consequences. Risks in the highest category are considered non-routine and would receive additional planning, employee training, and management scrutiny as appropriate.

Table 4.1-3. Risk Matrix

	Likelihood				
Consequence	**Rare**	**Unlikely**	**Possible**	**Likely**	**Almost Certain**
Critical	Moderate	Moderate	High	Extreme	Extreme
Major	Low	Moderate	Moderate	High	Extreme
Moderate	Low	Moderate	Moderate	Moderate	High
Minor	Very Low	Low	Moderate	Moderate	Moderate
Insignificant	Very Low	Very Low	Low	Low	Moderate

4.1.1 Risk Mitigation Strategies

Mitigation strategies to reduce the probability and consequences of any accidents and malfunctions include:

- Reducing probability of occurrence of the event (e.g. reinforcement of structures);
- Reducing consequences of the event (e.g., increased setbacks from sensitive sites); and
- Developing system redundancies (e.g., backup systems).

Sabina will implement the following mitigation actions to prevent accidents and malfunctions from occurring and to minimize impacts when such events occur:

- Systematic Risk Assessment Approach
  - The results of hazard identification and risk assessment are the basis for establishing and documenting:
    - Environmental, health, and safety objectives;
    - Environmental, health, and safety performance targets; and
    - Actions to achieve the established objectives and targets.
  - Each hazard classified as representing a priority risk requires an action plan with recommendations to control the risk. Recommendations include consideration for:
    - Operational controls;
    - Training and awareness; and
    - Performance measurement and monitoring.
  - The action plan and recommendations are forwarded to the area management responsible for the follow-up. In all cases, the action plan and recommendations are communicated to the interested and affected employees (and others as required). Typically, the recommendations are implemented in consultation with interested and affected employees (and others as required).
- Employee training programs:
  - Sabina will develop a training program for those involved in handling specific hazardous materials. Training will focus on handling procedures, spill prevention, and clean-up.
- Inspection and Maintenance Program
  - Sabina will implement routine inspection and maintenance program for its equipment, facilities, and hazardous material storage facilities. Equipment containing hazardous materials will be kept in good repair. Worn or damaged transfer equipment, e.g. valves and hoses, will be replaced or repaired promptly.
- Emergency Response
  - The Risk Management and Emergency Response Plan and Spill Contingency Plan will take into account the possible scenarios for major accidents and malfunctions.
  - Suitable spill kits will be maintained at transfer points for hazardous materials.
  - An on-site Emergency Response Team (ERT) will be established. The ERT will be trained to respond to likely spill scenarios. Field exercises and classroom training will be undertaken on an annual basis.
  - Detailed procedures for handling and disposal of spill contaminated materials will be developed.
  - Location maps identifying emergency response resources (including spill response kits) will be provided in appropriate future regulatory applications.
- Environmental Monitoring

  - Sabina will develop an Environmental Protection Plan for the Construction phase;
  - Employees and contractors will receive a site induction program during which they will be made aware of the site environmental sensitivities and reporting requirements for unsafe or hazardous situations.
  - Sabina will employ site-based environmental personnel during Construction to monitor contractor performance to ensure that suitable environmental precautions and standards are being followed.
- Adaptive Management
  - All incidents and accidents will be investigated and reported. Lessons learned from these investigations will inform revisions to work procedures and response techniques.

4.2 NATURAL HAZARDS

The environment has the potential to affect the design, operation, and closure of the Project. Extreme weather (storms, extreme rainfall or snowfall, extreme low temperatures) and geo-hazards (seismicity, ground and slope instabilities) have the potential to affect Project infrastructure and in turn represent concerns for human safety and the environment. An assessment of risk and identification of mitigation measures associated with effects of the environment on the Project is presented in Volume 9, Chapter 3, and is summarized below.

The following natural hazards were identified:

- Geotechnical hazards, including:
  - Slope stability
  - Underground stability
  - Frost heave
  - Ice scour
  - Coastal erosion and sea level trends
  - Seismic activity
- Unfavourable geological conditions
- Permafrost (thaw settlement and subsidence)
- Hydrological conditions
- Severe weather events, including:
  - Extreme precipitation events
  - Snow drifting/banking
- Sea ice conditions
- Ice ride-up and pile-up
- Isostatic rebound
- Climate change effects, including:
  - Permafrost changes
  - Hydrological changes
- Sensitive ecosystem and land features

An engineering hazard analysis was undertaken for each main project component, including the Goose Property, all-season roads and airstrip, winter ice roads, and the MLA. Tables 4.2-1, 4.2-2 and 4.2-3 present the results of the engineering hazard for these project components, including a description of the hazard, potential consequences, the likelihood and consequence of an event occurring, and the mitigation measures including engineering design features planned to reduce the likelihood and/or the consequence of the identified natural hazards.

The high consequence natural hazards include thaw-susceptible soils; seismicity; culvert crossing stability; and the stability of pit walls, stockpiles, underground workings and the tailings embankment. The primary mitigation measures for these features have included advancement of geotechnical investigations to date to understand ground conditions and the incorporation of appropriate factors of safety (Volume 9, Section 2.14.1). The proposed design of engineered structures is consistent with appropriately conservative factors of safety applied to other mining projects in the Arctic. Monitoring programs have been identified in other management plans to verify that engineered structures perform as expected.

The potential impacts of climate change on the Project were also considered. This includes an increase in the active layer over time which is relevant to post-closure performance of covers over WRSAs and the TSF, as well as increased precipitation. By the year 2100, active layer thickness is estimated to increase 65 cm for natural overburden sand at the Property (Volume 9, Section 2.11.1), and this has been accounted for in the design of engineered covers over potential acid generating and metal leaching materials. The impacts of climate change on the hydrological regime, including freshwater and groundwater regimes, can be considered in the amount of precipitation the area receives. Climate change analysis confirmed that the rate of change of rainfall depth over baseline conditions is expected to be less than 10% by the year 2040, and as such, water management structures were designed with a 10% increased rainfall depth.

The trend in extreme climate parameters, such as floods and storms due to climate change is currently unknown. However, with projected increases in total annual precipitation up to 6%, 11%, and 16% by the 2020s, 2050s, and 2080s respectively and an increase in frequency of heavy rain by up to 68% by 2080s (Section 2.13.2), extreme climate parameters may show similar trends. Still, it is unlikely that these trends will manifest in any significant magnitude over the life of the Project.

Table 4.2-1. Engineering Hazard Assessment – Goose Property

Engineering Hazard	Hazard Description	Potential Consequences	Likelihood	Consequence Factor	Mitigation Measures
Permafrost / Thaw Susceptible Soils	• Construction over ice-rich or thaw sensitive permafrost ground causing technical issues with Project infrastructure foundations. • Problems potentially leading to environmental impacts.	• Heavy structures experiencing creep settlement over ice-rich permafrost. • Thaw weakening of surficial soils causing failure or movement of foundations. • Melting of massive deposits below or adjacent to structures causing settlement or movement.	Moderate	High	• Geotechnical investigations have been progressed. • Where possible, found significant structures on bedrock and locate structures to avoid problem areas. • Excavations in overburden materials and disturbance of natural ground will be avoided where feasible. • If excavation is required, natural materials will be over excavated and backfilled with an insulating cover of thaw stable granular fill materials of a minimum thickness to protect against thaw and instability in the underlying ice-rich overburden soils. • Embankments or granular fill pads will be constructed with side slopes sufficient to protect underlying permafrost. • Design and construct with insulation to control and limit effects of heat and restricted cooling.
Seismicity	• Significant earthquake event subjecting structures to dynamic loading. • Low seismicity of region.	• Pit slope failure. • Failure of WRSA, stockpile or tailings slopes. • Failure of infrastructure.	Low	Moderate to high	• Geotechnical investigations have been progressed. • Concerns mitigated through seismic hazard assessment and understanding load potential. • Side slopes and foundations built to meet seismic design parameters. • Monitoring during operations for indicators of potential problems. • Impact of seismicity on structures in permafrost is low.
Flooding / Hydrology	• Although not expected to have significant impact, runoff and water pooling could impact thermal regime. • Significant runoff event exceeds capacity of access road culverts. • Icing of culverts reduces capacity for normal flows. • Debris build-up causes reduced capacity for flows.	• Surface water induced thermal degradation leading to thaw settlement or weakening of soils/foundations. • Overtopping of roads causing failure and potential downstream sediment issues.	Moderate	Low	• Hydrology baseline studies have progressed. • Where surface water collection or diversion is required, the thermal impact of runoff will be considered. Interception ditches or berms will be employed to redirect surface water flows. Ditches may have to be built by over-excavation and replacement with thaw stable processed rock fill material. • Maintain grading and drainage of all areas near infrastructure. • All culverts designed for 1-in-100-year flood event. • Regular monitoring of culverts to identify icing or other debris blockages.
Open Pit Stability	• Overall slope stability. • Rock fall potential. • Freeze/thaw cycles within the active zone will cause or accelerate the deterioration of the bench faces and increasing the chances of rock falls. • Ground water inflow could have an impact on slope stability. • Open pits could extend close to, or into, talik zones.	• Rock falls, groundwater inflows or an overall slope stability issue resulting in material impacting personnel or equipment working at lower elevations within the pit. • Injury or fatality. • Temporary shutdown of open pit operations.	Moderate	Moderate to high	• Geotechnical investigations have been progressed. • Bench face angles selected to reduce instabilities. • Catch benches incorporated into design to reduce impact of small scale instabilities. • Inter-ramp and overall slope angles selected to achieve target factor of safety against multi-bench or overall slope failures. • Bench maintenance program will include monitoring, scaling, and the cleaning of accumulated debris from the catch benches. • Groundwater inflows have been accounted for in the design when open pits intersect a talik zone. In other areas, inflows are expected to be negligible as a result of permafrost conditions. • Waterbodies that could cause a potential stability impact will be managed early, either through partial dewatering or diversion via temporary berm.
Open Pit Overburden Slope Stability	• Failure of natural overburden slope above open pit. • Piping and undercutting of toe due to groundwater seepage.	• Slope failure could impact personnel or equipment working at lower elevations within the pit. • Thermal degradation could lead to increased sediment reporting to open pit.	Moderate	Moderate	• Geotechnical investigations have been progressed. • Cut slopes designed to address stability issues. • Ice-rich slopes will be protected with thermal or erosion barriers (e.g., rock cover). • Diversion berms may be utilized to control surface run-off where seasonal flows can affect the slope.

(continued)

Table 4.2-1. Engineering Hazard Assessment – Goose Property (completed)

Engineering Hazard	Hazard Description	Potential Consequences	Likelihood	Consequence Factor	Mitigation Measures
Waste Rock Storage Area Stability	• Stability problems associated with waste rock storage and waste overburden material facilities.	• Weakening of thaw sensitive soils during summer dumping. • Weakening of thaw sensitive soils due to surface water flows impacting thermal regime outer-slope failure. • Presence of ice-rich foundations leading to the development of cracks or unstable slopes. • Acid rock drainage.	High	High	• Current design is maximum 2.4:1 side slopes. • PAG waste rock will be placed in a manner to prevent surface permafrost degradation and promote aggregation of the permafrost into the waste rock. • Ground disturbance will be minimized prior to placement of the thermal barrier. Only surface ice and snow to be removed from the footprint during the winter prior to placement of waste rock. • In order to enhance thermal protection, management of WRSA surface runoff will be facilitated through the construction of ditches and/or toe berms. • Ongoing monitoring of slopes. Any cracks that develop will be monitored and repaired as required to minimize inflow of surface water and subsequent ice wedge formation within the WRSAs. • Encapsulate PAG waste materials in NPAG waste rock to maintain frozen state to protect the PAG waste rock from seasonal thawing (i.e. contain the active layer) and prevent the release of ARD. • Encapsulate ice-rich materials in waste rock to maintain frozen state and prevent release of sediment.
Tailings Storage Facility Stability	• Stability problems associated with tailings deposition and storage.	• Slope failure could impact personnel or equipment in the area. • Presence of ice-rich foundations leading to the development of cracks within the rockfill embankments. • Slope failure could lead to uncontrolled release of water and tailings.	Moderate	High	• Geotechnical investigations of foundation ground conditions have been progressed. • Design selected to achieve target factor of safety against partial or overall slope failures during construction and TSF operations. • Maintenance program will include a monitoring and inspection program for settlement or thermal degradation. • TSF current design: 1-in-2,475 year seismic event and 1-in-1,000 flood, 24-hour storm event.
Underground Stability	• Failure of roof and walls. • Rock falls. • Groundwater inflows.	• Wall failure, rock falls or groundwater inflow could impact personnel or equipment working at depth. • Injury or fatality. • Temporary shutdown of underground operations.	Moderate	High	• Geotechnical investigations have been progressed. • Underground workings have been engineered to address stability. • Ground support will be installed as needed. • Hydrological investigations have been progressed and accounted for in mine design. • Water management systems designed to manage maximum potential inflow rates. • Underground maintenance program will include a monitoring program, scaling, and inflow inspection.
Surface Water Availability	• Insufficient Project surface water available from proposed sources due to reduced precipitation, or increased evapotranspiration or sublimation. • Run-off different than modelled.	• Process chemistry changes causing losses in mineral recovery. • Changes to water management and treatment plan.	Low	Low	• Meteorological and hydrological investigations have been progressed. • Current water management plan accounts for a range of expected precipitation and runoff conditions; changes outside of expected range will be managed by amending water management plan and balancing water supply and demand. • Other sources of surface water can be explored if needed.

Table 4.2-2. Engineering Hazard Assessment – All-weather Roads and Airstrip

Engineering Hazard	Hazard Description	Potential Consequences	Likelihood	Consequence Factor	Mitigation Measures
Permafrost / Thaw Susceptible Soils	• Massive ice or ice-rich soils at depth below higher embankments or in areas of cut. • Thaw sensitive soils near ground surface below low embankments.	• High embankments may experience creep settlement over time. • Settlement or heave of road surface due to thawing and freezing of ice-rich soils; higher risk in cut areas. • Construction disturbance or new ponding of water could impact thermal regime causing settlement, thermokarst development, and potentially impact stability of road. • Poor aesthetics.	Moderate	Low	• Geotechnical investigations have been progressed. • Design embankments with minimum fill thickness for thermal protection and implement flatter slopes in problem areas. • Embankment construction will be employed (i.e. no cuts into permafrost) where road alignment crosses overburden soils to avoid disturbing sensitive soils and surface vegetation. • Maintain grading and drainage from borrow areas and roads. • Runoff and sediment control measures. • On-going inspections and maintenance.
Seismicity	• Significant earthquake event subjecting structures to dynamic loading. • Low seismicity of region.	• Failure of culvert crossings along road alignment. • Sudden failure of road embankment. • Landslide, overburden/bedrock cut slope instability impacting road. • Liquefaction of clay-rich soils.	Low	Moderate	• Side slopes and surfaces built to meet seismic design parameters. • Use stable fill materials, modern construction practices, and QA/QC procedures. • Monitoring during operations for indicators of potential problems. • Impact of seismicity on structures in permafrost is low.
Flooding / Hydrology	• Significant runoff event exceeds capacity of culverts or other water crossings. • Icing of culverts reduces capacity or normal flows. • Debris build-up causes reduced capacity for flows.	• Overtopping of road leading to operational shutdown, repairs or environmental impacts due to high downstream sediment loading. • Ponded water impacting thermal regime and overall stability of structures.	High	Low to moderate	• Hydrology baseline studies have progressed. • All culverts current design 1-in-100-year storm event. • Regular monitoring of culverts to identify and mitigate risk of icing or other debris blockages.
Road Embankment Stability	• Sudden failure of road embankment due to physical failure of embankment fill or underlying foundations.	• Failure causing operational shutdown. • Costs of repairs. • Environmental impacts due to downstream sediment loading.	Low	Moderate	• All side slopes will be constructed at 2H:1V; safety berms required for embankments higher than 3 m. • Use stable fill materials, modern construction practices, and QA/QC procedures. • Monitoring during construction and operations for indicators of potential problems.
Landform Stability	• Large scale landslide or slope instability outside footprint of road. • Medium or large scale landslide through embankment footprint leading to subsidence in road bed.	• Sudden failure of road embankment. • Blockage of culverts. • Impact to thermal regime effecting longer term integrity of embankment permafrost foundations. • Temporary shutdown of road operations.	Low	Moderate	• Avoiding areas of major concern. • Monitoring of potential problem areas. • Overall topography is low relief which reduces overall risk.
Culvert Crossing Stability	• Failure of culvert crossing structures. • Abutment failure due to thawed areas or impacts of flows on thermal regime. • Erosion of abutment or foundations by water flows causing failure.	• Failure of culvert crossing causing operational shutdown. • Costs of repairs. • Injury or fatality. • Environmental impacts.	Low	High	• Geotechnical investigations have been progressed. • Design for thermal projection and abutment stability; maximize use of bedrock. • All culverts designed to 1-in-100-year storm event. • Scour protection around abutments. • Monitoring for advanced notification in event of potential failure.

Table 4.2-3. Engineering Hazard Assessment – Marine Laydown Area

Engineering Hazard	Hazard Description	Potential Consequences	Likelihood	Consequence Factor	Mitigation Measures
Permafrost / Thaw Susceptible Soils	• Construction over ice-rich or thaw sensitive permafrost ground causing technical issues with Project infrastructure foundation. • Problems potentially leading to environmental impacts.	• Heavy structures experiencing creep settlement over ice-rich permafrost. • Thaw weakening of surficial soils causing failure or movement of foundations. • Melting of massive deposits below or adjacent to structures causing settlement or movement.	Moderate	Moderate	• Geotechnical investigations have been progressed to understand ground conditions. • Where possible, found most significant structures on bedrock and locate structures to avoid problem areas. • Excavations in overburden materials and disturbance of natural ground will be avoided where feasible. • If excavation is required, natural materials will be over excavated and backfilled with an insulating cover of thaw stable granular fill materials of a minimum thickness to protect against thaw and instability in the underlying ice-rich overburden soils. • Embankments or granular fill pads will be constructed with a side slopes sufficient to protect underlying permafrost. • Monitoring during construction and operations for indicators of potential problems.
Seismicity	• Significant earthquake event subjecting structures to dynamic loading. • Low seismicity of the MLA region.	• Failure of infrastructure or foundations.	Low	High	• Concerns mitigated through seismic hazard assessment and understanding loading potential. • Use stable fill materials, modern construction practices, and QA/QC procedures. • Monitoring during operations for indicators of potential problems. • Impact of seismicity on structures in permafrost is low.
Flooding / Hydrology	• Although not expected to have significant impact, runoff and water pooling could impact thermal regime. • Significant runoff event exceeds capacity of access road culverts (i.e., icing of culverts or debris reduces capacity).	• Surface water induced thermal degradation leading to thaw settlement or weakening of soils/foundations. • Overtopping of roads causing failure and potential downstream sediment issues.	Low	Moderate	• Where surface water collection or diversion is required, the thermal impact of runoff will be considered. • Maintain grading and drainage of all areas near infrastructure. • All culverts designed for 1-in-100-year event. • Regular monitoring of culverts to identify icing or other debris blockages.

Extreme meteorological events that have the potential to affect the Project include:

- Extreme temperature and precipitation events
- White-out conditions
- Extreme cold
- Shortened winter season

Extreme temperature and precipitation events were identified in the engineering hazard assessment presented above, and have been incorporated into the engineering design of the Project, as described above and in more detail in Volume 9, Section 2.

Despite accounting for extreme meteorological events in the engineering design, high runoff events could potentially lead to elevated flows beyond the capacity of certain hydraulic structures established along road alignments and those within Project areas. There are some minor hydrological risks associated with surface runoff and water pooling that could impact the thermal regime. These risks are further increased by the combination of spring freshet and the potential ice blockage of culverts, which could reduce flow capacity and lead to overtopping and washouts of road sections. This condition may also contribute to high sediment loading to the downstream environment and increased erosion.

The Project will be designed for the cold temperatures experienced in the region. However, persistent extreme cold conditions can present difficult operating conditions in which equipment can be damaged or stop operating, potentially presenting a health and safety risk to workers.

Whiteout conditions offer operational challenges and scheduling impacts. These conditions occur in Polar Regions when illumination from snow on the ground and heavily falling or blowing snow obscures the landscape and reduces visibility. This has a potential to impede all aspects of outdoor operations. In case of whiteout conditions, site safety protocols will be activated to ensure the risks to personnel and operations are mitigated.

The potential changes associated with the timing of ice formation could affect operational components and ongoing field investigations. Although considered manageable, delayed ice formation could potentially impact operational components such as ice-based airstrips and winter ice roads. A shortened seasonal use of such components could lead to logistical and operational delays associated with transportation of freight and fuel between the Goose Property and the MLA. These risks can be mitigated by construction criteria that address the potential increased temperatures due to climate change. In addition, logistics, planning, and potential equipment fleet adjustments will be implemented to address changes in operational ice road seasons.

Several emergencies resulting from natural hazards such as weather have been assessed as accidents and malfunctions in the following section. This includes weather-related stranding, power outage, and weather related failures of mine infrastructure.

4.3 ACCIDENTS AND MALFUNCTIONS

Accidents and malfunctions may occur during any phase of the Project. Thus contingency planning and mitigation measures will be activated in any case where these have the potential to affect human health and the environment.

The primary environmental concern resulting from accidents and malfunctions is the possibility for spills, release of chemicals, reagents, petroleum products, or process materials onto the land or water. For example, damage to or malfunction of the wastewater system might result in the release of effluent. Fire presents another risk; this may result from vehicle accidents, damage to electrical systems or accidental explosions.

Shipping presents further risk potential. Ship damage through collision with other vessels or grounding may result in harm to marine life and the coastal environment through possible diesel spills along the shipping route.

A complete list of the accidents and malfunctions assessed in Volume 9, Section 3 are presented in Table 4.3-1. Accidents and malfunctions have been categorized by Project phase (Mobilization and Construction, Operations, Closure and/or Post-Closure) and location (Goose Property – GSE; Marine Laydown Area (MLA), and Winter Ice Road (WIR).

Table 4.3-1. Major Accidents and Malfunctions Summary

Issue of Concern	Location	Mobilization and Construction	Operations	Closure and/or Post-Closure
Diesel spill	GSE, MLA	X	X	X
Fuel spill along shipping route	MLA	X	X	
Fuel spill during ship-to-shore transfer of fuel	MLA	X	X	
Ship grounding	MLA	X	X	
Collision with other vessels	MLA	X	X	
Release of ammonium nitrate or other explosives	GSE, MLA, WIR	X	X	
Spill of hazardous materials	GSE, MLA, WIR	X	X	X
Weather related stranding	GSE, MLA, WIR	X	X	X
Power outage	GSE, MLA	X	X	X
Fire	GSE, MLA, WIR	X	X	X
Explosives accidents	GSE	X	X	
Aircraft incidents	GSE, MLA	X	X	X
Vehicle incidents	GSE, MLA, WIR	X	X	X
Crane incidents	GSE, MLA	X	X	X
All-weather road embankment failure and/or collapse of a water crossing	GSE, MLA	X	X	X
Winter ice road collapse over water crossing	WIR	X	X	X
Underground mine flooding	GSE		X	
Ground support failure in underground mine	GSE		X	
Underground equipment fire	GSE		X	

(continued)

Table 4.3-1. Major Accidents and Malfunctions Summary (completed)

Issue of Concern	Location	Mobilization and Construction	Operations	Closure and/or Post-Closure
Open pit mine slope failure	GSE		X	
Open pit mine flooding	GSE		X	
Open pit mine blasting	GSE		X	
Falls into Pit	GSE		X	X
Waste rock storage area stability	GSE		X	X
Tailings Storage Facility (TSF) slope failure	GSE		X	X
Tailings pipeline leakage	GSE		X	
Extreme storms overtopping and washouts of the TSF and TF embankment	GSE		X	X
Seepage from TSF	GSE		X	
Saline Water Pond slope failure	GSE		X	X
Saline water pipe leakage	GSE		X	X
Extreme storms overtopping and washouts of the saline water pond embankment	GSE		X	X
Failure of contact water containment ponds	GSE	X	X	X
Falls into containment Ponds	GSE, MLA	X	X	X
Failure of Sewage Treatment Plant	GSE	X	X	X
Failure of cyanide destruction process	GSE		X	
Introduction of invasive marine species	MLA	X	X	
Introduction of invasive terrestrial species	MLA	X	X	

GSE = Goose, MLA = Marine Laydown Area, WIR = Winter Ice Road

Table 4.3-2 provides a summary of potential Project related effects associated with accidents and malfunctions that may occur during the life of the Project. Mitigation measures designed to prevent such accidents and malfunctions from occurring are noted in Table 4.3-3.

Table 4.3-2. Major Accidents and Malfunctions Risk Summary

Issue of Concern	Consequence	Likelihood	Risk Rating
Diesel spill	Minor	Likely	Moderate
Fuel spill along shipping route	Major	Unlikely	Moderate
Fuel spill during ship-to-shore transfer of fuel	Major	Unlikely	Moderate
Ship grounding	Major	Unlikely	Moderate
Collision with other vessels	Major	Rare	Low
Release of ammonium nitrate or other explosives	Minor	Possible	Moderate
Spill of hazardous materials	Moderate	Possible	Moderate
Weather related stranding	Moderate	Possible	Moderate
Power outage	Minor	Unlikely	Low
Fire	Major	Unlikely	Moderate
Explosives accidents	Major	Unlikely	Moderate
Aircraft incidents	Major	Unlikely	Moderate
Vehicle incidents	Major	Likely	High
Crane incidents	Major	Likely	High
All-weather road embankment failure and/or collapse of a water crossing	Minor	Unlikely	Low
Winter ice road collapse over water crossing	Major	Unlikely	Moderate
Underground mine flooding	Moderate	Unlikely	Moderate
Ground support failure in underground mine	Major	Unlikely	Moderate
Underground equipment fire	Major	Possible	Moderate
Open pit mine slope failure	Major	Unlikely	Moderate
Open pit mine flooding	Minor	Unlikely	Low
Open pit mine blasting	Major	Unlikely	Moderate
Falls into Pit	Major	Possible	Moderate
Waste rock storage area stability	Minor	Unlikely	Low
Tailings Storage Facility (TSF) slope failure	Moderate	Unlikely	Moderate
Tailings pipeline leakage	Moderate	Possible	Moderate
Extreme storms overtopping and washouts of the TSF and TF embankment	Moderate	Unlikely	Moderate
Seepage from TSF	Minor	Possible	Moderate
Saline Water Pond slope failure	Moderate	Possible	Moderate

(continued)

Table 4.3-2. Major Accidents and Malfunctions Risk Summary (completed)

Issue of Concern	Consequence	Likelihood	Risk Rating
Saline water pipe leakage	Minor	Possible	Moderate
Extreme storms overtopping and washouts of the saline water pond embankment	Moderate	Unlikely	Moderate
Failure of contact water containment ponds	Minor	Unlikely	Low
Falls into containment ponds	Minor	Unlikely	Low
Failure of Sewage Treatment Plant	Minor	Unlikely	Low
Failure of cyanide destruction process	Minor	Unlikely	Low
Introduction of invasive marine species	Moderate	Possible	Moderate
Introduction of invasive terrestrial species	Minor	Unlikely	Low

Table 4.3-3. Mitigation Measures for Identified Accidents and Malfunctions

Accident or Malfunction Event	Risk Rating	Mitigation Measures / Relevant Management Plan(s)
Diesel spill	Moderate	• Design of fuel storage and handling facilities in accordance with regulatory requirements. • Procedures for on-site refueling. • Double walled storage with leak protection. • Fuel Management Plan. • Hazardous Materials Management Plan. • Spill Contingency Plan.
Fuel Spill during Ship-to-shore Transfer	Moderate	• Design of fuel storage and transfer facilities in accordance with regulatory requirements. • Procedures for fuel transfers, including ship to shore communications. • Fuel Management Plan. • Oil Pollution Emergency Plan (OPEP).
Fuel Spill along Shipping Route	Moderate	• Transport Canada approved shippers with appropriate vessels operating in accordance with the Canada Shipping Act and Arctic Waters Pollution Prevention Act, and respective regulations. • Safety Management System (in accordance with the International Safety Management Code). • Navigation safety measures (equipment, rules and procedures, and communication). • Updated nautical charts and passage plan. • Seafarers certification/crewings. • Double-hauled tankers with anti-collision devices. • Approved Shipboard Oil Pollution Emergency Plan (SOPEP) and liability and compensation insurance as required by the Marine Liability Act.

(continued)

Table 4.3-3. Mitigation Measures for Identified Accidents and Malfunctions (continued)

Accident or Malfunction Event	Risk Rating	Mitigation Measures / Relevant Management Plan(s)
Ship grounding	Major but unlikely	• Adhere to established shipping lanes. • Equipped with modern navigation equipment.
Collision with other vessels	Low	• Protocols are well established for shipping in the Arctic. Communication with other vessels, surveillance systems, and anti-collision devices are among some of the mitigation measures to avoid collision.
Release of Ammonium Nitrate and Explosives	Moderate	• Use of a licensed explosives contractor with proven arctic experience. • Transport, store, and handle explosive materials in accordance with the Transportation of Dangerous Goods (TDG) Act and regulations, Explosives Act and Regulations, the Nunavut Mine Health and Safety Act, and Sabina's Explosives Management Plan.
Spill of Hazardous Materials	Moderate	• Comply with Sabina's Hazardous Materials Management Plan, including the Cyanide Management Plan. • Appropriate labeling and handling procedures in accordance with the Workplace Hazardous Materials Information System (WHMIS) and Transportation of Dangerous Goose (TDG) Act and Regulations. • Use appropriate personal protective equipment (PPE).
Weather Related Standing	Moderate	• Detailed procedures will be established for dispatching of trucks in convoys on WIR. • Position markers to be established along WIR. • Emergency shelters equipped with food, survival equipment, and communication equipment to be established along WIR. • Establish a Working in Isolation Procedure
Power Outage	Low	• Routine equipment maintenance and redundancies • Authorized entry only into electrical rooms • Standby generators linked to system critical facilities (e.g., communications, heat, light, emergency response facilities, and sewage treatment plant) • Procedures for underground power failure (losing ventilation system), including worker notification, stopping use of diesel powered equipment, surface evacuation.
Fires	Moderate	• Follow applicable codes and standards for facilities, including fire and smoke detection systems, fire alarms, and fire suppression systems. • Fire extinguishers throughout buildings and on equipment; fire suppression systems on open pit and underground mining equipment. • Scheduled preventative maintenance of equipment. • Firewater main, hydrant and standpipe system and sprinkler systems servicing the Goose Property. • Sabina's ERT will be trained in firefighting and equipment use.
Explosives Accident	Moderate	• Use of a licensed explosives contractor with proven arctic experience. • Transport, store, and handle explosive materials in accordance with the Transportation of Dangerous Goods (TDG) Act and regulations, Explosives Act and Regulations, the Nunavut Mine Health and Safety Act, and Sabina's Explosives Management Plan.

(continued)

Table 4.3-3. Mitigation Measures for Identified Accidents and Malfunctions (continued)

Accident or Malfunction Event	Risk Rating	Mitigation Measures / Relevant Management Plan(s)
Aircraft Incidents	Moderate	• Sabina will use only well-established and safety-conscious air carriers. • There are extensive safety and preventative maintenance programs which follow federal aviation requirements. • Acceptable provision of marking, lighting, electronic beacons, and weather reporting services defined by consultation with air carriers.
Vehicle Incidents	High	• All access and haul roads will be regularly maintained, with speed limits enforced. • Motor vehicle accidents at the mine site would be dealt with by the mine Emergency Response Team. • Detailed procedures presented in the Road Management Plan, Spill Contingency Plan, and Fuel Management Plan.
Crane Incidents	High	• Sabina will contract a licensed and experienced crane operator. • Establish procedural, operator and rigger and ground worker requirements.
All-Weather Road Embankment Failure and/or Collapse of Water Crossing	Low	• Apply best engineering practices to the design of all-weather road. • Regular monitoring to identify icing or other debris blockages
Winter Ice Road Collapse over Water Crossing	Moderate	• Initial ice profiling prior to initiating road construction to ensure minimum ice thickness is met. • Use light bearing pressure equipment during initial construction. • Incorporate best practices with respect to ice road design and construction (ice profiling, road width, snow bank management, emergency shelters) • Regular inspection and maintenance of the road once constructed.
U/G Mine Flooding	Low	• Mine is in low hydraulic conductivity rock such that flooding is unlikely. • Adequate contingency pumping capacity will be provided.
Ground Support Failure in U/G Mine	Moderate	• Use geotechnical analyses to anticipate poor ground conditions • Adopt proper blasting, backfilling, rock bolting, screening, and concreting practices. • Monitoring and regular inspections by ground control staff.
U/G Equipment Fire	Moderate	• Scheduled preventative maintenance programs • Daily vehicle inspections, including looking for broken or leaking hydraulic or fuel lines. • Extinguishers and automatic fire suppression systems.
Open Pit Mine Slope Failure	Moderate	• Considered unlikely given proper pit design, slope monitoring, and proper pit operation. • Proactive slope monitoring program will be in place for all stages of development at each deposit (may include geotechnical and tension crack mapping and/or surface displacement monitoring). • Integrated mine dewatering and slope depressurization program.
Open Pit Mine Flooding	Low	• Mine is in low hydraulic conductivity rock such that flooding is unlikely. • Diversion of surface waters away from the open pits. • Adequate contingency pumping capacity will be provided.

(continued)

Table 4.3-3. Mitigation Measures for Identified Accidents and Malfunctions (continued)

Accident or Malfunction Event	Risk Rating	Mitigation Measures / Relevant Management Plan(s)
Open Pit Mine Blasting	Moderate	• Possible due to flyrock, lack of blast area security, premature blasting, and misfires. • Good blast design and execution by qualified personnel only. • All employees will be removed a safe distance from the blast area, and all entrances to the blast area will be guarded. • Site-specific blasting plans to match explosives, spacing, hole diameter, etc. with rock characteristics. • Proper communication between driller, blaster, access control guards and other personnel.
Falls into Pit	Moderate	• Use of barriers and operator training.
Waste Rock Storage Area Stability	Low	• Engineered structures with short- and long-term stability analyzed and high factors of safety applied in the designs. • Regular survey of WRSA walls for movement; any unanticipated or unusual observations will be reported and the area secured.
TSF Slope Failure	Moderate	• Design, operation, and monitoring of TSF in accordance with appropriate regulations and industry best practices (i.e., Canadian Dam Safety Association Guidelines). • TSF designed to meet risks presented by high water flows, slope instability, internal erosion, or earthquake. • Dam hazard classification and hazard analysis completed. • Regular survey of TSF embankment for movement; any unanticipated or unusual observations will be reported and the area secured and deposition of water and tailings will cease until stabilized or remedial measures taken.
Tailings Pipeline Leakage	Moderate	• Frequent inspection • Preventative maintenance program. • Processing will be shut down if a leak is detected. • Spill Contingency Plan will be implemented if a leak is detected.
Extreme Storm Causing Overtopping and Washouts of TSF	Moderate	• Natural and engineered controls to ensure TSF is not overfilled. • Design, operation, and monitoring of TSF in accordance with appropriate regulations and industry best practices (i.e., Canadian Dam Safety Association Guidelines). • Use alternate storage facilities if necessary.
Seepage from the TSF	Low	• Seepage collection will be undertaken using a downstream berm. Seepage may be directed to sumps and discharged back to the TSF or to environment, as appropriate.
Saline Water Pond Slope Failure	Moderate	• Natural and engineered controls to ensure pond is not overfilled. • Design, operation, and monitoring of pond embankments in accordance with appropriate regulations and industry best practices (i.e., Canadian Dam Safety Association Guidelines if applicable). • Use alternate storage facilities if necessary.
Saline Water Pipe Leakage	Moderate	• Frequent inspection • Preventative maintenance program. • Processing will be shut down if a leak is detected. • Spill Contingency Plan will be implemented if a leak is detected.

(continued)

Table 4.3-3. Mitigation Measures for Identified Accidents and Malfunctions (completed)

Accident or Malfunction Event	Risk Rating	Mitigation Measures / Relevant Management Plan(s)
Extreme Storm Causing Overtopping and Washouts of Saline Water Pond or Contact Water Containment Ponds	Low to Moderate	• Natural and engineered controls to ensure pond is not overfilled. • Design, operation, and monitoring of pond embankments in accordance with appropriate regulations and industry best practices (i.e., Canadian Dam Safety Association Guidelines). • Use alternate storage facilities if necessary.
Falls into Containment Ponds	Low	• People, animals or vehicles could fall into the containment ponds. • Adequate design of access roads and operator training. • Routine inspections and implementation of mitigation measures outlined in the Wildlife Mitigation and Monitoring Plan, if required.
Failure of Sewage Treatment Plant	Low	• STP will be equipped to handle variations in influent characteristics. • Preventative maintenance program. • Monitoring program to detect operational problems. • Back-up power supply in case of failure of main power supply. • Spill Contingency Plan to respond to unplanned discharges.
Failure of Cyanide Destruction Process	Moderate	• Regular monitoring of process water streams and final effluent.
Introduction of Invasive Marine Species	Low	• Ballast water exchange in accordance with the Ballast Water Control and Management Regulations.
Introduction of Invasive Terrestrial Species	Low	• Routine inspections of storage sites at MLA. • Consult with Government of Nunavut and take appropriate species-dependent actions.

5. Emergency Response

5.1 EMERGENCY RESPONSE EQUIPMENT

Important information will be posted conspicuously throughout the Project area, including:

- Location of emergency response equipment (first aid kits, PPE, fire protection equipment, spill response kits) and details of proper use.
- Location of Muster Points and First Aid Stations.
- Lists of personnel trained in emergency response procedures (first aid, fire suppression, spill response).
- Outlines of Emergency Response Procedures.
- Emergency contact lists.

5.1.1 Fire Protection Equipment

All work areas will be equipped with proper fire protection equipment and signage will be posted where required. The inspection, and if necessary, testing and maintenance of all firefighting equipment are carried out by a qualified person at least once a month.

All precautions necessary will be taken to prevent fire hazards when working:

- Flammable substances will be managed in accordance with the Fuel Management Plan, Hazardous Materials Management Plan, and Explosives Management Plan (FEIS Volume 10).
- All areas will be kept clear of any accumulation of material to enhance safe access and egress in case of emergency.
- Scrap, paper, rags etc. will be disposed by placing them in proper containers with lids secured.
- Oil and grease spills will be cleaned up immediately.

Smoke and carbon monoxide detectors will be located throughout the camp area.

Air horns and/or sirens will be posted by all building exits for use in alerting others in camp of an emergency situation. Air horn signal will be:

- 1 long blast = all emergency situations.

5.1.2 First Aid and Medical Equipment

First aid kits will be strategically located in vehicles and all Project sites. They will be stored in marked areas, readily accessible to responders.

Additional medical equipment will be located at the onsite Medical Clinic.

5.1.3 Spill Response Equipment

Available heavy equipment and aircraft will be used as appropriate for emergency use to respond to spill incidents.

Appropriately equipped spill response kits, additional on-site spill response equipment and SDS will be strategically located in vehicles and at all Project sites, especially the active mining areas. A location map is provided in the SCP (FEIS Volume 10, Chapter 5).

A vehicle outfitted with a self-contained collection of spill response materials for rapid deployment to spill sites will be utilized.

Reserve spill response equipment such as booms, socks and pads will be available for response to larger spill incidents, or to replenish materials used in the smaller equipment spill kits. Spill kits will be inspected routinely and restocked after use.

Further information on spill response equipment, including conceptual location maps, is provided in the SCP (FEIS Volume 10, Chapter 5) and OPEP (FEIS Volume 10, Chapter 6).

5.2 COMMUNICATION SYSTEMS

The primary means of onsite communication will be the phone system, hand-held radios, and vehicle radios. The primary means of external communication will be the phone system and stand-alone SAT phones.

Backup power sources and replacement batteries will be available to ensure continuous operation of communication systems.

In an emergency situation the "CAMP" radio channel will be used. The emergency call over the radio is "Code 1, Code 1, Code 1". Once an emergency call is given over the radio, all work must stop and radio silence is initiated. The CAMP channel will be used as the Emergency Channel.

Members of the ERT will be on-call for emergency situations 24 hours a day.

Emergency contact information is provided in Section 3.

5.3 MUSTER POINTS

In the event of an emergency, affected personnel must leave the emergency area and report to pre-determined Muster Points.

Muster Points will be designated based on Feasibility Study designs of the Project site and will be identified in updates on this Plan. A map of the Muster Points will be included in the Plan and will be posted around the Project site.

Emergency supplies (sleeping bags, stoves and food) will be kept at the Muster Points.

5.4 SURVEILLANCE PROCEDURES

Aircraft used to service the Project will be subject to surveillance procedures as specified by Transport Canada and the internal procedures of the contractors supplying the aircraft. Aircraft contractors will provide Sabina with documentation of minimum flying height and seasonal flight restrictions for the Project area.

5.5 EMERGENCY RESPONSE PROCEDURES

The location of an emergency incident, weather conditions, and the time of year will influence the response time and available resources. At both the Goose Property and the MLA, ERT manpower and emergency response equipment will be readily available, and road access around the properties will enable to rapid response to emergencies, and medivac if necessary.

Response to emergencies that occur as a result of Project traffic along the winter ice road will have varying response time, depending on the distance from nearby vehicles, the distance from the incident location along the winter ice road from either of the properties, and the weather conditions which could slow the response. Radio communication on the winter ice road is an important tool for communicating an incident. The time of day will be a factor where helicopter use is required, and weather events such as blizzards could delay response times or the ability to medivac injured personnel.

5.5.1 Medical Emergency

5.5.1.1 Onsite Medical Assistance

If the worker is injured but does not require immediate medical assistance or transportation:

- Provide immediate First Aid.
- Make arrangement with supervisor, or other personnel if needed, for transportation of the injured worker to the onsite Medical Clinic.
- Ensure worker's supervisor is informed of the injury to the worker and that they are being transported to the Medical Clinic.

- Worker is to remain at the Medical Clinic until the supervisor arrives.
- The Principal Medical Aide Designee who treated the patient is responsible for filling out the appropriate forms and reports.

If a worker is injured and immediate medical assistance or medivac transportation is required:

- Provide immediate First Aid.
- Call, or send someone else to notify of need for medical assistance.
- Contact the Principal Medical Aide Designee via the hand held VHF radio on "CAMP" Channel.
- Call: "Medic-Medic-Medic" and provide the following information:
  - "My name is _____; I am located at _____. (State worker's name) has been injured and requires immediate medical assistance." Describe the nature of the injury. Await confirmation that the message was received.
- Once an emergency call is given over the radio, all work must stop and radio silence is initiated. The CAMP channel will be used as the Emergency Channel.
- Stay at the scene:
  - Maintain contact with the Principal Medical Aide Designee if possible.
  - Render First Aid.
  - Post a spotter for direction.
  - If needed, send an escort vehicle to meet the Principal Medical Aide Designee en-route.
- Hand over the care of the patient to the Principal Medical Aide Designee when they arrive and provide assistance.
- The Principal Medical Aide Designee to assume control over the injured worker and further medical response. The Principal Medical Aide Designee will decide on the need for mobilization and transport.
- Logistics and Camp Supervisor to be on standby for instructions regarding medivac, runway preparation, lighting, clearing, etc.

5.5.1.2 Medivac Procedure

If a medical emergency is declared by the Principal Medical Aide Designee, the following will be executed:

- Logistics will be contacted via radio on CAMP Channel, and will be provided the required medical information by the Principal Medical Aide Designee, or their designate.
- Logistics will contact Cambridge Bay Heath Centre (867-983-4500) and inform on-duty nurse of emergency.

  *Important: A doctor must be receiving to initiate the Medivac.

- If Cambridge Bay Health Centre is unavailable, Logistics will call Stanton Hospital in Yellowknife (1-800-661-0867) and inform the on-duty nurse of emergency.
- Provide the following information to the on-duty nurse:

Company	Sabina Gold & Silver Corp.
Project	Back River Project
Camp No.	TBD (Update annually or whenever changed)
Patient Location	Latitude: 65° 32' 42"N Longitude: 106° 25' 43"W
Medicare/Health #	May need to be given at a later time.
# Of Injured Persons	
Patient Information	What happened?
Condition	Conscious or unconscious?
History	Any other known medical conditions
Age of Patient	
Time of Accident	

- Doctor from Cambridge Bay Health Centre will contact a doctor in Yellowknife with the injury details and that they are initiating a medivac.
- Await a call from Cambridge Bay doctor who will provide the name of the receiving doctor in Yellowknife.
- Call Air Tindi to request a medivac plane and provide them with the name of the receiving doctor and a brief incident description.
- Flight Paramedics will call back to have complete incident details; request any medical equipment that is necessary.
- Principal Medical Aid Designee to continue to update Logistics with patient's status and vitals.
- If a medivac is initiated, Logistics to get direction from Air Tindi as to the estimated time of arrival (ETA).
- Logistics to notify the Principal Medical Aide Designee of ETA for the medivac.

Secondary Contacts

If Air Tindi cannot be reached, contact:

- Summit Air 867-873-4464.
- Great Slave Helicopters 1-867-873-2081.

Compromised Air Transportation

Should air transport be unavailable due to weather or daylight hours, the patient will remain on site at the onsite medical clinic until air support can be provided.

In Case of Death

- Do not move the body unless it would be destroyed by a fire or other hazard.
- Cover the body.
- Contact supervisor.
- Supervisor to call the RCMP, Company directors, Mines Inspectors.

5.5.2 Fire/Explosion

If a **minor fire** is discovered:

- Sound the alarm (Code 1 call on the radio).
- Where it is safe to do so, onsite personnel will take immediate steps to extinguish small fires. All workers will be trained in use of fire extinguishers.
- If it is safe to do so, shut off equipment, warn others and use the planned escape route.
- In the event of a fire, all workers must report to the primary muster point, if this is not possible report to the secondary muster point.

When approaching a fire:

- Always seek help before approaching.
- Before approaching, be sure to check the extinguisher is charged, and complete a visual inspection for any obvious signs of deterioration to the extinguisher or low pressure.
- Always ensure you keep the fire in front of you and that you have a means of escape. Stay upwind of the fire.
- Use the PASS method when operating a fire extinguisher:
  - **P**ull the pin at the top of the extinguisher. The pin releases a locking mechanism that will allow you to discharge the extinguisher.
  - **A**im at the base of the fire, not the flames. This is important – in order to put out the fire, you must extinguish the fuel. Spraying the fire directly could cause it to spread.
  - **S**queeze the lever/nozzle slowly. This will release the extinguishing agent in the extinguisher. If the handle is released, the discharge will stop.
  - **S**weep from side to side. Using a sweeping motion, move the fire extinguisher back and forth until the fire is completely out, or until all expellant is used.
- Operate the extinguisher from a safe distance, several feet away and then move towards the fire once it starts to diminish.
- Never use a Class A extinguisher on an electrical fire.
- Do not hesitate to leave the area if the fire continues to grow.
- Once the fire is out, don't walk away immediately. Watch the area for a few minutes in case it re-ignites.
- Replace the fire extinguisher with a recharged one.
- Bring the discharged fire extinguishers to the warehouse for recharging.

For a **major fire** that cannot be easily and safely extinguished as described above, sound the alarm and the ERT will be notified and the mine rescue team will be mobilized to respond to the fire.

For emergencies associated with explosives, procedures outlined in the Explosives Management Plan and the explosives supplier's Emergency Response Assistance Plans will be initiated. This information will be available in later revisions of this Plan.

5.5.3 Air Emergency

As soon as an air emergency is identified the Project Air Traffic Controller or security personnel will notify the ERC who will assess the need for additional emergency response resources.

In the event of a helicopter or plane crash:

- The ERC will contact the RCMP who will establish access and traffic control.
- Medical response procedures will be initiated (Section 5.5.1).
- If required, fire response procedures will be initiated (Section 5.5.2).
- Emergency response personnel will not move debris associated with the wreckage, unless it inhibits passenger rescue.
- The RCMP/Coroner will be responsible for dealing with fatalities.
- Following the emergency response, the ERC will direct the ERT in the investigation and cleanup of the crash site.

5.5.4 Hazardous Material Spill

Spills may result from any of the following situations:

- Leaks or ruptures in tanks, drums or containers;
- Equipment failure including valves, hoses, piping or containment structures;
- Overfilling containers;
- Improper storage;
- Spills during transfer; and
- Accidents during transportation.

Procedures will vary seasonally and be based on the nature of the hazardous material spilled. The applicable SDS will be consulted to ensure that the materials are being handled safely and appropriately. Response procedures specific to land, water, snow and ice are presented in the SCP (FEIS Volume 10, Chapter 5) and the OPEP (FEIS Volume 10, Chapter 6).

All site personnel will be briefed on the procedures to be followed to report a spill and initiate spill response. The following details the steps to be taken in the event of a spill. Steps are listed in order of importance; however, circumstances and conditions may alter the order of these steps to meet a specific situation.

- Source Control:
  - Identify the product and determine the source.
  - Reduce or stop the flow of product without endangering anyone. This may involve very simple actions such as turning off a pump, closing a valve, sealing a puncture hole with almost anything handy (e.g., a rag, a piece of wood, tape, etc.), raising a leaky or discharging hose at a level higher than the product level inside the tank, or transferring fuel from leaking containers.
- Control of Free Product:

  - Prevent or limit the spread of the spilled material.
  - Accumulate/concentrate spilled product in an area to facilitate recovery.
  - Barriers positioned down-gradient of the spill will slow or stop the progression of the spill. Barriers can consist of absorbent booms, dykes, berms, or trenches (dug in the ground or in snow/ice).
- Protection:
  - Evaluate the potential dangers of the spill in order to protect sensitive ecosystems and natural resources.
  - Block or divert the spilled material away from sensitive receptors. This can also be achieved by using various types of barriers.
- Clean up the Spill:
  - Recover and contain as much free product as possible.
  - Recover and containerize/treat contaminated soil, water, and snow.
  - Pressure-wash contaminated bedrock surfaces, shorelines, ice and recover as much as possible oily water for containerization and/or treatment.
- Report the Spill:
  - If the volume or type of spill warrants it, notification must be made as soon as reasonably practicable to the 24-hour Spill Report Line by calling **(867) 920-8130**. Use form NT-NU Interactive spill form. Contact information is also located on the top right corner of the form.
  - Provide basic information such as date and time of the spill, type and amount of product discharged, photographic records, location and approximate size of the spill, actions already taken to stop and contain the spill, meteorological conditions and any perceived threat to human health or the environment.

Additional details on responding to spills on land, water, snow and ice, and for specific materials (i.e. fuel, tailings, chemicals, etc.) are provided in the SCP and OPEP (FEIS Volume 10). The SCP describes Nunavut spill reporting requirements, as well as TDGR reporting requirements (both immediate and follow up reporting) applicable to spills that occur during transport.

5.5.5 Natural Hazards

Natural hazards that may affect the Project are discussed in Section 4.2 and are included as accidents and malfunctions in Section 4.3. The primary natural hazards potentially affecting the Project include extreme precipitation events (rainfall or snowfall), extreme cold, and geo-hazards (seismicity, ground and slope instabilities). Related to extreme snowfall events is the potential for white-out conditions that reduce visibility to near zero.

Weather events are usually anticipated ahead of time; when these events are known and have the potential to affect operations and worker safety, workers will be notified ahead of time and will be urged to take additional precautions and be aware of the potential for operations to be suspended due to adverse conditions. The following additional measures will be undertaken in regard to natural hazards:

- Extreme rainfall events – Visual inspection of water management facilities and engineered structures will be conducted prior to, during (if safe), and immediately following major rainfall

events. Notification will be made to cease pumping of tailings or water if conditions are unsafe.

- Extreme snowfall (potential white-out conditions) – If visibility is deteriorating making work unsafe, workers will notify their supervisor, who will inform the General Manager. Workers will stop work if considered unsafe, and the General Manager will make a site-wide decision on the suspension of work when weather conditions are potentially adverse.
- Extreme cold – Workers will be advised to take additional precautions in the event of extreme cold conditions, or to cease work or change work plans according to the weather.
- Seismic activity – Workers will cease work, seek safe refuge, and implement emergency response measures for natural hazards:
  - Sound the alarm (Code 1 call on the radio).
  - If it is safe to do so, shut off equipment, warn others and use the planned escape route.
  - Workers must report to the primary muster point, if this is not possible report to the secondary muster point.

Natural hazard events may trigger the occurrence of other emergencies (accidents and malfunctions) that will necessitate other emergency response procedures described in this section.

5.5.6 Evacuation

The need to evacuate part of or the entire Project site may result from:

- Extreme weather events;
- Seismic activity;
- Tundra fire;
- Toxic gas release;
- Hazardous material spill; and
- Power outage in extreme cold.

If an evacuation is required:

- All personnel will be under the direction of the ERC.
- All employees will report to the designated Muster Point.
- Supervisors will perform a count of personnel to ensure all are accounted for and call the ERT with the message "All persons account for."
- The ERT will coordinate airplane/helicopter support as required and handle telephone notifications and inquiries.
- The ERT will have the site helicopters stand-by and await instructions. If needed for fighting fires, the ERT will ask to have the Bambi basket ready.
- The situation will be accessed, and personnel will be given instructions for which areas have been cleared and can be used as shelter.
- If required, personnel will be evacuated to Cambridge Bay, Kugluktuk or Yellowknife, where accommodation and any further transport arrangements will be handled by the ERT.

5.5.7 Security

If security is required, contact Cambridge Bay RCMP: 867-983-0123.

5.6 MULTIPLE EMERGENCY EVENTS

The potential exists for multiple emergencies to occur simultaneously, or for one emergency to lead to other emergency events occurring. Examples of this could include an extreme precipitation event resulting in an unplanned discharge, slope failure, etc. or a major storm resulting in a vehicle or aircraft collision.

The conduct of risk assessment and the identification of mitigation measures and emergency response procedures is the first defence in preventing multiple emergency events from occurring. The risk assessment ensures that adequate factors of safety are incorporated in the design of embankments, pit and stockpile slopes, and water management features.

Relevant factors of safety implemented into operations includes ceasing operations (mining, winter ice road construction and operation) if conditions do not permit the safe continuance of work. For example, winter ice road dispatch operations will constantly monitor weather and, with the indication of pending adverse weather conditions, will notify operators on the road and prevent additional convoys from entering the road.

A key emergency response measure that minimizes the potential for multiple emergency events from occurring is to immediately communicate an emergency site-wide, and to order cease work orders if appropriate.

In the event of multiple emergencies, all emergency response activities will continue to be coordinated through the Emergency Response Coordinator, who will designate multiple incident commanders to oversee the response to each individual emergency. Operations will be shut down and all personnel not assisting with response will be on standby, awaiting instructions to assist if necessary.

5.7 FOLLOW-UP TO A SERIOUS INCIDENT

All emergency situations are to be reported to the ERC or designated representative. It is their responsibility to notify Sabina headquarters staff and external parties as outlined in the roles and responsibilities section of this Plan (Section 2).

6. Plan Evaluation and Adaptation

The RMERP will be reviewed annually and updated as necessary to incorporate lessons learned from any incidents that may have occurred, amendments to legislation, new characteristics of the sites, the equipment on site, new policies of the company, environmental issues and to provide updated information on new staff, external contact details and other changes.

Most important will be the review of aspects of the Plan affecting safety of employees of the facility, contractors, and the general public. Operational aspects of the Plan, as well as any paperwork that deals with the Plan, will be reviewed. All aspects of the Plan will be continuously audited for effectiveness.

The updated version of the Plan will be distributed to the distribution list. Formal evaluations of the RMERP will be documented, deficiencies noted in the report, and progress in addressing deficiencies tracked in writing. Responsibilities to address deficiencies and accountabilities will be assigned and deadlines for addressing required changes will be set.

7. Record Keeping

An internal log of incidents resulting in a response from the ERT will be kept and maintained by the ERC. The Principal Medical Aide Designee will maintain records of all medical incidents. Each record will include date, location, nature of emergency situation, factors leading to emergency situation, details of response, any negative impact, status of cleanup, and corrective actions taken.

Training records for emergency response personnel and records of emergency response exercises will be kept by the ERT.

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

Documentation will be maintained in accordance with Sabina's standard operating procedures.

8. Loss Prevention

Loss prevention measures are required for a mining development or similar undertaking. Loss prevention practices available to Sabina and other potentially affected parties include:

- Periodic project risk reviews to update Sabina's risk register and related management plans and procedures for the Project.
- Security measures to protect the Project from vandalism and theft.
- Insurance policies to be held by Sabina for liability and loss related to its own operations.
- Insurance policies held by Sabina's contractors related to the services or products provided; this includes marine liability insurance to be held by shipping companies contracted for the Project (see the Shipping Management in Chapter 15 of this volume) and others (i.e., explosives contractor, airlines, etc.)
- Compensation programs established under the Inuit Impact and Benefit Agreement (IIBA) covering potential environmental impacts, such as compensation for impacts to wildlife and harvesting.

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4. Fuel Management Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Fuel Management Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 4	Table 4-1, Table 7.3-2	Regulations	Include Transportation of Dangerous Goods Regulations
	Figure 6.1-2, Figure 6.1-3	Bulk Fuel Storage	Include conceptual design drawings of Goose and MLA Bulk Fuel Storage
	7.3.1	Bulk Fuel Transfer Procedure	Include bulk fuel truck transfer procedure

BACK RIVER PROJECT
FUEL MANAGEMENT PLAN

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Glossary and Abbreviations

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

AST	Above Ground Storage Tanks
CCME	Canadian Council of Ministers of the Environment
ERC	Emergency Response Coordinator
FC	Fire Code
FMP	Fuel Management Plan
MLA	Marine Laydown Area
OPEP	Oil Pollution Emergency Plan
SCP	Spill Contingency Plan
TDG	Transportation of Dangerous Goods
ULC	Underwriters' Laboratories of Canada
WCB	Workers' Compensation Board
WHMIS	Workplace Hazardous Materials Information System

1. Introduction

This chapter describes the Fuel Management Plan (FMP or Plan) that Sabina Gold & Silver Corp. (Sabina) will follow in the development and operation of the Project. The FMP and other management plans are intended to describe the ways in which Sabina will address or mitigate issues identified in the Final Environmental Impact Statement (EIS). This Plan outlines the approach for managing hydrocarbon products that are to be stored and managed at the Back River Project (the Project). This includes provisions for the Marine Laydown Area (MLA) in southern Bathurst Inlet and the Goose Property.

The FMP has been prepared in accordance with Section 9.4.2 of the EIS Guidelines issued by the Nunavut Impact Review Board (NIRB) to Sabina (NIRB 2013). This Plan was prepared in conformance with current Federal and Territorial statutory requirements

The information presented herein is current as of October 2015. This is a living document and will be updated based on engineering design, management reviews, incident investigations, regulatory changes, or other Project-specific protocols. The Plan will be included in Sabina's future Type A Water Licence Application and may be updated prior to submitting the application pending comments from review of the FEIS. The plan may be updated again prior to construction if instructed to do so by the NWB during the licensing process. The plan will be reviewed on a regular basis to incorporate any lessons learned, major changes to facility operation or maintenance, and environmental monitoring results. Any updates to the Plan will be filed with the Annual Report submitted under the Type A Water Licence.

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 scope of this plan focusses on the environmental protection measures required for fuel management. This entails the implementation of procedures for transportation, handling, inspection, storage, transfer, reporting and documentation for all fuel products throughout the mine life. These products include diesel, gasoline, lubricating oils, hydraulic fluids, propane, and paint thinner.

Sabina's intent is that through the diligent implementation of measures outlined in this plan the frequency of spill incidents will be minimized at the mine.

2.1 RELATED DOCUMENTS

To avoid overlap and inconsistencies with other biophysical management plans, Sabina has referenced where appropriate the following management plans:

- Site Water Monitoring and Management Plan;
- Waste Management Plan;
- Hazardous Materials Management Plan;
- Spill Contingency Plan;

- Occupational Health and Safety Plan; and
- Oil Pollution Emergency Plan (OPEP).

In the event of a spill in the marine environment the Oil Pollution Emergency Plan will apply. In the event of a spill at the Goose Property, MLA, or along the winter ice road (WIR), the Spill Contingency Plan will apply.

3. Planning and Implementation

Planning for the Fuel Management Plan started with the development of the DEIS, which identified existing (baseline) conditions, assessed potential impacts of the Project, developed conceptual mitigation strategies, and developed specific mitigation measures to execute these strategies. Conceptual strategies and plans will continue to be elaborated and executed throughout the Mobilization and Construction, Operations, and Closure phases of mining. Environmental management and social aspects will be tracked, reviewed, and updated through ongoing maintenance of the Plan. These updates will incorporate relevant feedback from the public, obtained during ongoing public consultations.

Significance criteria have been developed that assist in identifying priority aspects, establish management criteria, and activity-specific mitigation measures. For social issues and effects, a key factor for determining significance is ongoing feedback from public consultation. These efforts will be used to communicate progress, and involve the public where necessary, on environmental performance.

Monitoring will be the principal mechanism to provide feedback to continually gauge the effectiveness of environmental performance. Operational control is facilitated through contractor job-specific standard operating procedures (SOPs), work instructions, tailgate meetings where required, contract requirements, and service agreements. The effectiveness of physical operation controls will be reviewed and modified in accordance with preventative maintenance and procedural reviews.

4. Applicable Legislation and Guidelines

Federal and Territorial legislation that is applicable to fuel management in Nunavut is presented in Table 4-1.

Other applicable standards, systems, and regulatory bodies include:

- Underwriters' Laboratories of Canada (ULC) Standards;
- Canadian Standards Association (CSA) Standards;
- Workplace Hazardous Materials Information System (WHMIS); and
- Workers' Compensation Board (WCB).

Table 4-1. Applicable Legislation for Back River Project Fuel Management

Acts	Regulations	Guidelines
Federal		
Canadian Environmental Protection Act (1999 c.33)	*Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* (SOR/2008-197) *Environmental Emergency Regulations* (SOR/2003-307) *Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations* (SOR/2002-301)	Canadian Council of the Ministers of Environment - Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products Notice with respect to substances in the National Pollutant Release Inventory Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil
Transportation of Dangerous Goods Act (1992, c. 34) *Fisheries Act* (1985, c. F-14)	*Transportation of Dangerous Goods Regulations* (SOR/2001-286)	National Fire Code of Canada (2010)
Territorial – Nunavut and Northwest Territories		
Nunavut Environmental Protection Act	*Spill Contingency Planning and Reporting Regulations* (NWT Reg (Nu) 068-93) *Used Oil and Waste Fuel Management Regulations* (NWT Reg 064-2003)	Guideline for the General Management of Hazardous Waste in Nunavut Guideline for Industrial Waste Discharges in Nunavut Guideline for the Management of Waste
Northwest Territories Waters Act *Territorial Lands Act* *Mackenzie Valley Resource Management Act*		Guidelines for Spill Contingency Planning, Aboriginal Affairs and Northern Development Canada

5. Roles and Responsibilities

The General Manager is ultimately responsible for the success of this plan and approves all relevant policies and documents, auditing, action planning, and the verification process.

The HSE Manager is responsible for ensuring regular inspection of petroleum storage facilities at the Back River Project and will coordinate with the Safety and Environmental Superintendents with respect to their areas of responsibility. All employees, contractors, and contractor employees are responsible for complying with the intent of this plan.

The HSE Manager will ensure that the following requirements are satisfactorily implemented before work starts on a fuel storage facility:

1. Drawings and designs of temporary and permanent fuel storage and fuel transfer facilities will be provided by the Project engineer or fuel services provider.
2. A written commissioning plan will be provided to Sabina by the Project engineer or the responsible fuel services provider.

3. The commissioning plan will include the contractor's details for implementation of their contractual responsibilities which may include:
   - Detailed equipment commissioning procedures and schedules for testing all systems.
   - A fire and spill contingency plan integrated into the Project Risk Management and Emergency Response Plan.

All manifests, training, and other tracking documentation will be maintained and kept readily available, as required, by the HSE Manager or designate.

6. Facility Planning and Fuel Delivery

6.1 FACILITY SITING AND LOCATION

Land based fuel storage facilities will be constructed and utilized at the Marine Laydown Area (MLA), and Goose Property, Figure 6.1-1 shows the location of these sites. The current conceptual fuel storage facility placements for each site are presented in Figures 6.1-2, and 6.1-3.

Details on the fuel storage facilities and logistical considerations are provided in subsequent sections of this plan.

6.2 FUEL SUPPLY

During Mobilization and Construction, and Operations, fuel will be delivered to the MLA by marine vessels before delivery to the Goose Property via winter ice road.

Fuel will travel in tanker ships and/or barges, and then will be transferred through floating hose to on land storage tanks at the Marine Laydown Area. The summer sealift freight will originate from the east from Bécancour, Quebec or from the west from Vancouver, British Columbia, largely depending on the origin of the goods. Freight originating from Bécancour will travel by barges and ships, and by barges from Vancouver. The ships and barges will be self-sufficient for offloading cargo. Lightering barges will be used to transfer cargo from the vessel to the MLA Marshalling Area on shore.

Fuel will be transported from the MLA to the Goose Property via winter ice road. The Goose-Marine Laydown Area Winter Ice Road is approximately 160 km in length.

6.3 MARINE LAYDOWN AREA

The Marine Laydown Area (MLA), located on the Bathurst Inlet in Nunavut, has been designed to be capable of offloading and storing 60 ML of diesel (Table 6.3-1). Fuel storage at the MLA is designed with capacity for a one-year supply of diesel fuel for the operational year with the maximum fuel usage. A total of four 15 ML field erected fuel tanks will be constructed at the MLA to handle the maximum requirement. Initially, one 15 ML fuel tank is erected in Year -3, two more 15 ML fuel tanks are erected in Year -2, and the last 15 ML tank is installed in Year -1. Note that in advance of the large tank erected in Year -3, six 90,000 L isocontainers will be installed at the MLA; these may be used during the operational period as necessary.

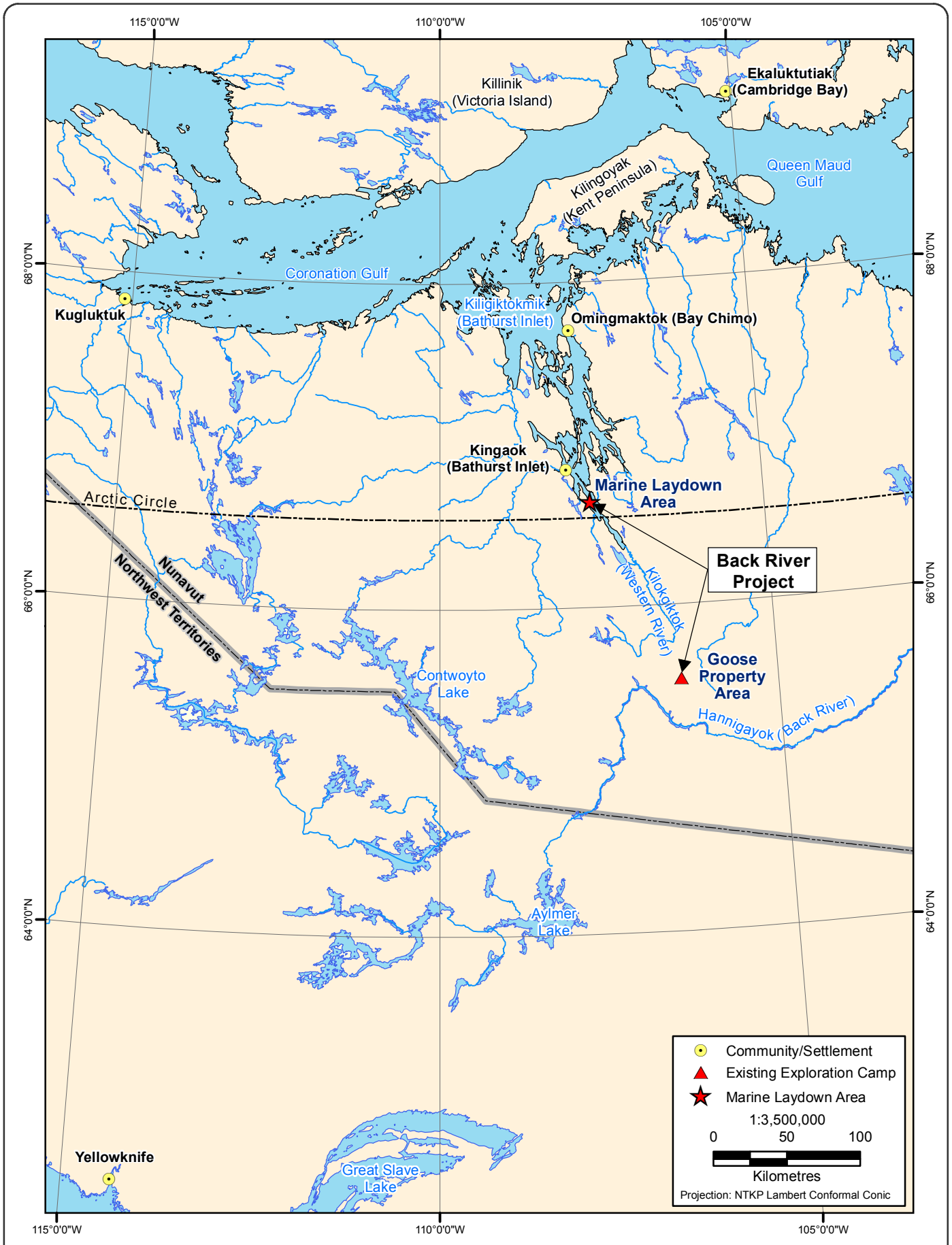

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Figure 6.1-1

Site Location of the Back River Project

Table 6.3-1. Fuel Storage

Site	Ultimate Storage Capacity	Mobilization and Construction Year – 4 to -1	Operations Year 1 to 10	Peak Consumption
Marine Laydown Area	4 x 15 ML steel tanks 6 x 90,000 L isocontainers	Build and use 4 x 15 ML tanks Use six 90,000 L isocontainers	Use 4 x 15 ML tanks Use six 90,000 L isocontainers	2.5 ML (Year 7)
Goose Property	3 x 15 ML steel tanks 13 x 75,000 L isocontainers	Use existing 75,000 L isocontainers Build and use 3 x 15 ML tanks	Use 3 x 15 ML tanks	53 ML (Year 3)

Construction of the MLA will take place during the Construction phase. Initial fuel requirements will be delivered by sealift during the open water season with the vessels departing prior to winter ice formation in Bathurst Inlet.

In conformance with the Canadian Council of Ministers of the Environment (CCME) Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products (CCME 2003), and the *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* (2008), all Project fuel storage facilities will be designed to have bermed spill containment with capacity equal to the volume of the largest tank plus 10% of the volume of the remaining tanks, or 110% volume of the largest tank, whichever is greater. The fuel tank storage area embankment (or bund) will be lined with HDPE for spill containment. The fuel storage area will be provided with standard instrumentation and controls to monitor and safely manage the inventory in the tanks. Water management of the contact water from the fuel tank storage area will be incorporated into the water and waste management plans.

Temporary storage of fuel during Mobilization and Construction may be required as permanent storage tanks are under construction and prepared for operation. In this case, temporary storage may utilize smaller portable double-walled fuel storage tanks.

6.4 GOOSE PROPERTY

The Goose Property fuel storage is currently comprised of thirteen 75,000 L double-walled fuel tanks. Fuel was either flown to Goose by aircraft or hauled to Goose by Cat-train from a supply barge at the Bathurst Inlet.

Sabina will construct a 45 ML fuel storage facility at the Goose Property (Table 6.3-1). Fuel storage at the Goose Property is designed with capacity for a ten month supply of diesel fuel for the operational year with the maximum fuel usage.

A total of three 15 ML field erected fuel tanks will be constructed at the Goose Property. One 15 ML fuel tank will be erected in Year -2 to support construction, while the remaining two 15 ML fuel tanks will be built the following year.

The 45 ML storage capacity will be utilized for Operations. Fuel for the Goose Property will be supplied from the Marine Laydown Area Fuel Storage and transported to the Goose Property via winter ice road. The Goose-Marine Laydown Area Winter Ice Road is approximately 160 km in length.

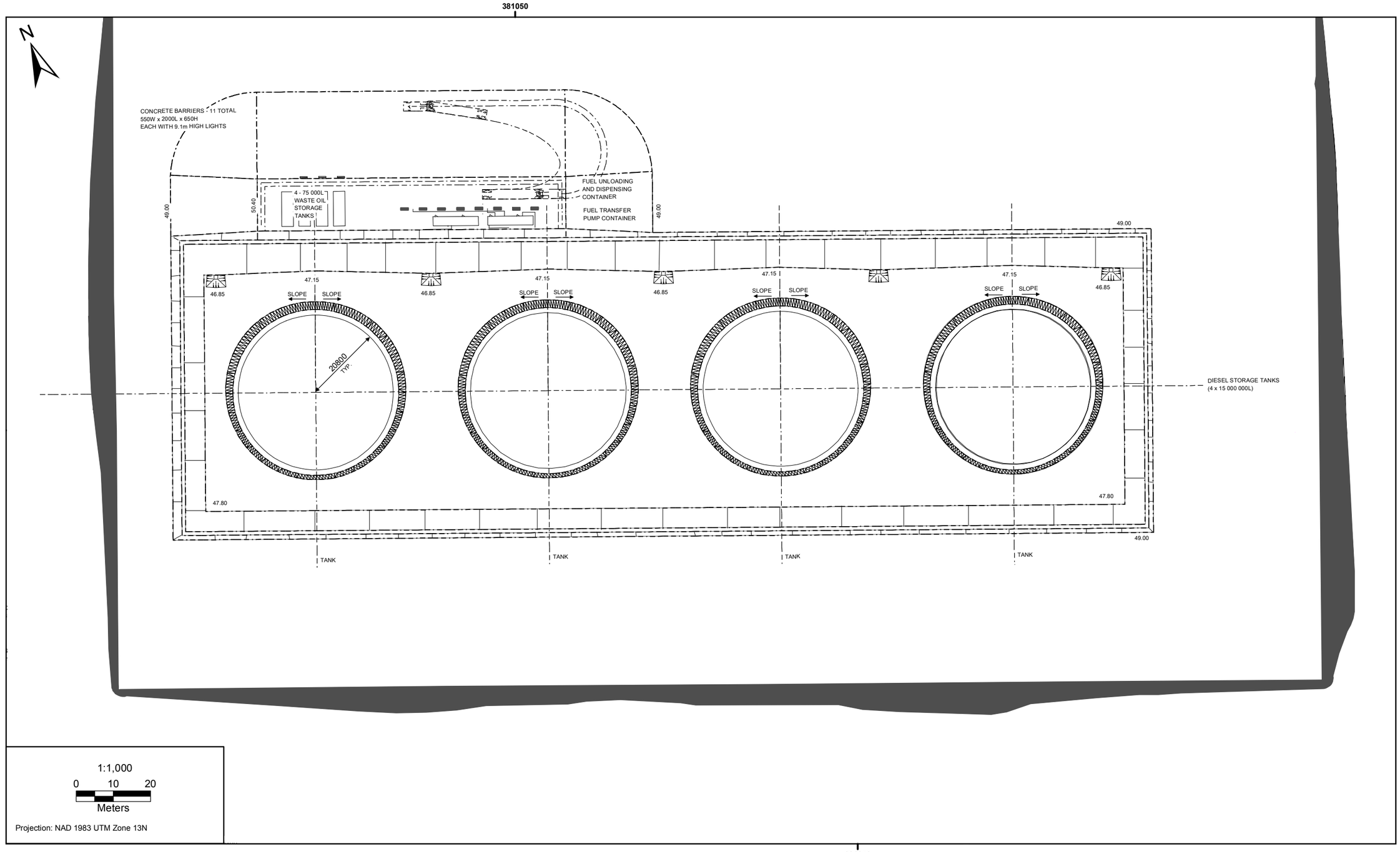

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Figure 6.1-2

MLA Fuel Storage

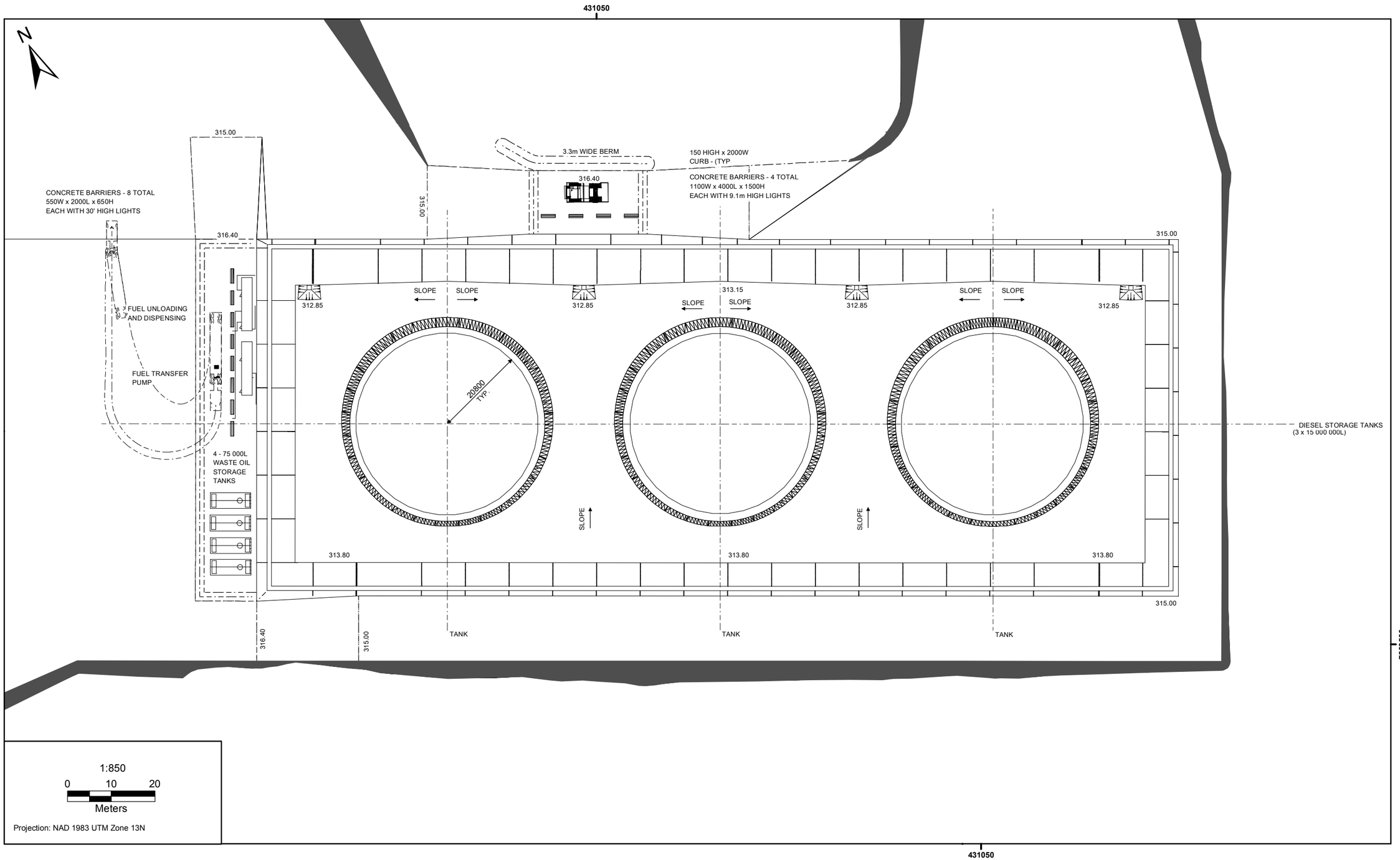

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Figure 6.1-3

Goose Fuel Storage

The Goose Property Fuel Storage will be constructed in line with CCME's Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products (2003) and *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* (2008). The fuel tank storage bund will be lined with HDPE for spill containment. Fuel dispensing equipment for mining, plant services, and freight vehicles will be located adjacent to the fuel tank bund and the fueling area will drain into the bund. A fuel transfer module will provide fuel to the Goose Power Plant day tank and diesel consumers in the Goose Process Plant. The fuel storage area will be provided with standard instrumentation and controls to monitor and safely manage the inventory in the tanks. Water management of the contact water from the fuel storage area will be incorporated into the water and waste management plans. Fuel within secondary containment will be stored at the airstrip in case of emergencies.

6.5 FUEL CONSUMPTION AND DELIVERY

Arctic grade diesel fuel will predominantly be used by mining equipment, motor vehicles, and power generation. Limited quantities of propane will be used in maintenance facilities for smaller motorized equipment and machinery, and in the accommodation complex for meal preparation.

The number and size of the fuel storage tanks for Mobilization and Construction, and Operations' activities is presented in Table 6.3-1. The anticipated quantities and volumes of fuel will vary depending on the phase of the Project. The major consumers of fuel during Pre-production at Goose are power generation, open pit mining, construction equipment, and earthworks.

Fuel required for Year -3 activities will be flown to site using a Boeing 737 jet equipped with a 15,900 L fuel bladder. Fuel required for Year -2 and Year -1 will be transported to the MLA using an ocean going vessel and trucked to the Goose Property on the winter ice road. The major consumers of fuel are power generation, site support, Winter Ice Road construction, maintenance, and haulage, and earthworks.

Fuel will be transported to the MLA via ice-class ocean going vessels. In the first year, it will be stored in the temporary fuel tanks and in subsequent years in the permanent fuel storage tanks.

7. Environmental Protection Measures

Fuel will be delivered by fuel tankers during the open water season. The floating hose method will be used for the transfer of fuel to the on land storage tanks. An Oil Pollution Emergency Plan (OPEP) has been developed to address fuel spill incidents related to the MLA facility.

Refuelling stations will be equipped with lined and bermed areas to contain minor spills or leaks that may occur during refuelling. The liner (e.g., 40 mm hypolon liner or equivalent) will be protected by aggregate bedding. Vehicles and mobile equipment will drive onto this bedding for refuelling.

Fuel storage areas and vehicles will be equipped with spill kits for emergency response. Sabina's Spill Contingency Plan identifies spill kit locations and appropriate response measures for spills. The spill kits will contain the appropriate type, size, and quantity of equipment for the volume/type of product present in each of the fuel storage facilities.

7.1 DESIGN REQUIREMENTS

The fuel storage facilities will be designed with features that protect the environment as per Table 7.1-1.

Table 7.1-1. Fuel Storage Facility Design Requirements

Topic / Activity	Environmental Protection Measures
Design Features	• The CCME Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products will be followed in design, construction, and operation of the fuel storage facilities. • All fixed location Above Ground Storage Tanks (AST) > 230L will be constructed and maintained in accordance with Underwriters' Laboratories of Canada (ULC) tank specifications, and bear a current ULC certification plate or label. • All ASTs will be installed on firm foundations designed to minimize uneven settling and corrosion, and to prevent the design stress of the tank from being exceeded. • Fuel hose length will not exceed 4.5m, or 6m where a retracting system is used.
	• Fuel tanks will be locked (unless enclosed by a fence) when not being used for vehicle fuelling, or when not being filled by tanker trucks. • Fuel storage tanks must be vented to allow vapours to escape.
Moving Tanks	• Where a storage tank > 230L is removed (e.g., moved from one site to another) or abandoned, it is permitted to be reused for the storage of flammable liquids and combustible liquids only after having been refurbished and found to conform to acceptable standards. • A fuel storage tank > 230L requires spill control (or secondary containment) when it is removed from a mobile unit and installed in a fixed location. • Lighting will provide adequate illumination to ensure safe fuelling and allow users the ability to read safety placards and posted fuelling procedures, and to readily locate spill response equipment.
	• There must be no leaks from the valve or pipe system to the pump. Draw-off valves must be threaded at the discharge end or otherwise designed to provide a liquid tight connection to the delivery hose. • Collision protection may include concrete filled steel posts placed more than 1 m from the outer edge of the tank shell and spaced less than 1.5 m apart. Concrete barriers, if used, will have a minimum height of 750 mm and be spaced at least 500 mm from the tank shell. Posts and barriers will be painted yellow and equipped with reflective stripes. Earthen materials may be used in similar manner to serve as traffic barriers.

7.2 SITING AND STORAGE

Table 7.2-1 summarizes the fuel storage facilities siting and storage requirements.

Table 7.2-1. Fuel Facility Siting and Storage

Topic / Activity	Environmental Protection Measures

Siting and Storage	• Design of fuel storage facilities will meet regulatory requirements for design and operation and will apply best management practices including:
	  o fire prevention system design appropriate and adequate for the materials being stored
	  o tanks will have a minimum 1m separation between them
	  o siting away from ignition sources and environmentally sensitive areas
	  o drums, containers, and storage areas properly labelled, marked, placarded, and secured
	  o containers or liner materials will be matched with the materials being stored
	• All tanks for fuelling operations will be placed aboveground, and outside of buildings.
	• Tank siting will consider site drainage and surface flow routes for fluids if spilled during tank filling or product transfers. Grading and drainage will be designed to prevent liquids from reaching waterways, drain systems, and potable water sources.
	• Spill response and cleanup kits will be readily available in the refuelling area.

(continued)

Table 7.2-1. Fuel Facility Siting and Storage (completed)

Topic / Activity	Environmental Protection Measures
Secondary Containment & Collision Protection	• Fuel storage and dispensing systems will meet all applicable Nunavut regulations and all applicable Fire Code requirements. • Large or stationary equipment will be placed in secondary containment or will have a drip pan placed under vehicle/equipment prior to commencing any maintenance. • Precipitation accumulating within the containment area will be tested and treated if necessary prior to discharge.
	• Water collection facilities will be designed to convey water to oil/water separators for hydrocarbon removal.
	• Accidental damage to containment structures will be inspected immediately and appropriate repairs undertaken. The extent of damage, repairs, and any follow up inspection will be reported in accordance with best practices.

7.3 FUELLING OPERATIONS AND TRAINING

Environmental Protection Measures for fuel management entail the implementation of proper transportation, inspection, storage, transfer, and use of all petroleum products. Protection measures to ensure that fuel products are managed effectively are summarized in Table 7.3-1.

Table 7.3-1. Fuelling Operations

Topic / Activity	Environmental Protection Measures
Transportation	• Drivers making deliveries on site will receive a site orientation that includes relevant sections of the *Transportation of Dangerous Goods Act* (1992, c. 34), *Transportation of Dangerous Goods Regulations* (SOR/2001-286), Sabina safety requirements, and site traffic protocols. • Fuels will be trucked in sealed containers, be manifested, and equipment will be labelled and placarded in accordance with *Transportation of Dangerous Goods Regulations* (SOR/2001-286). • Applicable WHMIS signage and TDG placards will be identifiable on all containers during transportation and storage. • Manifests will identify fuel type, quantity, and date of all deliveries to the mine site and will be retained on file at the contractor's head office for a period of two years. • Transportation vehicles will be equipped with spill kits of appropriate size and content. Vehicle operators will be trained in haul road safety and spill response. • Planning of delivery timing will consider weather conditions, road conditions, and availability of appropriate transportation equipment and personnel.
Bulk Transfer and Refuelling	• Only persons trained to safely handle fuels and aware of WHMIS and TDG requirements will implement procedures to transfer fuel. • Qualified personnel will continuously supervise the refuelling operation to ensure against overflow or spillage. • Daily inspections will be performed by the personnel responsible for the refuelling facility. • Refuelling will occur at a refuelling point with drainage capture / collection installed, in the event that refuelling occurs elsewhere, drip trays will be used under vehicles and equipment. • Refuelling and maintenance activities of equipment will not occur within 31 m of a watercourse or water body except where required due to equipment breakdown or approved activities near water. • Refuelling equipment from a tank vehicle is permitted if the fuelling is conducted using approved hose-reel and automatic closing nozzles, and appropriate training and equipment are supplied to deal with any incidental spillage. • Before fuel transfer, verify that a level shutoff device can be substituted for the person at the delivery tank, in which case operation of the shutoff should be verified each time it is used.

(continued)

Table 7.3-1. Fuelling Operations (completed)

Topic / Activity	Environmental Protection Measures
Bulk Transfer and Refuelling *(cont'd)*	• All connections will be bonded to prevent static discharge. • Any delivery hose that has the potential to cause a spill, if it were pulled from the delivery pump or valve, should be fitted with a breakaway valve. • Propane fuel delivery vehicle tanks will be manufactured and certified in accordance with applicable regulations and equipped to ensure the safe discharging of propane to a receiving tank. • Smoking is not permitted where dispensing is being carried out. • Spill control is required for small containers of flammable and combustible liquids that have the potential to spill. • When dispensing flammable liquids, ensure that static electrical charges are controlled by establishing an electrical connection between the tank or container and truck box fill stem, or by providing other appropriate measures as applicable. • Hose nozzle valves must conform to CAN/ULC-S620-M, "Hose Nozzle Valves for Flammable and Combustible Liquids" (FC 4.5.5.2.). • Valves at the storage tank must be constructed of steel according to the Fire Code. • An automatic shutoff nozzle must be used when using an integral hold-open device. • When a hose nozzle valve with a hold-open device is used, a break-away coupling conforming to CAN/ULC-S644-M, "Emergency Break-away Fittings for Flammable and Combustible Liquids" will be provided. • Do not use any object or device to maintain the flow of fuel that is not an integral part of the hose nozzle valve assembly. • Use only manufacturer's specified pressure relief security caps. • Use fuel dispensing pumps conforming to good engineering practice, and designed for flammable or combustible liquids. • Employees will remain at the dispensing nozzle whenever they are pumping fuel from any storage tank. • Tanks must not be filled beyond their safe filling level.
Training and Review	• Training for fuel dispensing attendants will include procedures for: supervising the dispensing of flammable and combustible liquids; taking appropriate measures to prevent sources of ignition from creating a hazard at the dispensers; taking appropriate action in the event of a spill to reduce the risk of fire; and shutting off the power to all dispensers in the event of a spill or fire. • Fuel management training for all employees and contractors will include: evacuation procedures and routes; distributing Material Safety Data Sheets (MSDS); alarm systems; when to attempt immediate response to an emergency and when to call for help; reporting procedures for personnel; shutdown procedures for equipment and electrical systems; types of potential emergencies; procedures for handling flammable liquids; importance of good housekeeping; importance of safe work habits; and procedures for control and cleanup of leaks and spills. • Training will be provided by a combination of trained, qualified mine staff and outside training service organizations, as appropriate. Training manuals will be developed before the mine begins operation.

7.3.1 Bulk Fuel Truck Transfer Procedure

A contract supplier will fill the storage tanks in the Goose Fuel Farm. General procedures will ensure that the handling of fuel will meet the applicable legislation that includes the *Transportation of Dangerous Goods Act* and the *Transportation of Dangerous Goods Regulations*. The general procedures to be followed are listed below. Similar procedures would be followed for fueling remote station tanks. Before fuel transfer, verify that:

- All fuel transfer hoses are connected properly and couplings are tight;
- Transfer hoses are not obviously damaged;

- Fuel transfer personnel are familiar with procedures;
- Personnel are located at both the fuel delivery truck/barge and fuel transfer tank(s) and can manually shut off the flow of fuel;
- If a high liquid level shutoff device is installed at the transfer tank, verify that the shutoff is operating correctly each time it is used; and
- Fuel transfer proceeds per the established procedures of the contract supplier.

Any accident or spill must be reported immediately to the Operations Superintendent or Environment Department. Notification and response procedures are detailed in the Spill Contingency Plan.

7.4 FUEL INVENTORY MANAGEMENT

All fuel products discussed in this plan will be transported to the Project and will be safely stored in the designated fuel storage areas as previously discussed. Total amounts of the fuel products received will be reconciled against amounts ordered. Fuel volumes will be measured (metered or manual dipping) as they are distributed for use from the bulk tanks. Inventory records will be updated when fuel is used and added to each tank. An unexplained loss of fuel may indicate a leak and will be immediately investigated.

Fuel tanks and fuelling equipment will be kept in good operating condition and the potential for inadvertent releases of product will be achieved through procedures provided in Table 7.4-1.

Table 7.4-1. Facility Monitoring and Preventative Maintenance

Topic / Activity	Environmental Protection Measures
Facility Monitoring and Preventative Maintenance	• Vehicles and equipment will be inspected prior to mobilization to the Project and malfunctions will be rectified. • Inspections will look for signs of deterioration, leaks, unsecured container lids or excess accumulation of materials in the containment areas. All visible leaks and releases will be documented and promptly corrected. • Equipment and light vehicle operators will conduct daily visual inspections at the start of their shifts to ensure equipment integrity, cleanliness, and the adequacy of spill prevention material. • Fuel tanks will be visually monitored on a weekly basis for signs of leakage. This will include looking for signs of corrosion, staining on the ground, and cracks or breaks in hoses and other ancillary equipment during the visual inspection. Tanks will be repaired as soon as problems are noted. • Signs on tanks will be visible and legible. • Containment areas will be kept clear of debris, excess snow, ice or standing water. • If sheen is visible on water within the secondary containment, it will be tested prior to discharge and treated if necessary. • Inspection, monitoring, and record keeping for tanks will be in accordance with regulatory requirements for the Project. • Inspection findings will be reviewed with transporters to correct deficiencies, maintain awareness, and to recognize negative or positive performance.

8. Monitoring Program

Deliveries of fuel to the Project will be overseen by the Environmental Superintendent. On-site Environmental Monitors will be responsible for observing and documenting the bulk transfer of fuel.

Monitoring of fuel storage tanks on site will be conducted in accordance with the CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products (CCME 2003) and *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* (2008).

Water pooling within the secondary containment of the fuel storage facilities will be treated as necessary prior to release to the receiving environment in conformance with discharge water quality criteria (Table 8.1-1).

Table 8.1-1. Proposed Bulk Fuel Storage Pooling Water Discharge Criteria (CCME 2003; 2013)

Parameter	Maximum Average Concentration (mg/L)
Benzene	0.370
Ethyl benzene	0.090
Toluene	0.002
Xylene	0.300
Lead	0.200
Oil and Grease	15 and no visible sheen

Notes:
The concentrations for Benzene, Ethyl benzene, Toluene, Xylene, and Lead are Freshwater CCME Guidelines for the Protection of Aquatic Life (CCME 2013).
The concentration for Oil and Grease is included in CCME (2003).

9. Mitigation and Adaptive Management

9.1 SPILL PREVENTION AND RESPONSE

Spill response procedures, equipment, and organizations are based on a work and activity scope level assessment of potential spill risk. Sabina's comprehensive Spill Contingency Plan (SCP) and Oil Pollution Emergency Plan (OPEP) outlines Sabina's plan for responding to hydrocarbon or other contaminant spill incidents that may occur at the Back River Project.

In the event of a spill in the marine environment the Oil Pollution Emergency Plan will apply. In the event of a spill at the Goose Property, MLA, or along the winter ice road (WIR), the Spill Contingency Plan will apply. General spill prevention and response measures specific to fuel management are provided in Table 9.1-1.

Table 9.1-1. Spill Prevention and Response

Topic / Activity	Mitigation Measures

Spill Response Equipment
(further detailed in Spill Contingency Plan
	• Spill kits appropriate for the hydrocarbon products being handled or transported will be positioned at refuelling areas. At a minimum, each kit will contain:
	  o Sufficient hydrophobic absorbent material (e.g., oil absorbent booms and sorbent pads) to contain and cleanup potential drips, leaks or spills.
	  o Gloves and heavy plastic bags to contain oily absorbent materials and contaminated soils or wastes.
	• Spill kits will be inspected daily to ensure sufficient materials are available.
	• Containment booms, linkable oil absorbent booms, and floating oil absorbent pads will be stored on-site to manage any releases to water.
	• Reserve spill response equipment such as booms, socks, and pads will be available for response to larger spill incidents, or to replenish materials used in the smaller equipment spill kits.
	• Sabina will ensure that relevant personnel are responsible for maintaining or providing necessary spill response equipment in their area, if there is a potential for an environmental spill.
	• Sabina will ensure secondary spill response teams are in place and capable of effecting containment, remediation, communication, and reporting.

Spill Response (further detailed in Spill Contingency Plan)	• In the event a spill does occur, the following immediate actions will be taken by the responder (as is safe):
	  o Identify source.
	  o Stop release if safe to do so.
	  o Contain spill to minimize impacts.
	  o Notify the supervisor immediately.
	• Clean up in a manner appropriate to the spill, removing contaminated soil and snow.
	• Used spill kit materials will be disposed of in designated hazardous waste areas.
	• Spill kits will be restocked after use.

Spill Reporting	• All spills will be reported to appropriate personnel per the procedures defined in Sabina's Spill Contingency Plan.

10. Record Keeping

Records will be kept under the supervision of designated Sabina personnel at each Project site for reconciled bulk fuel inventory, weekly use summaries, weekly reconciliation for each storage tank, overfill alarm tests, pressure tests (if applicable), inspections and maintenance checks, any alteration to the system, reports of leaks or losses, reports of spill responses, and records of training.

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

11. Environmental Reporting

Spill reporting will be conducted in accordance with Sabina's comprehensive Spill Contingency Plan and also included as a component of the Back River Project Risk Management and Emergency Response Plan. Reportable spills will be immediately and externally reported by the Operations Superintendent or designated alternate to the 24-hour NWT/Nunavut Spill Response Line as required.

12. Plan Effectiveness

Certain components of the Fuel Management Plan will need to be updated based on site experience. Therefore, it will be necessary to audit or review the Plan on a regular basis to identify those components that need updating or upgrading. Most important will be the review of the Plan aspects affecting safety of the environment, employees of the facility, contractors, and the general public. Operational aspects of the Plan, as well as any paperwork that deals with the Plan, will be reviewed. All aspects of the Plan will be continuously audited for effectiveness.

Formal evaluations of the Fuel Management Plan will be documented, deficiencies noted in the report, and progress in addressing deficiencies tracked in writing. Responsibilities to address deficiencies and accountabilities will be assigned and deadlines for addressing required changes will be set.

References

Canadian Council of Ministers of the Environment. 2003. *Environmental Code of Practice for Above Ground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.*

Canadian Council of Ministers of the Environment. 2013. *Canadian Environmental Quality Guidelines Summary Table*. Retrieved from: http://st-ts.ccme.ca/

5. Spill Contingency Plan

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BACK RIVER PROJECT
Spill Contingency Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 5	1.1	Introduction	Revised Introduction format
	1.4	Introduction	Added acronyms for terminology including EMRP.
	3.0	Hazardous Materials On Site	Reference made to HMMP allowing for one reference to list all hazardous materials at site.
	5.8	Communication Officer	Added description of Communication Officer to document
	Table 5.10-1 to 5.10-4	Contact list	Removal of names from contact list.
	5.11	External Resources	Acknowledged commitment to external resources
	Figures 7-1, 7-2	Spill Kit Locations	Spill Kit Location Maps
	8.2	Environmental Protection Measures	Additional information on oil spill response procedures at MLA and elsewhere
	8.3.3, 8.3.4	Secondary Containment	Added section on Tailings or Reclaim water spill + Chemical spills and related response
	9.1.1	Marine Spills	Monitoring of spills
	9.1.2	TDGR	Reporting of spills related to TDGR guidelines

BACK RIVER PROJECT
SPILL CONTINGENCY PLAN

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Glossary and Abbreviations

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

AANDC	Aboriginal Affairs and Northern Development Canada (formerly INAC, DIAND)
ANSI	American National Standards Institute
ATV	All-Terrain Vehicle
CCME	Canadian Council of Ministers of the Environment
DEIS	Draft Environmental Impact Statement
DFO	Department of Fisheries and Oceans
EC	Environment Canada
ERAP	Emergency Response Assistance Plan
ERT	Emergency Response Team
FEIS	Final Environmental Impact Statement
HAZCOM	Hazard Communication
HMMP	Hazardous Materials Management Plan
HR	Human Resources
HSC	Occupational Health & Safety Committee
INAC	Indian and Northern Affairs Canada
ISO	International Organization for Standardization
KIA	Kitikmeot Inuit Association
MLA	Marine Laydown Area
NDOE	Nunavut Department of Environment
NIOSH	National Institute for Occupational Safety and Health
NIRB	Nunavut Impact Review Board
NU	Nunavut
NWB	Nunavut Water Board
NWT	Northwest Territories
OHF	Oil Handling Facility
OHSA	Occupational Health and Safety Administration
OHSP	Occupational Health & Safety Plan
OPEP	Oil Pollution Emergency Plan
PPE	Personal Protective Equipment

SDS	Safety Data Sheet
SCP	Spill Contingency Plan
SOPEP	Shipboard Oil Pollution Emergency Plan
TC	Transport Canada
TDGA	*Transportation of Dangerous Goods Act*
TDGR	Transportation of Dangerous Goods Regulations
WCB	Workers' Compensation Board
WHMIS	Workplace Hazardous Materials Information System

1. Introduction

1.1 OVERVIEW

This chapter describes the Spill Contingency Plan (SCP or Plan) that Sabina Gold & Silver Corp. (Sabina) will follow in the development and operation of the Project. The SCP and other management plans are intended to describe the ways in which Sabina will address or mitigate issues identified in the Final Environmental Impact Statement (EIS). This Plan outlines the approach in responding to hydrocarbon or other contaminant spill incidents that may occur at the Back River Project (the Project). This includes provisions for the Marine Laydown Area (MLA) in southern Bathurst Inlet, and the Goose Property. The Plan addresses land and freshwater based emergency response and spill scenarios, with marine response detailed in the Oil Pollution Emergency Plan (OPEP).

The SCP has been prepared in accordance with Section 9.4.3 of the EIS Guidelines issued by the Nunavut Impact Review Board (NIRB) to Sabina (NIRB 2013). This Plan was prepared in conformance with current Federal and Territorial statutory requirements

The information presented herein is current as of August 2015. This is a living document and will be updated based on engineering design, management reviews, incident investigations, regulatory changes, or other Project-specific protocols. The Plan will be included in Sabina's future Type A Water Licence Application and may be updated prior to submitting the application pending comments from review of the FEIS. The plan may be updated again prior to construction if instructed to do so by the NWB during the licensing process. The plan will be reviewed on a regular basis to incorporate any lessons learned, major changes to facility operation or maintenance, and environmental monitoring results. Any updates to the Plan will be filed with the Annual Report submitted under the Type A Water Licence.

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

1.2 SCOPE AND OBJECTIVES

The scope of this Plan focuses on the spill response and environmental protection measures required in the event of a hydrocarbon or other contaminant spill at any of the Back River Project properties and associated infrastructure, including winter ice and all-weather access roads and airstrips. This entails the implementation of response procedures for Project-related spills, releases, or discharges to land, water, ice and snow of the following products:

- Hydrocarbon products including diesel fuel, gasoline, hydraulic oil.
- Soluble solids such as ammonium nitrate prill.
- Liquids such as glycols and paints.
- Corrosive liquids including sulphuric acid and sodium cyanide.
- Compressed (inert and flammable) gas.
- Other hazardous substances.

The SCP is designed to protect worker and public safety and minimize potential impacts to the environment in the event of a Project-related spill. This will be achieved through the application of best management practices implemented through predetermined lines of response and plans of action.

1.3 PLANNING AND IMPLEMENTATION

Planning for the SCP started with the development of the DEIS which identified existing (baseline) conditions, assessed potential impacts of the Project, developed conceptual mitigation strategies and developed specific mitigation measures to execute these strategies. Conceptual strategies and plans have advanced with FEIS and will continue to be elaborated and executed throughout the construction, operation, and closure phases of mining. Environmental management will be tracked, reviewed, and updated through ongoing maintenance of the Plan. These updates will incorporate relevant feedback from the public, obtained during public consultation.

1.4 COMPLEMENTARY PLANS AND DOCUMENTS

To avoid overlap and inconsistencies with other biophysical management plans, Sabina has referenced, where appropriate, the following management plans:

- Explosives Management Plan (ExMP)
- Fuel Management Plan (FMP).
- Hazardous Materials Management Plan (HMMP).
- Occupational Health and Safety Plan (OHSP).
- Oil Pollution Emergency Plan (OPEP).
- Risk Management and Emergency Response Plan (RMERP)
- Shipboard Oil Pollution Emergency Plan (SOPEP; to be provided in the future by Shipping Company).
- Shipping Management Plan (SMP).
- Site Water Monitoring and Management Plan (SWMMP).

Additionally, Emergency Response Assistance Plans (ERAPs) will be required for the transport of certain chemicals in accordance with Section 7 of the Transportation of Dangerous Goods Regulations (TDGR). This is discussed further in Section 8.3.4.

Based on the quantity of fuel to be transferred from ship to shore at the MLA, the MLA will be considered an Oil Handling Facility (OHF). This SCP is intended to interface with the OPEP developed for the MLA and the SMP developed for the shipping component of the Project.

1.5 LINKAGE WITH SABINA OIL POLLUTION EMERGENCY PLAN (OPEP)

The *Response Organizations and Oil Handling Facilities Regulations* under the Canada Shipping Act stipulates that operators of designated OHFs must have an onsite OPEP that has been approved by Transport Canada.

The OPEP prepared for the MLA Oil Handling Facility applies to marine spills that may occur during ship-to-shore fuel transfers. Ship-specific Shipboard Oil Pollution Emergency Plans (SOPEPs) specifically address marine spill incidents that may be associated with spills from shipping vessels while at sea. The OPEP prepared for the MLA has been designed to complement this plan.

Sabina's Emergency Response Team will be trained to adequately handle any emergencies that impact the ocean, land and freshwater, including implementation of this SCP for land-based spills, and implementation of the OPEP for any spills that may occur during ship-to-shore fuel transfers.

1.6 APPLICABLE LEGISLATION

Both Federal and Territorial legislation exist to address spills of potentially harmful substances. Operational policies and procedures that fulfill conditions in applicable legislation will be further developed as the project proceeds.

Table 1.6-1 summarizes the primary Federal and Territorial legislation applicable to spill contingency planning and response in Nunavut.

Table 1.6-1. Legislation Applicable to the Spill Contingency Plan

Acts	Regulations	Guidelines
Federal		
Arctic Waters Pollution Prevention Act (R.S.C., 1985, c.A-12)	Arctic Shipping Pollution Prevention Regulations (C.R.C., c. 353)	
Canadian Environmental Protection Act (R.S.C.1999 c.33)	Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations (SOR/2008-197) Environmental Emergency Regulations (SOR/2003-307) Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2002-301) Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149)	Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products (Canadian Council of the Ministers of Environment (CCME) 2003) Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil (CCME, 2008)
Fisheries Act (1985, c.F-14)	Metal Mining Effluent Regulations (SOR/2002-2222)	
Explosives Act (1985, c.E-17)	Ammonium Nitrate and Fuel Oil Order (C.R.C., c.598) Explosives Regulations (C.R.C., c.1516)	
National Fire Code of Canada (2010)		
Transportation of Dangerous Goods Act (1992, C.34)	Transportation of Dangerous Goods Regulations (SOR/2001-286)	2012 Emergency Response Guidebook (Transport Canada and U.S. Department of Transportation, 2012)
Territorial Lands Act (R. S. 1985, c.T-7)	Northwest Territories and Nunavut Mining Regulations (C.R.C., c.1516) Territorial Land Use Regulations (C.R.C., c.1524) Territorial Lands Regulations (C.R.C., c. 1525)	
Hazardous Products Act	*Controlled Products Regulations*	*Workplace Hazardous Materials Information System (WHMIS)*
Nunavut Act (1993 c.28)		

(continued)

Table 1.6-1. Legislation Applicable to the Spill Contingency Plan (completed)

Acts	Regulations	Guidelines
Territorial – Nunavut		
Environmental Protection Act	Spill Contingency Planning and Reporting Regulations(NWT Reg (Nu) 068-93) Used Oil and Waste Fuel Management Regulations (NWT Reg 064-2003) The removal of hazardous materials will require the registration with the Government of Nunavut, Department of Environment (DOE) as a waste generator as well as carrier (if applicable) prior to transport	Government of Nunavut (GN) Environmental Guidelines for the Management of: • General Management of Hazardous Waste in Nunavut (GN, 2010a) • Waste Paint (GN, 2010b) • Mercury-Containing Products and Waste Mercury (GN, 2010c) • Industrial Waste Discharges into Municipal Solid Waste and Sewage Disposal Facilities (GN, 2011a) • Waste Batteries (GN, 2011b) • Waste Solvent (GN, 2011c) • Waste Antifreeze (GN, 2011d) • Used Oil and Waste Fuel (GN, 2012) • Biomedical and Pharmaceutical Waste (GN, 2014) Canada-Wide Standards for Petroleum Hydrocarbons (PHC) In Soil (CCME, 2008)
Mine Health and Safety Act (SNWT (Nu) 1994, c.25)	Mine Health and Safety Regulations (NWT Reg (Nu) 125-95)	
Workers' Compensation Act (RSNWT, 1998, c.W-6)	Workers' Compensation General Regulations (Nu Reg 017-2010)	
Explosives Use Act (RSNWT (Nu) 1988, c.E-10)	Explosives Regulations (RRNWT (Nu) 1990, c.E-27)	
Fire Prevention Act (RSNWT (Nu) 1988, c.F-6)	Fire Prevention Regulations (RRNWT (Nu) 1990, c.F-12)	
Motor Vehicles Act (RSNWT (Nu) 1988, c.M-16)	Large Vehicle Control Regulations (RRNWT (Nu) 1990, c.M-30)	
Public Health Act (RSNWT (Nu) 1988, c.P12)	Camp Sanitation Regulations (RRNWT (Nu) 1990, c.P-12) General Sanitation Regulations (RRNWT (Nu) 1990, c.P-16)	
Safety Act (RSNWT 1988, c.S-1)	General Safety Regulations (RRNWT (Nu) 1990, c.P-16) Work Site Hazardous Materials Information System Regulations (RSNWT 1988, c.81 (Supp))	
Transportation of Dangerous Goods Act (1990, RSNWT (Nu) 1988, c.81 (Supp))	Transportation of Dangerous Goods Regulations (1991, NWT Reg (Nu) 095-91)	

2. Definitions and Spill Quantities

For the purpose of this Plan, a **major spill** is defined as an accidental release of product into the environment that has the potential for significant adverse impact and is a reportable quantity.

A **minor spill** is defined as any hazardous chemical spill that does not involve highly toxic, highly reactive, or explosive chemicals, in a situation that is not life threatening, nor poses immediate risk to the receiving environment. Furthermore, this type of spill presents a manageable physical or health hazard to personnel who, when wearing proper personal protective equipment (PPE), will not be exposed to any chemical at a level that exceeds any recognized action levels or permissible exposure limits.

2.1 MINIMUM REPORTABLE THRESHOLDS

Minimum reportable thresholds are provided by:

- Guidelines for Spill Contingency Planning, Appendix B-3: Immediately Reportable Spill Quantities (Aboriginal Affairs and Northern Development, 2010).

- Transportation of Dangerous Goods Regulations (TDGR) – Part 8 – Accidental Release and Imminent Accidental Release Reporting Requirements

The lowest minimal reportable thresholds from each of the two references are reproduced as Table 2-1.

Table 2-1. Externally Reportable Volumes

TDGA Class	Description of Contaminant	Amount Spilled
1	Explosives	Any amount
2.1	Compressed gas (flammable)	Any amount of gas from containers with a capacity greater than 100 litres
2.2	Compressed gas (non-corrosive, non-flammable)	Any amount of gas from containers with a capacity greater than 100 litres
2.3	Compressed gas (toxic)	Any amount
2.4	Compressed gas (corrosive)	Any amount
3.1, 3.2, 3.3	Flammable liquid (hydrocarbon fuels)	100 litres
4.1	Flammable solid	25 kg
4.2	Spontaneously combustible solids	25 kg
4.3	Water reactant solids	25 kg
5.1	Oxidizing substances	50 litres or 50 kg
5.2	Organic peroxides	1 litre or 1 kg
6.1	Poisonous substances	5 litres or 5 kg
6.2	Infectious substances	Any amount
7	Radioactive	Any amount
8	Corrosive substances	5 litres or 5 kg
9.1 (in part)	Miscellaneous products or substances, excluding PCB mixtures	50 litres or 50 kg
9.1 (in part)	PCB mixtures of 5 or more parts per million	0. 5 litres or 0. 5 kg
9.2	Environmentally hazardous	1 litre or 1 kg
9.3	Dangerous wastes	5 litres or 5 kg
None	Other contaminants	100 litres or 100 kg

If a spill on site meets or exceeds the minimum reportable thresholds, or is thought to exceed the minimum reportable thresholds, the spill will be reported by the Environmental Superintendent (or

designate) to the **NWT-NU 24-Hour Spill Report Line**. All spills of fuel or hazardous materials into a waterbody or ice will be reported to the Spill Report Line, to ensure compliance with the *Fisheries Act*.

Additional direction on the reporting of spills, including also TDGR requirements for reporting of spills of dangerous goods in transit, is provided in Section 9.

Procedures will be developed and implemented to require all non-reportable spills to be communicated by staff and responded to as needed.

3. Hazardous Materials On-site

A number of hazardous materials are anticipated to be stored on site during all stages of construction and operations. The specific materials and quantities of hazardous materials being stored at one time will vary depending on the Project stage. A list of the main hazardous materials to be transported to and stored on site is provided within the HMMP (Hazardous Materials MP). As Project planning and design progresses, specific products and expected amounts will be included in this Plan.

4. Spill Prevention

Training and awareness are two major elements of spill prevention. All site staff and contractors will review the contents of the Spill Contingency Plan (SCP) during their on-site orientation and will be informed of where copies of the Plan are stored. The mandatory site orientation will provide hazard awareness training, identify the locations of spill kits and other response equipment, and discuss appropriate application. A more detailed description of the training to be provided to site staff is provided in Section 6.0 of this Plan.

In addition to training, all work sites and hazardous materials storage facilities will be routinely inspected. Good housekeeping practices will be adopted with emphasis on storage facilities and loading zones.

General practices, to be implemented by Sabina, that support spill prevention include:

- Assign spill response personnel and clearly publish their contact information.
- Provide easy access to current Safety Data Sheets (SDS) for all hazardous materials on site.
- Maintain updated inventory of hazardous materials present at each site (in the HMMP).
- Store materials in appropriate containers to the specified capacity, in areas adequately protected from weather and physical damage.
- Conduct regular inspections of storage facilities.
- Segregate incompatible materials.
- Provide training involving the SCP, Spill Kits and other response equipment.
- Stock adequate spill response materials and equipment, and have them readily available for transportation, transfer and storage of hazardous materials.
- Create an environment which promotes prompt communications of all spill incidents.

5. Roles and Responsibilities

The initial stage of any emergency or spill incident and resultant response is critical. An effective and timely response is essential to prevent an emergency or spill situation from escalating to a higher level. Therefore, all relevant personnel must be fully aware of their individual duties and responsibilities as presented in this Plan.

Figure 5-1 summarizes Sabina's generalized emergency and spill response organization chart. This organization chart (Figure 5-1) is the generalized emergency response organization chart presented in the Risk Management and Emergency Response Plan, as well as the OPEP, as the same roles and responsibilities apply to spills and other emergencies.

Specific responsibilities and duties inherent to personnel involved in emergency and spill response are outlined in Sections 5.1 to 5.9. In the SCP, all spills are emergencies. Having said that, and similar to other emergencies, the severity of the spill will determine the need and level of response and participation of the ERT members.

5.1 EMERGENCY RESPONSE COORDINATOR

The Emergency Response Coordinator (ERC) is the General Manager or his designate if absent. ERC duties during an emergency are detailed as follows:

- The Emergency Response Coordinator (ERC) will ensure coordination of ERT support systems.
- Upon being notified of an emergency, the ERC will initiate response activities and assess the situation based on current information from the Incident Commander.
- Activate the emergency response process and escalate according to severity of incident.
- The ERC will coordinate all activities. In the event the ERC leaves his post, the ERC will designate an individual to coordinate in his absence.
- Ensure that the appropriate area manager/s has been notified.
- Provide internal notification as applicable based on the level of emergency.
- Provide instruction to ensure that appropriate external resources are notified.
- Receive information from the Incident Commander and ensure appropriate resources are made available.
- Provide support for the acquirement of additional supplies and resources as requested by the Incident Commander.
- Contact departmental resources via radio as required during the emergency response.
- Provide internal notification of the "all clear".
- Ensure the coordination and establishment of an emergency debriefing session.
- Review incident log and post response incident report.
- Post incident debrief with Incident Commander.
- Provide necessary information to Public Relations for a media statement release if required.
- Complete a report on the events surrounding the incident.

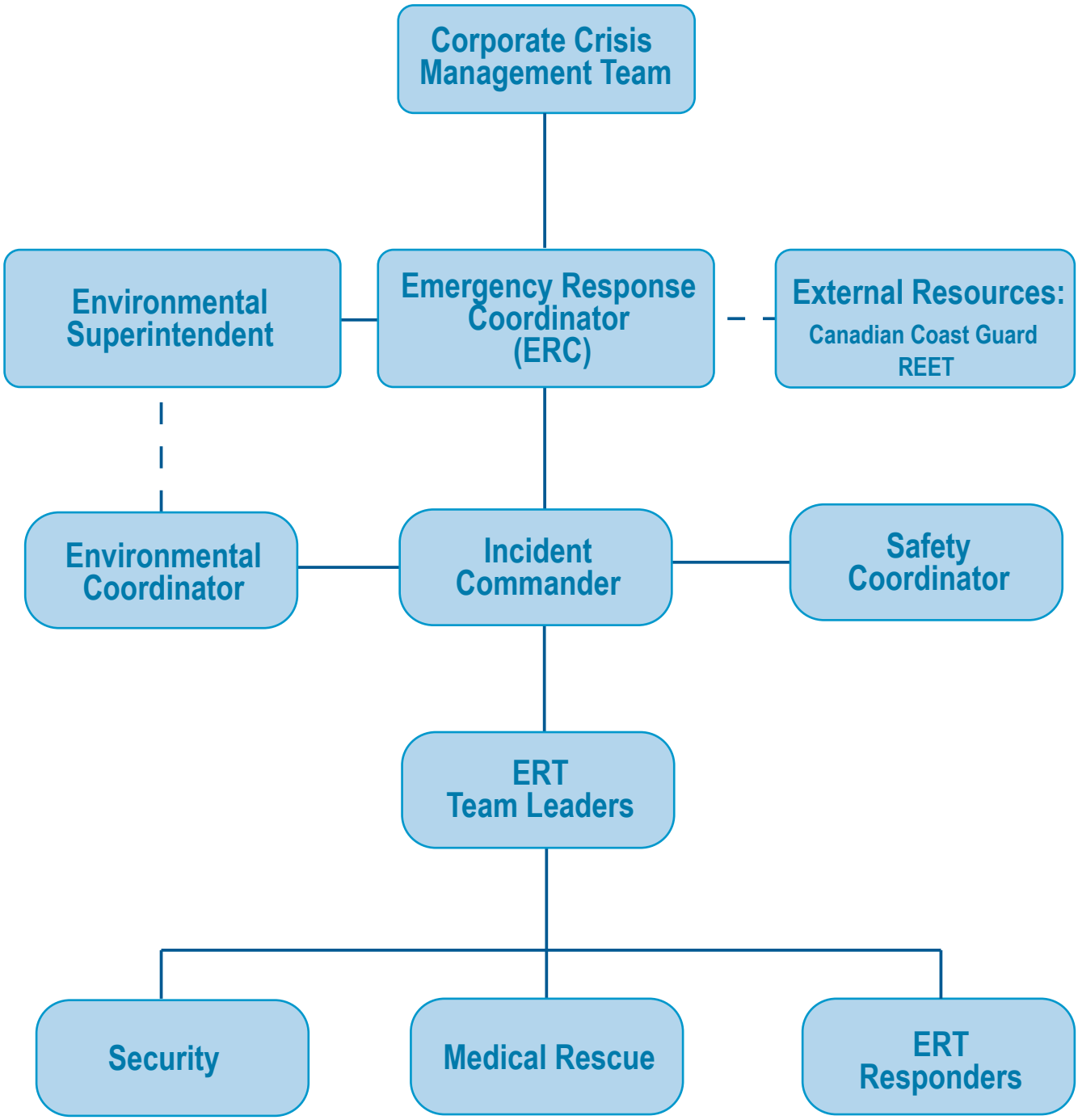

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Figure 5.1

Spill Response Organization Chart

- Coordinate collection of all incident notes, reports, statements and log of events.
- End the event in a project tracking system.

5.2 ENVIRONMENT SUPERINTENDENT

The duties of the Environment Superintendent during a spill emergency are detailed as follows:

- For major spills contact the ERC and report to the command center.
- Report the spill to NWT-NU 24-hour Spill Report Line depending on whether threshold volume is triggered.
- Document all actions and decisions.
- Assist the ERC in evaluating the initial situation and assessing the magnitude of the spill.
- Assist in developing an overall plan of action.
- Collect photographic records of the spill event and cleanup efforts.
- Report to the ERC and provide recommendations on resource requirements (additional manpower, equipment, material) to complete the cleanup effort.
- Provide liaison with management to keep them informed of cleanup activities.
- Act as the spokesperson with government agencies as appropriate.
- Participate in post-emergency debriefing.
- Assist in the accident/incident investigation process.
- Complete Government Agency notification processes.
- Ensure that the spill is cleaned up and follow-up communication and reports are filed with the AANDC and KIA.
- Document the cause of the spill and effectiveness of the cleanup effort, and recommend the appropriate measures to prevent a recurrence of the spill.
- Ensure that all involved departments complete reporting process.
- Prepare and submit follow-up documentation required by appropriate regulators.
- Ensure that spill reports submitted to AANDC and KIA include photographic records and an updated map showing Universal Transverse Mercator (UTM) coordinates, date, and amount and nature of the spill.

For marine spills at the OHF, the Environment Superintendent will be available to the Canadian Coast Guard during the entire incident.

5.3 INCIDENT COMMANDER

The Incident Commander is the site lead administrator for the ERT, responsible for ensuring the necessary emergency response equipment and adequate level of training for ERT members. The Incident Commander directs the ERT at the scene as ERT Leader. In the absence of the Incident Commander, a senior team member will be designated in his place. The following duties during an emergency are performed by the Incident Commander:

- Muster accordingly and brief team members.

- Report to the scene of the emergency.
- Take charge of the scene.
- Evaluate the details of the emergency as presented by those on scene. Assess the immediate situation, confirm the level of emergency and notify the ERC.
- Maintain contact with the ERC and provide support in coordination of the response.
- Direct ERT members in their respective tasks as required.
- Contact departmental resources via radio as required during the emergency response.
- Request internal/external resources as required.
- Advise ERT on aspects of internal/external support as they are received.
- Develop a written log of events indicating instructions given, action taken and outcomes achieved.
- Announce the 'all clear' to the ERC when the emergency has ended.
- Lead the post-emergency debriefing session.
- Ensure that all ERT equipment is returned to original order and/or replaced to ensure future rapid response.
- Provide assistance with ongoing investigation.
- Prepare a written report on response activities.

5.4 ENVIRONMENTAL COORDINATOR

The Environmental Coordinator will liaise with the Incident Commander to advise on direction of environmental response efforts once the scene has been assessed by the Incident Commander and all medical and/or fire emergencies are under control.

The Environmental Coordinator will:

- Directly proceed to the scene of the incident.
- Make recommendations for response methods and resources based on area sensitivities and incident severity through the Incident Commander as necessary.
- Make recommendations for additional resources through the Incident Commander as necessary.
- Participate in post-emergency debriefing.
- Maintain a log of events, actions, and outcomes.

5.5 SAFETY COORDINATOR

The duties of the Safety Coordinator during an emergency are detailed as follows:

- Contact the ERC.
- Respond to the scene and make direct contact with the Incident Commander.
- Establish perimeters around the area of the emergency and direct appropriate resource personnel responsible for traffic flow.

- Assist with identifying and assessment of potential hazards of the ERT response and notify the Incident Commander.
- Ensure appropriate personal protective equipment for involved ERT and non ERT personnel.
- Note pertinent information that may be relative to the investigation.
- Secure the area in coordination with site security.
- Participate in post-emergency debriefing.
- Assist in the accident/incident investigation and complete report.

5.6 EMERGENCY MEDICAL PERSONNEL

Duties during an emergency are as follows:

- Respond when required as directed by the Incident Commander.
- Responsible for all decisions of medical-related situations on site.
- Responsible for assessing, administering and delegating emergency medical care.
- Advise the Incident Commander of the number and condition of any ill/injured personnel.
- Advise the ER Coordinator of off-site resources required.
- Maintain a log of events, actions and outcomes.
- Participate in a post-emergency debriefing session.

5.7 TEAM LEADERS – (EMERGENCY RESPONSE TEAM)

- Report to the scene of the incident.
- Work closely with the Incident Commander to determine appropriate response strategy for their respective work area.
- Contact departmental resources via radio as required during the emergency response.
- Direct ERT members in their respective tasks as required.
- Participate in a post-emergency debriefing session.

5.8 COMMUNICATIONS OFFICER

The Communications Officer manages the collection and dissemination of all information relating to an emergency, including:

- Government agencies, including those that may be involved in responding to any emergency
- Communities (Hamlets, community groups and individuals)
- Media

The Communications Officer will be part of the Corporate Crisis Management Team identified on Figure 5-1, and most likely will be a corporate executive such as the Vice President, Environment & Sustainability, or a designate. The Communications Officer will get involved in large spills that warrant communication with stakeholders other than the KIA and AANDC.

If the severity of the incident warrants, the Communications Officer or designate will control radio use and restrict it to emergency response only. The Communications Officer will also direct the collection

and management of all written information, photographs, drawings and video recordings generated during the emergency. This includes the following records:

- A record of the chronology of events
- Log of telephone calls
- Log of written statements regarding the emergency (emails, press releases, etc.)
- A list of personnel on-site at the time of the emergency along with emergency contact information, in case it is needed

All other communications of an emergency by other project personnel will be prohibited, to limit possible uncontrolled dissemination of misinformation.

5.9 SECURITY

Security personnel or designates are key in an emergency response in that they will receive an initial notification of an emergency and provide first communications to essential personnel and secure the area.

Duties during an emergency are as follows:

- Security will report muster and evacuation status to the Incident Commander and await further instruction.
- Provide traffic and personnel control at scene as directed by the Incident Commander.
- Assist in controlling access to the emergency area.
- Maintain open radio communication (via radio or telephone intercom system).
- Keep a written record of events throughout incident.
- Relay notification of ‘all clear” order when directed by Incident Commander.
- Maintain Security of the scene as directed by the ER Coordinator or Incident Commander.
- Direct all off-site inquiries regarding the emergency to the ER Coordinator or designate.
- Participate in a debriefing session for the emergency response.

5.10 EMERGENCY RESPONSE TEAM CONTACT INFORMATION

Contact information for all Sabina Staff members involved in spill response is presented in Table 5.10-1. Contact information for Project contractors will be updated and presented in Table 5.10-2 when they become available. External contacts that may provide additional assistance as necessary are presented in Table 5.10-3. Key government contacts are provided in Table 5.10-4. These contacts will be reviewed and updated with every review of the SCP.

Table 5.10-1. Emergency Response Management Team

Title	Contact Name	Telephone No.
Emergency Response Coordinator	TBD	TBD
Environmental Superintendent	TBD	TBD
Incident Commander	TBD	TBD

(continued)

Table 5.10-1. Emergency Response Management Team (completed)

Title	Contact Name	Telephone No.
Environmental Coordinator	TBD	TBD
Safety Coordinator	TBD	TBD
Operations Superintendent	TBD	TBD
Emergency Medical Personnel	TBD	TBD
Team Leaders	TBD	TBD
Communications Officer	TBD	TBD

Table 5.10-2. Contractor Contacts

Title	Telephone No.
TBD	TBD
TBD	TBD
TBD	TBD

Table 5.10-3. External Spill Response Contacts

Expediting Company	Contact Name	Telephone No.
Fuel Supplier, Mobile Environmental Response	TBD	TBD
Kitnuna	TBD	(867) 983-2331
Nuna Logistics Ltd.	TBD	(867) 682-4667
Dupont (Fuel Dye)	TBD	(905) 821-5660
Frontier Mining (Sorbents)	TBD	(867) 920-7617
Acklands (Sorbents)	TBD	(867) 873-4100

Table 5.10-4. Key Government Contacts

Agency/Organization	Contact Name	Telephone/Fax No.
NWT/NU 24hr Spill Report Line		Phone: (867) 920-8130 Fax: (867) 873-6924 Email: spills@gov.nt.ca
Aboriginal Affairs and Northern Development Canada	Water Resources Officer Resource Mgmt. Officer A/Manager of Field Ops	Phone: (867) 669-2438 Phone: (867) 975-4296 Phone: (867) 975-4295
Canadian Coast Guard (in the event of a spill to the marine environment)		Phone: (800) 265-0237
Department of Fisheries and Oceans	fisheriesprotection@dfo-mpo.gc.ca	Phone: 1 (855) 852-8320
Environment Canada	Manager of Enforcement NWT/NU 24hour Spill Report Line	Phone: (867) 669-4730 Phone: (867) 920-8130
Government of Nunavut Environmental Protection	Director Environment	Phone: (867) 979-7800
Kitikmeot Inuit Association (KIA)	Lands Inspector	Phone: (867) 982-3310 x223

(continued)

Table 5.10-4. Key Government Contacts (completed)

Agency/Organization	Contact Name	Telephone/Fax No.
Nunavut Water Board	Exec. Director	Phone: (867) 360-6338
	Manager of Licensing	Phone: (867) 360-6338
RCMP (Kugluktuk)		Phone: (867) 982-2111
RCMP (Yellowknife)		Phone: (867) 669-1111
Workers Safety and Compensation Commission	Chief Inspector of Mines	Phone: (867) 669-4430 Fax: (867) 873-6924

5.11 EXTERNAL RESOURCES

The Canadian Coast Guard (CCG) is responsible for spill response in the Arctic. In 2007, the CCG undertook an evaluation of risk and requirements for additional Arctic pollution response equipment, in consultation with key partners and clients, purchased and placed Arctic Response Packs in 19 communities throughout the Arctic. These Arctic Response Packs provide communities with on-site equipment to use in the event of a small scale pollution incident in their waters. Arctic Response Packs are located in Cambridge Bay, Kugluktuk and Gjoa Haven. Each of the new Arctic Community Packs contains surface booms and accessories, shoreline cleanup kits, small vessels and outboard motors and trailers, and in select communities, beach flushing kits.

Along with the deployment of the Arctic Response Packs, the Canadian Coast Guard was to provide training where the Arctic Community Packs are located (Transport Canada 2014). Community residents can therefore play a role in helping the lead response agency, the Canadian Coast Guard, should a marine spill occur.

Additionally, local communities can provide valuable local knowledge on what sensitivities are important to the local community they represent and what resources are available to assist in a response. This type of information was collected as part of the Inuit knowledge study work undertaken or reviewed by the Project.

Additional discussion on CCG and community marine spill response is provided in the Shipping Management Plan and the OPEP.

6. Training and Emergency Response Exercises

6.1 GENERAL

Sabina will ensure that relevant personnel involved in a response have received prior training and the requisite skills to safely minimize the impact of a spill to the environment.

The personnel directly linked to emergency (including spill) response operations will receive training to familiarize themselves with the Spill Contingency Plan and the Risk Management and Emergency Response Plan on a regular basis according to their duties and responsibilities. All completed training will be recorded in a training register, to be kept up to date by the ERT.

The personnel directly linked to spill response operations, contract employees and the other responders identified in the environmental emergency plan should take part in the yearly training

program. Training will be conducted to ensure adequate numbers of responders are available for all levels, times, and work shifts.

6.2 SITE ORIENTATION

On site orientation will be provided to all personnel to ensure employees are aware of:

- Applicable Legislation.
- Environmental Receptors (i.e. surface water and sensitive areas).
- What First Responders are to do in case of a spill.
- The location of SDS sheets and Spill Report Forms.
- The location of the Spill Response Kits.
- The general locations of fire extinguishers and firefighting equipment.
- The location of the Spill Contingency Plan and the Fire Action Plan.

6.3 ROLE SPECIFIC

Specific training will be provided to all employees whose job function may have a higher probability of experiencing a spill, such as those handling chemicals, to ensure understanding of:

- Workplace Hazardous Materials Information Systems (WHMIS) and Transportation of Dangerous Goods Regulations (TDGR).
- Identify and avoid the conditions which may lead to a spill.
- Develop an understanding of the potential environmental impacts of a spill.
- Recognize the hazards associated with sources of ignition (smoking, electrical sparks) near a fuel source.
- Spill kit contents and use of them.

For employees involved in fuel handling, additional training would be provided regarding appropriate refueling techniques and drum handling procedures. Personnel not trained to handle chemical spills shall not attempt to clean up spills; they are to contact emergency response personnel for clean-up assistance. Medical staff potentially involved in supporting response workers will receive role-specific training including information on the details of the Spill Contingency Plan and SDSs.

6.4 EMERGENCY RESPONSE TEAM

Members of the Emergency Response Team will be provided a higher level of training to allow for safe and adequate response. This includes:

- Information provided as part of the Role-Specific Training.
- Fire extinguishers and water pump locations and use.
- Details of the Spill Contingency Plan and the Fire Action Plan.
- Identify, evaluate and mitigate the hazards posed by any spilled product by using appropriate PPE (personal protective equipment).

6.5 SPILL RESPONSE EXERCISES

Spill response exercises will be conducted on occasion to validate on site capabilities, practice the internal and external notification processes and evaluate the management of the response through the decisions and actions of the spill management team participating in the exercise(s).

The exercises will involve the application of realistic hands-on scenarios where the Emergency Response Team will deploy the appropriate equipment to respond to the specific spill scenario developed for the exercise. The spill exercise may be broken down into two or more sessions to ensure adequate coverage. Records of all spill response exercises will be kept on file and posted to provide access for those who were unable to attend.

7. Spill Response Equipment

Available heavy equipment and aircraft will be used as appropriate for emergency use to respond to spill incidents. Appropriately sized spill kits and spill response equipment will be strategically located in vehicles and all Project sites, especially the active mining areas.

Each department will be responsible for providing all necessary SDS and sufficient spill response kits in their respective work areas. Spill Kits and SDSs will be stored in marked areas, readily accessible to responders. The Spill Kit location maps for the Goose Property as well as the MLA area are identified in Figure 7-1 and 7-2 respectively. Any spill kit location updates within either of these 2 areas will be applied to these reference maps as the project develops.

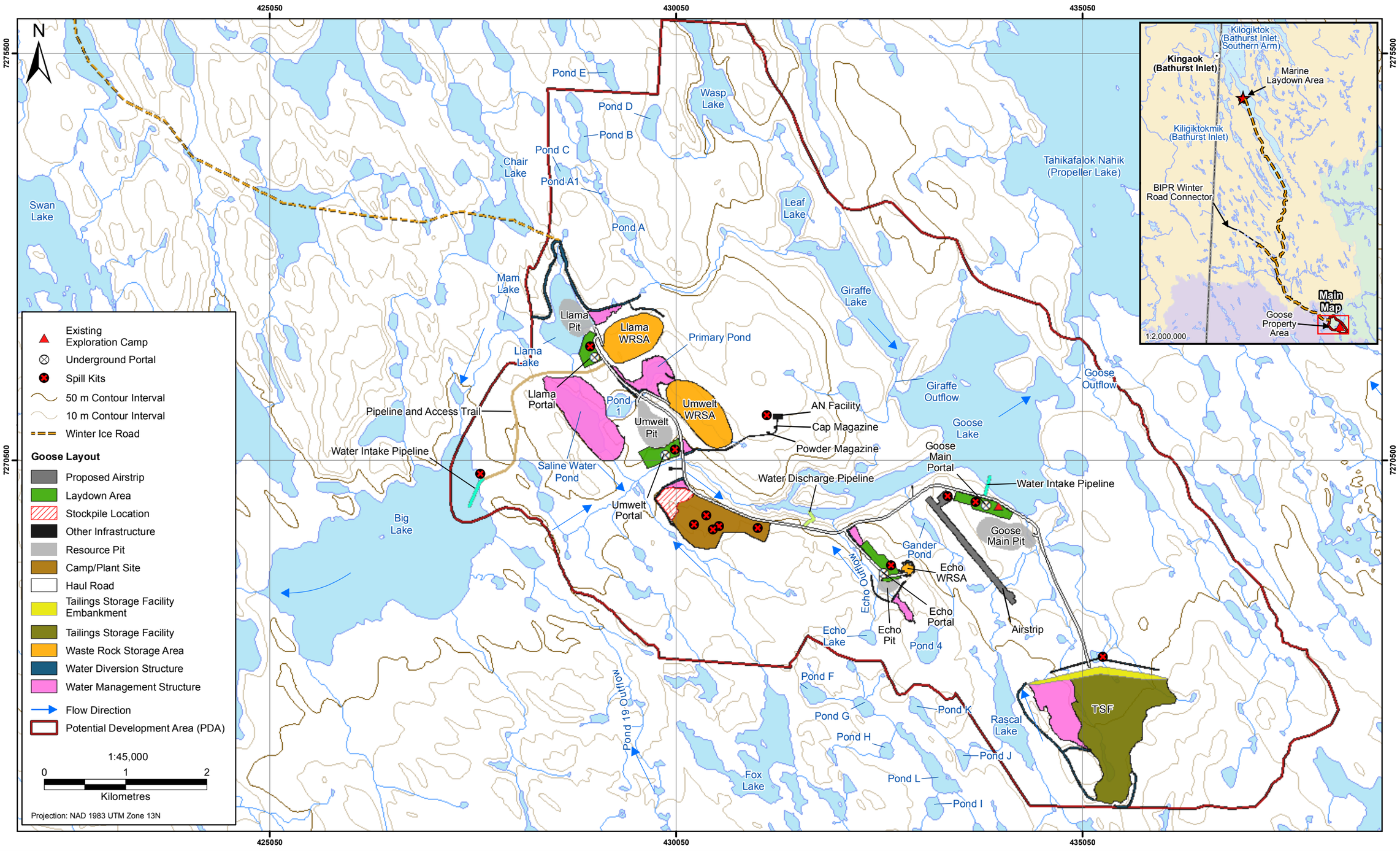
Spill kits will be customized to account for specific hazards and conditions in each work site. Customized spill kits particular for the activity and area will be selected for use on the site as required. At a minimum, each kit will contain:

- Sufficient hydrophobic absorbent material (e.g., oil absorbent booms and absorbent socks) to contain and cleanup potential drips, leaks, or spills.
- Gloves and heavy plastic bags to contain oily absorbent materials and contaminated soils or wastes.
- Barrier tape to keep personnel out of contaminated areas.
- Sorbent granular materials to soak up free oil.
- Other appropriate PPE such as disposal coveralls, rubber gloves and safety goggles.

A vehicle outfitted with a self-contained collection of spill response materials for rapid deployment to spill sites will be utilized.

Reserve spill response equipment such as booms, socks and pads will be available for response to larger spill incidents, or to replenish materials used in the smaller equipment spill kits. Spill kits will be inspected routinely and restocked after use.

Table 7-1 provides a general list of mobile and stationary equipment likely available on site. This list will vary by project phase and response requirements.



Sabina GOLD & SILVER CORP.

Goose Property
General Arrangement

Figure 7.1

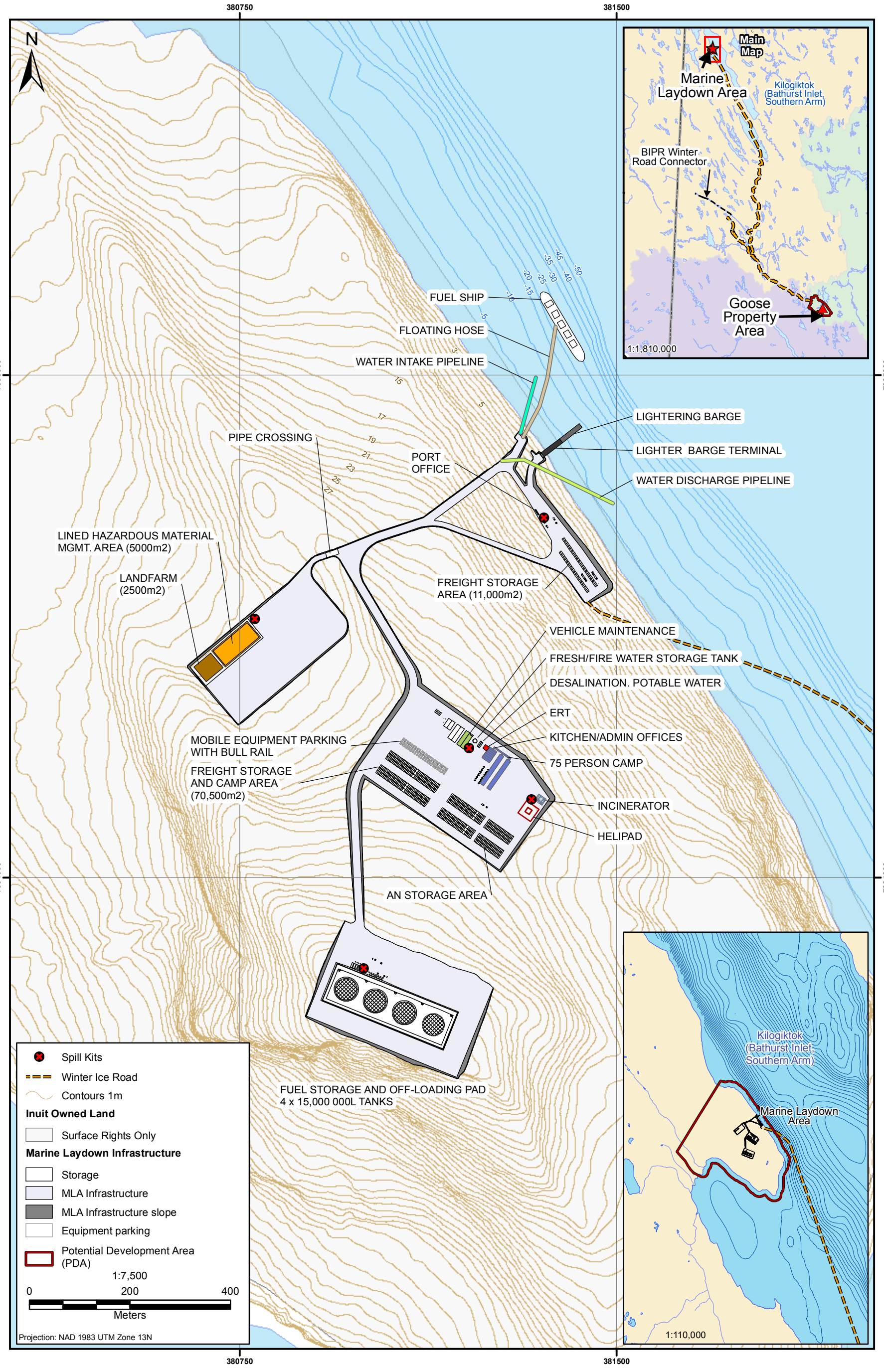


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Figure 7.2

Marine Laydown Area General Arrangement

Table 7-1. General Equipment for Emergency Spill Response

Mobile Equipment	
Grader	Winch Trucks
Cranes	Pickup Trucks
Snowmobiles	Generator Sets
Vacuum Truck	Fire Truck
Loaders	Aluminium Boats
Backhoes	Fuel Trucks
Bulldozers	Bobcats
Forklifts	Haul Trucks
Water Trucks	Snow Cats
Excavators	
Temporary Containment Systems	
Booms	Spill Kits
Drums	Spill Absorbent Material
Tanks	Silt Fencing
Tailings Storage Facility	Lined Excavations
Emergency Transportation	
Aircraft (helicopter)	Snowmobiles
4-Wheel Drive Vehicles (e.g. Pickup trucks)	Boats
ATVs	
Communication Equipment	
Radios	Fax
Telephone	Wireless Communication Systems
Satellite phone	

A mobile environmental emergency trailer will be located on site at each of the Back River Project properties; their typical contents are listed in Table 7-2.

Table 7-2. Environmental Emergency Trailer Equipment List

Equipment	
Pump/skimmer	White oil spill pads
Pump accessories	Universal booms
Vacuum ends	Cell U-Sorb
Tubing or pipes for vacuum or pumping	Sphagsorb
45 gallon top	Wedge wood
Diesel fuel jerry can	Plug patties
Spill kit accessory	Quattrex bags
Drum opener	Hand shovel
Wescot (to open empty drum screw)	Ice Breaker Chisel
Empty drums	Sledge hammer
Drums berms	Rod bars
Tarps	

8. Spill Response Procedures

Spills may result from any of the following situations:

- Leaks or ruptures in tanks, drums or containers.
- Equipment failure including valves, hoses, piping or containment structures.
- Overfilling containers.
- Improper storage.
- Spills during transfer.
- Accidents during transportation.

Procedures will vary seasonally and based on the nature of the hazardous material spilled. The applicable SDS will be consulted to ensure that the materials are being handled safely and appropriately. Response procedures specific to land, water, snow and ice are presented in this section.

8.1 GENERAL SPILL RESPONSE

All site personnel are briefed on the procedures to be followed to report a spill and initiate spill response. The following details the steps to be taken in the event of a spill. Steps are listed in order of importance; however, circumstances and conditions may alter the order of these steps to meet a specific situation. The Site Superintendent and Environmental Superintendent will be notified as soon as feasible for any spill.

8.1.1 Source Control

Identify the product and determine the source. Reduce or stop the flow of product without endangering anyone. This may involve very simple actions such as turning off a pump, closing a valve, sealing a puncture hole with almost anything handy (e. g., a rag, a piece of wood, tape, etc.), raising a leaky or discharging hose at a level higher than the product level inside the tank, or transferring fuel from leaking containers.

8.1.2 Control of Free Product

Prevent or limit the spread of the spilled material. Accumulate/concentrate spilled product in an area to facilitate recovery. Barriers positioned down-gradient of the spill will slow or stop the progression of the spill. Barriers can consist of absorbent booms, dykes, berms, or trenches (dug in the ground or in snow/ice).

8.1.3 Protection

Evaluate the potential dangers of the spill in order to protect sensitive ecosystems and natural resources. Block or divert the spilled material away from sensitive receptors. This can also be achieved by using various types of barriers.

8.1.4 Clean Up the Spill

Recover and contain as much free product as possible. Recover and containerize/treat contaminated soil, water, and snow. Pressure-wash contaminated bedrock surfaces, shorelines, ice and recover as much as possible oily water for containerization and/or treatment.

8.1.5 Report the Spill

Provide basic information such as date and time of the spill, type and amount of product discharged, photographic records, location and approximate size of the spill, actions already taken to stop and contain the spill, meteorological conditions and any perceived threat to human health or the environment.

8.2 RESPONSE BY SPILL LOCATION

Spills may occur at the Goose Property and the MLA year-round. As such, spills may occur to unfrozen land and water as well as frozen ground, snow and ice.

At the Goose Property, there are numerous lakes and streams in the vicinity, with Goose Lake and its tributaries being the primary waterbody that could be affected by fuel spills. There are no streams at the MLA and the closest waterway is the ocean (Bathurst Inlet).

Spills may also occur along the winter ice road route during the winter period only. Therefore, spills along the winter ice road will be onto snow and ice.

The location, weather conditions, and the time of year will influence the degree of environmental contamination that could result from a spill, as well as the response time and available resources. At both the Goose Property and the MLA, manpower and spill response equipment will be readily available, and road access around the properties will enable to rapid deployment of a response to spills. Response to spills that occur as a result of Project traffic along the winter ice road will have varying response times, depending on the distance from nearby vehicles, the distance from a spill location along the winter ice road from either of the properties, and the weather conditions which could slow the response. Radio communication on the winter ice road is an important tool for communicating an incident and all vehicles transiting the roadways will be equipped with 2-way radio and/or satellite phone communication capabilities. Winter conditions along the winter ice road will help contain spills and reduce the potential of spills from entering local waterways.

8.2.1 Spills on Land

Response to spills on land will include the general procedures previously detailed.

Initially use the equipment that is quickly available to build a berm to contain the spill and stop the material from entering any waterway. This can be built with soil, booms, lumber, snow, etc.

These barriers should be placed down gradient (down-slope) from the source of the spill and as close as possible to the source. Barriers slow the progression of flow and also serve as containment to allow for recovery.

A plastic liner should be placed at the foot of and over the dykes to protect the underlying soil or other material and to facilitate recovery of the spill. Construct dykes in such a way as to accumulate a thick layer of free product in a single area (V shaped or U shaped).

Trenches are useful in the presence of permeable soil and when the spill is migrating below the ground surface. A plastic liner should be placed on the down-gradient edge of the trench to protect the underlying soil.

Large volumes of free product should be recovered, as much as possible, by using vacuums and pumps, and containerized. Mixtures of water and fuel may be processed through an oil-water separator. Absorbent sheets should be used to soak up residual spill to water, on the ground (soil and rock), and in vegetation.

8.2.2 Spills on Water

Response to spills on water includes the general procedures previously detailed.

Various containment, diversion and recovery techniques are discussed in the following sections. The following elements must be taken into consideration when conducting response operations:

- Type of waterbody or watercourse (lake, ocean, stream, river).
- Water depth and surface area.
- Wind speed and direction.
- Resonance and range of tides.
- Type of shoreline.
- Seasonal considerations (open-water, freeze-up, break-up, frozen).

Containment of an oil slick on the ocean requires the deployment of mobile floating booms to intercept, control, contain and concentrate (i.e., increase thickness) the floating oil. One end of the boom is anchored to shore while the other is towed by a boat or other means and used to circle the oil slick and return it close to shore for recovery using a skimmer. Reducing the surface area of the slick increases its thickness and thereby improves recovery. Mechanical recovery equipment (i.e., skimmers and oil/water separators) will be mobilized, if required.

If oil is spilled in a lake it may not be possible to deploy booms using a boat. In this case, measures are taken to protect sensitive and accessible shoreline. The oil slick is monitored to determine the direction of migration. In the absence of strong winds the oil will likely flow towards the discharge of the lake. Measures are taken to block and concentrate the oil slick at the lake discharge using booms where it can subsequently be recovered using a portable skimmer, a vacuum, or sorbent materials.

In small slow-flowing rivers, streams, channels, inlets or ditches, inverted weirs (i.e., siphon dams) can be used to stop and concentrate moving oil for collection while allowing water to continue to flow unimpeded. In the case of floating oil in a stream or migration to a culvert (i.e., at a road crossing) a culvert block can be used to stop and concentrate moving oil for collection while allowing water to continue to flow unimpeded. In both cases, oil will then be recovered using a portable skimmer or sorbent materials.

In the case of spills in larger rivers with fast moving currents, diversion booming is used to direct the oil slick ashore for recovery. Single or multiple booms (i.e., cascading) may be used for diversion. Typically, the booms are anchored across the river at an angle. The angle will depend on the current velocity. Choosing a section of a river that is both wider and shallow will make boom deployment easier. Diversion booming may also be used to direct an oil slick away from a sensitive area to be protected.

8.2.3 Spills on Snow and Ice

In general, snow and ice will slow the movement of hydrocarbons. The presence of snow may also hide the oil slick and make it more difficult to follow its progression. Snow is generally a good natural sorbent, as hydrocarbons have a tendency to be soaked up by snow through capillary action. However, the use of snow as a sorbent material is to be limited as much as possible. Snow and frozen ground also

prevent hydrocarbons from migrating down into soil or at least slow the migration process. Ice prevents seepage of fuel into the water.

Response to spills on snow and ice includes the general procedures previously detailed. Most response procedures for spills on land may be used for spills on snow and ice. The use of dykes (i.e., compacted snow berms lined with plastic sheeting) or trenches (dug in snow or ice) slow the progression of the fuel and also serve as containment to allow recovery of the fuel. Free product is recovered by using a vacuum, a pump, or sorbent materials. Contaminated snow and ice is scraped up manually or using heavy equipment depending on volumes.

The contaminated snow and ice is placed in containers or within plastic lined berms on land. For contingency purposes, a contaminated snow storage site will to be designated and located in close proximity to each of the main Project work sites to facilitate inspection and monitoring, in an area which will still be readily accessible once it is time to remove the snow (i.e., spring or summer), and at least 31 m away from any body of water or ditch. Once enough snow has melted, the oily water can be removed from the storage site and processed through an oil-water separator that would be mobilized to site. Hydrocarbons recovered will be burned in the camp incinerator or shipped off-site.

8.3 RESPONSE BY TYPE OF MATERIAL SPILLED

8.3.1 Fuel

Regular inspections will be conducted to ensure that there has not been a leak or that conditions within fuel storage areas could result in a leak. These inspections will include the fuel drums and storage containers, secondary containment sumps and associated spill containment devices, any pumps and product-handling equipment, and overfill protection devices. Inspections will be recorded to include who completed the inspections, areas included in the visual inspection and any deficiencies noted.

Fuel spills, leaks at fuel storage or transfer facilities or vehicle accidents will be handled by following these steps:

- Identify the source of the leak or spill.
- Contact the Environmental Superintendent/Site Superintendent.
- Stop leaks from tank or barrel by closing valves.
- Utilizing patching kits to seal leaks.
- Placing plastic sheeting at the foot of the tank or barrel to prevent seepage into the ground.
- Contain the spill and the source if possible.
- Take photographs of the spill site before and after the clean-up.

Small spills will be cleaned up by removing the contaminated soil and storing it in empty 205 L drums for backhaul and disposal at an approved hazardous waste disposal site. Should a large spill occur, cleanup and disposal efforts will be coordinated as necessary with the appropriate authorities and agencies.

8.3.2 Domestic Sewage

Any problems with the sewage treatment system will be promptly reported to the Site Superintendent.

In the event of a power failure, the stand-by generator will be put into operation as soon as possible. Similarly, in the case of a pump failure, the backup pump will be put on-line. As necessary appropriate safety equipment and personal protective clothing will be available to site personnel.

8.3.3 Tailings or Reclaim Water

A spill of tailings or reclaim water may potentially occur. Though highly unlikely, a spill could occur from an overtopping or breach of the TSF embankment. Such a spill, however unlikely, could also occur from a tailings pipeline, or a reclaim water pipeline returning water from the TSF or TF to the process plant. Tailings or contact water may contain trace (< 1 mg/L) cyanide which can be toxic to aquatic organisms, but also breaks down rapidly and does not persist in the environment.

In the event of an unplanned release from the TSF, the emergency response plan will be implemented. The TSF embankments and supernatant water level in the TSF will be instrumented and regularly monitored as described in the Tailings Management Plan. In the instance of a pipeline rupture, pressure sensors instrumented in the pipelines will signal a loss of pressure that will signal an alarm to shut off the pumps, thereby limiting the volume of material that may be released.

8.3.4 Chemicals

Assess the hazard of the spilled material by referring to the relevant SDS. Each response will vary based on the specific material. If the chemical is hazardous, ensure personal protective equipment (PPE) is utilized (latex gloves, eye protection, etc.) before approaching the spill. As most chemicals are only used in extremely small quantities on site, absorbent mats can be used to soak up spilled liquids then placed in appropriate containers for treatment and/or disposal.

Ammonium nitrate (AN) and sodium cyanide are two main hazardous materials that will be used in large quantities by the Project. Both will be delivered by sealift in solid form in tote bags within shipping containers. They will be protected from the elements to prevent contact with water during transport and storage. Spillage, although unlikely, is possible during transport from the MLA to Goose Property over the winter ice road. Ammonium nitrate (AN) may be spilled during handling and ammonium nitrate fuel oil may be spilled during handling or during use in the open pit or underground. The Explosives Management Plan (V10.13) provides best management practices used to reduce the risk or loss or spillage of AN and ANFO.

AN dissociates readily in water to ammonia which, in its unionized form, may be toxic to fish and other aquatic organisms. Sodium cyanide is similarly water soluble and may be acutely toxic to fish. Storage on land away from water in containers protected from the elements significantly reduces the risk of ammonia loss to water bodies. Release of these materials into a waterbody during the open water season is highly unlikely.

Sodium cyanide is used in the process plant to extract the gold and a cyanide destruction process reduces residual cyanide concentrations in the tailings supernatant, as discussed in the previous section. A Cyanide Management Plan included as an appendix to the HMMP describes the measures to be undertaken for the safe handling of cyanide on the Project. Cyanide breaks down into carbon and nitrogen in the presence of sunlight and ammonia breaks down into other nitrogen compounds.

Response to spills of these materials would involve clean-up of mainly solids and any affected soil, snow or ice. Clean up will be undertaken by workers licensed to handle explosives (ammonium nitrate or explosives) or by workers with appropriate training in the safe handling of the chemical (sodium cyanide). Any affected waters can be contained and recovered for disposal if this is practical, or can be monitored for degradation, attenuation, and dilution.

General guidelines for cleaning up spills of these types of materials are similar to previously identified sections 8.2.2 and 8.2.3.

- For an accidental release to the land, depending on the topography, contain the discharge by constructing a perimeter dyke system.
- Collect the material through absorbent material, booming or absorbent matting. For release to water, depending on the circumstance, utilize damming, water diversion, skimming or booming to minimize the dispersion of the spilled material.
- Collect the contaminated soil and/or water as well as the absorbent materials used in the process afterwards for proper disposal in a certified waste handling facility. Collect any spilled material followed by placing same inside a container such as a 205 litre drum and seal with a lid.
- Label the drum(s), store within a designated area, keep closed and when available, transport to a licensed disposal facility for disposal.
- Ensure the spill area and equipment used to manage the spill has been cleaned prior to demobilizing from the spill area.
- Contact the appropriate regulatory groups through the notification procedure and advise of the spill situation depending on whether the spill is reportable or could adversely affect the environment.

The transport of both explosives, ammonium nitrate and sodium cyanide will require the development of Emergency Response Assistance Plans (ERAPs) under Section 7 of the TDGR. The plans will outline what is to be done to respond to an actual or anticipated release of the specific dangerous goods in the course of their handling or transporting that could endanger public safety. The ERAPs require the approval of the Minister of Transport. With the permission of the supplier, a supplier's approved ERAP can be adopted and used by a user such as Sabina. Relevant ERAPs will be developed or adopted by Sabina or its contractors and incorporated into this Spill Contingency Plan when they become available, for the Project's transport of the applicable dangerous goods.

8.4 RESPONSE TO FIRE

Various products, including fuel, may be flammable under certain circumstances. It is important to ensure that the spill does not present a risk of fire prior to commencing the cleanup. If a fire does break out refer to relevant site firefighting procedures. Fire response procedures are detailed in the RMERP.

8.5 DISPOSAL

Appropriate disposal for any recovered product and contaminated soil, water or absorbent clean up material is regulated and must be authorized by the agency investigating the incident. Obtain approval from all appropriate government agencies before disposal.

Fuel-contaminated soil can be remediated at camp through land-farming or incineration. Any non-reusable recovered product, contaminated soil and clean up material, which cannot be incinerated, will be stored in containers and returned to camp prior to eventual disposal in an approved disposal/treatment site.

8.6 POST-SPILL MONITORING AND REMEDIATION

Should there be any concern of contaminants remaining in the area following clean-up, appropriate sampling and monitoring should be undertaken to determine residual contamination. Based on the results of the monitoring program the site should be remediated as necessary.

8.7 SPILL FOLLOW-UP INVESTIGATION

The root cause of all spills will be investigated. An incident investigation will be performed by the Environmental Superintendent following every major spill. Minor spills as defined in Section 2.0, will be investigated by the appropriate supervisor. The likely cause of the spill will be determined, and remedial action will be taken to ensure that similar spills are prevented. Remedial action may involve:

- Additional training for personnel.
- Enhanced equipment maintenance or inspection program.
- Additional preventative infrastructure, such as containment berms, oil/water separators, etc.

The performance of the spill response procedures will also be reviewed, and updated as necessary.

9. Spill Reporting

9.1 ENVIRONMENTAL REPORTING

All spills are to be internally reported to the General Manager or designated representative. It is their responsibility to notify Sabina headquarters staff and external parties as outlined in the roles and responsibilities of this Plan.

Reportable spills, as identified in this Plan, are to be externally reported to the NWT-Nunavut 24-hr Spill Response Line.

NWT-NU 24-Hour Spill Report Line:
Phone: 867 920 8130
Fax: 867 873 6924
Email: spills@gov.nt.ca

The Environmental Superintendent will ensure spills are reported externally as required. The Spill Response Form (Appendix B) is to be completed for all spills requiring external reporting. The completed form will be forwarded to the NWT/Nunavut Spill Response Centre within the required 24-hour reporting period.

Any spill, or incident that may likely result in a spill, of an amount equal to or greater than the amount listed in Table 2-1 shall be promptly reported externally. Spills adjacent to or into a surface water or groundwater access shall be externally reported regardless of quantity.

Spills within secondary containment will be reported and included in an internal log. In the situation that the spill within the containment is above the thresholds noted in Table 2-1, a report to the NWT-Nunavut 24-hr Spill Response Line will be submitted if the spill exceeds 40% of the capacity of the secondary containment.

9.1.1 Marine Spill Reporting:

Spills of a marine nature will be reported to the Canadian Coast Guard (Central and Arctic region):

- 1-800-265-0237 (24-hour).
- The fax number for transmission of the written report is (519) 337-2498.

Reporting of marine spills shall be conducted in accordance with Transport Canada Guideline TP-9834E, "Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and /or Marine Pollutants". Sabina will report any presence of oily sheens on the water near vessels at the port site to the NT-NU Spill Line.

The Vessel Pollution and Dangerous Chemical Regulations, (SOR 2012-69) require that spills be reported to the nearest office of Transport Canada as follows:

Manager, Technical Services
Transport Canada, Marine Safety
Tel: 204 984 8618
Cell: 204 880 0754
Email: TBD

Manager, Marine Safety (PNR)
Transport Canada
Tel: 204 984 0397
Fax: 204 984 8417
Email: TBD

9.1.2 TDGR Reporting:

In addition, the TDGR has immediate and 30-day reporting requirements for dangerous goods accidents or incidents if the spill occurred during transport. **Immediate reporting** is required by the TDGR to:

- The Local police
- Nunavut Emergency Services at 1 800 693 1666
- The person's employer;
- The consignor of the dangerous goods;
- The owner/lessee/charterer of the road vehicle involved (if applicable); and
- CANUTEC at 613 996 6666 for railway vehicles, ships, aircrafts, aerodromes or an air cargo facility; for Class 1 Explosives and Class 6.2 Infectious Substances; and for an accidental release from a cylinder that has suffered a catastrophic failure.

A **follow-up report** must be made by the employer of the person who had possession of the dangerous goods at the time of the accidental release, the "dangerous goods accident" or the "dangerous goods incident", or by the person if self-employed. The follow-up report must be made, in writing, to the Director General within 30 days after the occurrence of the accidental release, the "dangerous goods accident" or the "dangerous goods incident". The follow-up report must include the following information:

- **T**he name and address of the place of business of the person providing the information and the telephone number, including the area code, at which that person may be contacted;
- **T**he date, time and location of the accidental release, the "dangerous goods accident" or the "dangerous goods incident";
- **T**he name and address of the place of business of the consignor;
- **T**he classification of the dangerous goods;
- **T**he estimated quantity of dangerous goods released and the total quantity of dangerous goods in the means of containment before the accidental release, the "dangerous goods accident" or the "dangerous goods incident";
- A description of the means of containment involved based on the identification markings and a description of the failure or damage to the means of containment, including how the failure or damage occurred;
- **F**or an accidental release from a cylinder that has suffered a catastrophic failure, the certification safety marks and a description of the failure;
- *For example, there was an explosion, a valve sheared off or there was a crack in the cylinder.*
- **T**he number of deaths and injuries resulting from the accidental release, the "dangerous goods accident" or the "dangerous goods incident";
- An estimate of the number of people evacuated from private residences, public areas or public buildings; and
- **I**f an emergency response assistance plan was activated, the name of the person who responded to the emergency in accordance with the emergency response assistance plan.

The address for the Director General is:

Transport Dangerous Goods (TDG)

Place de Ville, Tower C, 9th Floor, 330 Sparks St.

Ottawa, Ontario K1A 0N5

9.2 INTERNAL RECORD KEEPING

An internal log of spills, no matter how small, will be kept and maintained by the Environmental Department. Each record will include date, location, material spilled, volume, reason for release, any negative impact, status of cleanup, and corrective actions taken. Photos (before, during and after cleanup) shall also be taken of all significant spills. To assist with internal tracking, a Sabina Spill Form is included in Appendix C.

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

10. Plan Evaluation and Adaptation

The SCP will be updated annually to incorporate lessons learned from any incidents that may have occurred, amendments to legislation, new characteristics of the sites, the equipment on site, new policies of the company, environmental issues and to provide updated information on new staff, external contact details and other changes. Changes to roles and responsibilities will also be incorporated into the RMERP, as the emergency response team is the same.

Most important will be the review of aspects of the Plan affecting safety of employees of the facility, contractors, and the general public. Operational aspects of the Plan, as well as any paperwork that deals with the Plan, will be reviewed. All aspects of the Plan will be continuously audited for effectiveness.

The updated version of the Plan will be distributed to the distribution list. Formal evaluations of the SCP will be documented, deficiencies noted in the report, and progress in addressing deficiencies tracked in writing. Responsibilities to address deficiencies and accountabilities will be assigned and deadlines for addressing required changes will be set.

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Appendix A

Expected Hazardous Materials Transported, Stored and Used On-site

Sabina
GOLD & SILVER CORP.

Appendix A. Hazardous Materials Transported, Stored and Used On-Site

Type	Source	Project Phase Generated	Project Location Generated	Potential Environmental Effects	Waste Management and Pollution Prevention Strategies
Fuels and Used Petroleum Products (oils / lubricants /greases)	Vehicles and equipment including generators and pumps	Construction / Operations / Closure	Goose Property, George Property, and MLA	Petroleum products can accumulate on the surface of waterbodies or may sink to the bottom. Fish can uptake hydrocarbons in the environment. Feeding and reproduction of aquatic life (e.g., fish, plants, and insects) may be affected Micro-organisms in soil degrade hydrocarbons, sometimes at the expense of plant nutrition Petroleum products can damage the respiratory system if aspirated and be toxic if ingested	Spill Response Procedures (safety procedures, initial assessment, spill report, containment, storage, and disposal) will be employed When possible. waste oil will be used in incinerators or designed used-oil heaters Waste oil may be collected and stored in empty bulk lubricant cubes to be stored in the designated hazardous waste section of the waste storage facility Contaminated snow/water will be stored in clearly-marked, sound, sealed containers in the laydown yard and may be shipped off-site to an appropriate facility Bioremediation may be considered for contaminated soil
Oil and Fuel Filters	Vehicles and equipment	Construction / Operations / Closure	Goose Property, George Property, and MLA	Petroleum products can accumulate on the surface of waterbodies or may sink to the bottom. Fish can uptake petroleum hydrocarbons once it is in their environment. Feeding and reproduction of aquatic life (e.g., fish, plants, and insects) may be affected Micro-organisms in soil degrade hydrocarbons, sometimes at the expense of plant nutrition Petroleum products can damage the respiratory system if aspirated and be toxic if ingested	Waste oil and fuel filters will be drained in a heated and ventilated section of the maintenance shop. Filters will then be crushed to minimize volume and release any additional oil. This area of the maintenance shop will adhere to Sabina's Spill contingency plan and have a liner or tray to catch any spills or splashes The filters will be placed in sealed containers and labelled and stored at the waste management facility These containers may be shipped off-site to a registered hazardous waste receiver
Used Sorbents and Rags	Used in the maintenance of vehicles, equipment and spill control	Construction / Operations / Closure	Goose Property, George Property, and MLA	Petroleum products can accumulate on the surface of waterbodies or may sink to the bottom. Fish can uptake petroleum hydrocarbons once it is in their environment. Feeding and reproduction of aquatic life (e.g.,	Where possible, used rags and sorbents will be incinerated on-site If incineration is not practical, used sorbents and rags will be stored in clearly-marked, sound, sealed containers in the laydown yard

Appendix A. Hazardous Materials Transported, Stored and Used On-Site

Type	Source	Project Phase Generated	Project Location Generated	Potential Environmental Effects	Waste Management and Pollution Prevention Strategies
				fish, plants, and insects) may be affected Micro-organisms in soil degrade hydrocarbons, sometimes at the expense of plant nutrition Petroleum products can damage the respiratory system if aspirated and be toxic if ingested	and then shipped off-site to a registered hazardous waste receiver
Hydraulic Fluid	Used in vehicles and equipment (e.g., brakes, power steering, forklifts, underground hauling equipment)	Construction / Operations / Closure	Goose Property, George Property, and MLA	Hydraulic fluid may enter the environment from spills and leaks from equipment or from improper storage. Once in the environment some hydraulic fluids break down and have the potential to mix with water and, in high quantities, may harm fish	Equipment will be regularly maintained to prevent spills from ruptured hydraulic fluid lines Biodegradable, low toxicity hydraulic fluids will be used where practical Where possible, used hydraulic fluid will be incinerated on-site Used hydraulic fluid that cannot be incinerated will be stored in clearly marked, sound, sealed containers These containers may be shipped off-site to a registered hazardous waste receiver Unused hydraulic fuel in the original containers will be return to the manufacture for disposal or reuse at closure.
Empty Petroleum Hydrocarbon Containers and Drums	Packaging for oils, solvents and penetrating oils	Construction / Operations / Closure	Goose Property, George Property, and MLA	Petroleum products may accumulate on the surface of waterbodies or may sink to the bottom. Fish can uptake petroleum hydrocarbons once in the environment. Feeding and reproduction of aquatic life (e.g., fish, plants, and insects) may be affected Micro-organisms in soil degrade hydrocarbons, sometimes at the expense of plant nutrition Petroleum products can damage the respiratory system if aspirated and be toxic if ingested	Sabina and its contractors will purchase these items in bulk to minimize the amount of packaging Backhauled to a recycling facility

Appendix A. Hazardous Materials Transported, Stored and Used On-Site

Type	Source	Project Phase Generated	Project Location Generated	Potential Environmental Effects	Waste Management and Pollution Prevention Strategies
Glycol	Used as a coolant and antifreeze in equipment	Construction / Operations / Closure	Goose Property, George Property, and MLA	Glycol's odour is a known wildlife attractant Glycol can have toxic effects on aquatic organisms and wildlife	Environmental benign glycols will be used where practical Equipment will be regularly maintained to prevent spills from ruptured glycol lines Waste glycol will be stored in the waste storage facility in clearly marked, sound, sealed containers These containers may be shipped off-site to a registered hazardous waste receiver Unused glycol in the original containers may be returned to the manufacture for disposal or reuse at closure.
Reagents	Additives required for mine processing	Operations / Closure	Goose Property and MLA	Reagents (hydrated lime, sodium cyanide, activated carbon, sodium hydroxide, hydrochloric acid, sulphur, copper sulphate, MBS, flocculant, and antiscalant) may enter the environment from spills and leaks from containers, process equipment or from improper storage. Once in the environment, some may cause harm to the terrestrial and aquatic ecosystem by entry of deleterious and other polluting substances (e.g. cyanide)	Spill prevention procedures will be developed Spill Response Procedures to respond to the spill (safety procedures, initial assessment, spill report, containment, storage, and disposal) Spent reagents will be collected and stored in clearly-marked, sound, sealed empty bulk containers. Containers will be stored in the designated hazardous waste section of the waste storage facility Reagents may be shipped off-site to a registered hazardous waste receiver Unused reagents will be sent back to the manufacture as required in original containers at closure
Lab Reagents		Operations / Closure	Goose Property and MLA	Lab Reagents may enter the environment from spills and leaks from containers, or from improper storage. Once in the environment, some may cause harm to the terrestrial and aquatic ecosystem by entry of deleterious and other polluting substances	Spill prevention procedures will be developed Spill Response Procedures to respond to the spill (safety procedures, initial assessment, spill report, containment, storage, and disposal)

Appendix A. Hazardous Materials Transported, Stored and Used On-Site

Type	Source	Project Phase Generated	Project Location Generated	Potential Environmental Effects	Waste Management and Pollution Prevention Strategies
					Spent reagents will be collected and stored in clearly-marked, sound, sealed empty bulk containers. Containers will be stored in the designated hazardous waste section of the waste storage facility Reagents may be shipped off-site to a registered hazardous waste receiver Unused reagents will be sent back to the manufacture as required in original containers at closure
Solvents	Used to degrease machinery in the maintenance shop	Construction / Operations / Closure	Goose Property, George Property, and MLA	Petroleum fuels can accumulate on the surface of waterbodies or may sink to the bottom. Fish can uptake petroleum hydrocarbons once it is in their environment. Feeding and reproduction of aquatic life (e.g., fish, plants, and insects) may be affected Micro-organisms in soil degrade hydrocarbons, sometimes at the expense of plant nutrition Petroleum products can damage the respiratory system if aspirated and be toxic if ingested	Low toxicity solvents and physical cleaning (e.g., steam jet) will be used where practical Petroleum-based solvents will not be allowed into the environment and will be subject to the spill response plan Waste or excess solvents will be stored in the waste storage facility in clearly marked, sound, sealed containers These containers may be shipped off-site to a registered hazardous waste receiver Unused solvents in the original containers may be returned to the manufacturer for disposal or reuse at closure
Paints		Construction / Operations / Closure	Goose Property, George Property, and MLA		When feasible, latex paints will be used on site. Latex paints should be collected in a covered area and opened to dry. Unused full containers of paint will be returned to the manufacture, if possible Paint containing hazardous materials, that cannot be used will be sealed and shipped off site to a registered hazardous waste receiver.

Appendix A. Hazardous Materials Transported, Stored and Used On-Site

Type	Source	Project Phase Generated	Project Location Generated	Potential Environmental Effects	Waste Management and Pollution Prevention Strategies
Fluorescent Light Tubes	Indoor lighting	Construction / Operations / Closure	Goose Property, George Property, and MLA	Fluorescent tubes contain mercury phosphor powder and traces of lead and cadmium	Lights should be equipped with motion sensors to reduce usage where practical Discarded fluorescent lights will be consolidated together and stored indoors in the waste storage facility in their original packaging Fluorescent light tubes may be shipped off-site to a registered hazardous waste receiver
Electronics and Electrical Materials	Electrical devices that cannot be repaired and cannot be recycled	Construction / Operations / Closure	Goose Property, George Property, and MLA	Electrical waste and devices may or may not contain polluting substances (such as mercury, lead, arsenic, cadmium, and polyvinyl chloride (PVC) that could enter the ecosystem	Sabina's environment staff will determine the risk of electronic devices and classify them as hazardous or non-hazardous waste and determine the appropriate method of recycling/ disposal
Equipment Batteries	Equipment batteries	Construction/ Operations / Closure	Goose Property, George Property, and MLA	Lead batteries (i.e., vehicle batteries) contain sulphuric acid and lead harmful to environmental receptors Rechargeable batteries (i.e., industrial forklift, radio and transmitter batteries) usually contain either potassium hydroxide or nickel cadmium with toxic effects	Protect and service batteries to prevent damage and loss of charge Test batteries prior to disposal to confirm the battery is spent All batteries will be shipped off-site to a recycling facility or a registered hazardous waste receiver
Hazardous Medical Waste	Small amounts of medical waste from First Aid (e.g., syringes, used medical supplies)	Construction / Operations / Closure	Goose Property, George Property, and MLA	May be sharp or may contain bacteria and viruses which can be a risk to human or wildlife health	Medical waste will be labeled "Biohazard" and stored in a secure area of the First Aid Station Medical waste will remain under the care of medical personnel until backhauled to a registered hazardous biological waste receiver Medical waste will not be incinerated on-site as it poses a handling risk from sharps for the incinerator operator and workers collecting waste

Appendix A. Hazardous Materials Transported, Stored and Used On-Site

Type	Source	Project Phase Generated	Project Location Generated	Potential Environmental Effects	Waste Management and Pollution Prevention Strategies
Aerosol Cans		Construction / Operations / Closure	Goose Property, George Property, and MLA		Pressurized aerosol cans will be punctured on site and landfilled.

Appendix B
NWT-NU Spill Report Form

Sabina
GOLD & SILVER CORP.

NT-NU SPILL REPORT

OIL, GASOLINE, CHEMICALS AND OTHER HAZARDOUS MATERIALS

NT-NU 24-HOUR SPILL REPORT LINE
TEL: (867) 920-8130
FAX: (867) 873-6924
EMAIL: spills@gov.nt.ca

REPORT LINE USE ONLY

A	REPORT DATE: MONTH – DAY – YEAR	REPORT TIME	☐ ORIGINAL SPILL REPORT, OR ☐ UPDATE # _____ TO THE ORIGINAL SPILL REPORT	REPORT NUMBER ____-_____
B	OCCURRENCE DATE: MONTH – DAY – YEAR	OCCURRENCE TIME		

C	LAND USE PERMIT NUMBER (IF APPLICABLE)	WATER LICENCE NUMBER (IF APPLICABLE)
D	GEOGRAPHIC PLACE NAME OR DISTANCE AND DIRECTION FROM NAMED LOCATION	REGION ☐ NWT ☐ NUNAVUT ☐ ADJACENT JURISDICTION OR OCEAN
E	LATITUDE DEGREES MINUTES SECONDS	LONGITUDE DEGREES MINUTES SECONDS

F	RESPONSIBLE PARTY OR VESSEL NAME	RESPONSIBLE PARTY ADDRESS OR OFFICE LOCATION	
G	ANY CONTRACTOR INVOLVED	CONTRACTOR ADDRESS OR OFFICE LOCATION	
H	PRODUCT SPILLED	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER
	SECOND PRODUCT SPILLED (IF APPLICABLE)	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER
I	SPILL SOURCE	SPILL CAUSE	AREA OF CONTAMINATION IN SQUARE METRES
J	FACTORS AFFECTING SPILL OR RECOVERY	DESCRIBE ANY ASSISTANCE REQUIRED	HAZARDS TO PERSONS, PROPERTY OR ENVIRONMENT
K	ADDITIONAL INFORMATION, COMMENTS, ACTIONS PROPOSED OR TAKEN TO CONTAIN, RECOVER OR DISPOSE OF SPILLED PRODUCT AND CONTAMINATED MATERIALS		

L	REPORTED TO SPILL LINE BY	POSITION	EMPLOYER	LOCATION CALLING FROM	TELEPHONE
M	ANY ALTERNATE CONTACT	POSITION	EMPLOYER	ALTERNATE CONTACT LOCATION	ALTERNATE TELEPHONE

REPORT LINE USE ONLY

N	RECEIVED AT SPILL LINE BY	POSITION STATION OPERATOR	EMPLOYER	LOCATION CALLED YELLOWKNIFE, NT	REPORT LINE NUMBER (867) 920-8130

LEAD AGENCY ☐ EC ☐ CCG ☐ GNWT ☐ GN ☐ ILA ☐ INAC ☐ NEB ☐ TC | SIGNIFICANCE ☐ MINOR ☐ MAJOR ☐ UNKNOWN | FILE STATUS ☐ OPEN ☐ CLOSED

AGENCY	CONTACT NAME	CONTACT TIME	REMARKS
LEAD AGENCY			
FIRST SUPPORT AGENCY			
SECOND SUPPORT AGENCY			
THIRD SUPPORT AGENCY			

Appendix C
Sabina Internal Report Form

Sabina
GOLD & SILVER CORP.

SABINA INTERNAL SPILL REPORT FORM

This form is to be used for internal documentation of spills of any petroleum product, chemical, ethylene glycol (antifreeze), or other hazardous material. See recent Spill Contingency Plan for reporting thresholds and structure. Once complete file with the Operations Superintendent.

***Report Date and Time*:**	***Spill Date and Time*:** ☐ Spill occurred ☐ Spill observed
***Spill Location*:** ☐ Goose ☐ Marine Laydown Area ☐ George ☐ Other (e.g. Drill, Boulder Pond)	***Describe Location*:**
***Coordinates (Lat/Long or UTM)*:**	

***Product(s) Spilled*:**	Jet fuel	Diesel (P50)	Gasoline	AvGas	Oil (type)	Antifreeze	Other (describe)
***Quantity (L or kg)*:**							

Personnel Involved:	☐ Sabina	☐ Contractor	☐ Visitor	☐ Other

***Cause of Spill*:**
***Containment/Cleanup Measures Taken*:**
***Factors Affecting Spill or Recovery (weather, snow, ground conditions, etc.)*:**
***Additional Action Required*:**
***Additional Comments*:**

	Name	***Employer***	***Signature***
***Reported by*:**			
***Reported to*:**			

6. Oil Pollution Emergency Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Oil Pollution Emergency Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions)
Chapter 6	Al Sections	Facility Classification	Update text to reflect Level 2 facility
	Preamble	Policy Statement	Updated to reflect Sustainable Development Policy
	3.2	Infrastructure	Updated to reflect FS design changes
	3.3.3	Bathymetry	Commitment to conduct soundings
	3.3.6	Sensitivities	Update to reflect Sensitivity Analysis (Appendix V7-6A)
	7.2.2	National Environmental Emergencies Centre	Updated to reflect replacement of REET with NEEC
	Annexes	Various	Updates to figures and tables

BACK RIVER PROJECT
OIL POLLUTION EMERGENCY PLAN

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Glossary and Abbreviations

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

AANDC	Aboriginal Affairs and Northern Development Canada
ASPPR	Arctic Shipping Pollution Prevention Regulations
AWPPA	Arctic Waters Pollution Prevention Act
AWPPR	Arctic Waters Pollution Prevention Regulations
BIPR	Bathurst Inlet Port and Road
CSA	Canada Shipping Act
CCME	Canadian Council of Ministers of the Environment
DFO	Department of Fisheries and Oceans
EC	Environment Canada
ECC	Emergency Command Centre
ERC	Emergency Response Coordinator
GN-DOE	Government of Nunavut, Department of Environment
KIA	Kitikmeot Inuit Association
MLA	Marine Laydown Area
MSDS	Material Safety Data Sheet
NWT	Northwest Territories
OHF	Oil Handling Facility
OPEP	Oil Pollution Emergency Plan
OPPR	Oil Pollution Prevention Regulations
PPE	Personal Protective Equipment
PHA	Process Hazard Analysis
REET	Regional Environmental Emergencies Team
SOPEP	Shipboard Oil Pollution Emergency Plan
TC	Transport Canada
UTM	Universal Transverse Mercator
WHMIS	Workplace Hazardous Materials Information System

Oil Handling Facility Declaration

Pursuant to paragraph 168(1) (b) of the *Canada Shipping Act, 2001*, Sabina Gold & Silver Corp. declares that:

(a) to comply with the regulations made under paragraph 182(a) of the *Canada Shipping Act, 2001*, on the detection of an oil pollution incident that arises out of the loading or unloading of oil to or from a ship, the measures as outlined in the Back River Project, Marine Laydown Area - Oil Handling Facility, Oil Pollution Emergency Plan shall be implemented.

(b) ~~in accordance with paragraph 168(1)(a) of the *Canada Shipping Act, 2001*, I have an arrangement with the certified response organization known as *~~

~~(Name of response organization)~~

~~The arrangement is with respect to _____ tonnes of oil~~
~~(Number of tonnes)~~

~~and in respect of _____~~
~~(Geographic location of the oil handling facility)~~

*** NOTE: In accordance with paragraph 168(2) of the *Canada Shipping Act, 2001*, the requirements under paragraph 168(1)(a) and 168(1)(b)(ii) do not apply.**

(c) ~~the persons listed below are authorized to implement the arrangement described in paragraph (b):**~~

**** NOTE: In accordance with paragraph 168(2) of the *Canada Shipping Act, 2001*, the requirements under paragraph 168(1)(b)(iii) do not apply in respect to the arrangement described in paragraph (b).**

(d) the persons listed below are authorized to implement the oil pollution emergency plan required by paragraph 168(1)(d) of the *Canada Shipping Act, 2001*:

Date: October 31, 2015

Sabina Gold & Silver Corp. _____ Matthew Pickard, Vice President, Environment & Sustainability

Table 1. Contact Information of Sabina Personnel with Authority to Implement the OPEP

Role	Primary	Alternate
Emergency Response Coordinator		
Phone:	TBA	TBA
Alternate Phone:		
Email:		
Incident Commander		
Phone:	TBA	TBA
Alternate Phone:		
Email:		
Environmental Superintendent		
Phone:	TBA	TBA
Alternate Phone:		
Email:		
Safety Superintendent		
Phone:	TBA	TBA
Alternate Phone:		
Email:		
Environmental Coordinator		
Phone:	TBA	TBA
Alternate Phone:		
Email:		

** Will be completed once a construction decision is made.*

Preamble

This Oil Handling Facility, Oil Pollution Emergency Plan (OPEP) for the Back River Project Marine Laydown Area - Oil Handling Facility shall be in effect at the commencement of operations.

Formal distribution of the Plan shall be made to:

Transport Canada
Box 8550
344 Edmonton Street (RMW)
Winnipeg, Manitoba, R3C 0P6

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Sustainable Development Policy

Sabina Gold & Silver Corp. regards itself as a responsible explorer and mineral developer. We are committed to fostering sustainable development throughout all stages of our activities. We constantly strive to conduct our operations in a manner that balances the social, economic, cultural and environmental needs of the communities in which we operate. To build on this commitment Sabina will:

- Meet or strive to exceed all relevant legislated sustainable development requirements in the regions where we work.
- Ensure appropriate personnel, resources and training is made available to implement our sustainable development objectives.
- Establish clear lines of responsibility and accountability throughout the Company to meet these objectives.
- Implement proven management systems and procedures to facilitate our sustainable development objectives. A priority will be placed on developing and implementing management structures related to the environment, health and safety, emergency response and stakeholder engagement.
- Act as responsible stewards of the environment for both current and future generations. We will make use of appropriate assessment methodologies, technologies and controls to minimize environmental risks throughout all stages of mineral development.
- Work closely with local communities and project stakeholders to understand their needs, address their concerns and provide project-related benefits to create win-win relationships. Our goal is to earn and maintain a social licence to operate at all our operations while building partnerships.
- Pursue economically feasible projects in order to generate shareholder profitability and support long-term positive socio-economic development in the regions where we work.
- Utilize a precautionary approach as it applies to potential effects from our activities. Work with employees, contractors and stakeholders to promote a culture of open and meaningful dialogue to ensure that any known or suspected departures from established protocols are reported to management in a timely manner.
- Regularly review this policy to ensure it is consistent with Sabina's current activities and the most recent legislation.
- Continually improve our performance and contributions to sustainable development including pollution prevention, waste minimization and resource consumption.
- Implement programs at each of our operations to monitor and report compliance and proactively address potential deficiencies in our policies and procedures.

The objectives of our sustainable development policy cannot be accomplished without the active involvement and commitment of many dedicated individuals. As such, we will regularly communicate this policy and its outcomes to our employees, contractors and relevant stakeholders. Together, we can foster a culture of sustainable development at Sabina.

1. Introduction

The Back River Project, Marine Laydown Area, Oil Handling Facility (MLA-OHF), Oil Pollution Emergency Plan (OPEP) was developed to specifically assist in implementing measures to protect the marine environment and minimize impacts from potential spill events. The OPEP outlines potential spill scenarios, and provides specific procedures for responding to spills while minimizing potential health and safety hazards and environmental damage. It provides instructions to guide all personnel in emergency spill response situations, defines the roles and responsibilities of management and responders and outlines the measures taken to prevent spills, the related exercise and evaluation programme, and the mechanism for regular updates to the plan.

It represents one plan in a series of environmental management plans that have been prepared for the Project Final Environmental Impact Statement (FEIS).

The information presented herein is current as of October 2015. At this stage, certain aspects of the OPEP remain conceptual. The next update will likely accompany the Type A Water Licence Application. Following this, the OPEP will be further updated based on detailed engineering design prior to the start of construction, incorporating construction engineering drawings of facilities and associated fuel management infrastructure.

Sabina Gold & Silver Corp. (Sabina) will maintain a distribution list for the OPEP providing contact details for all parties that receive the Plan including key personnel, organizations, and outside agencies.

1.1 LEGISLATIVE REQUIREMENT

The *Canada Shipping Act*, 2001, stipulates that operators of designated oil handling facilities must have an on-site oil pollution emergency plan.

The MLA-OHF, OPEP takes into account the requirements of the *Canada Shipping Act*, 2001, part 8, subsections 168. (1), 168. (2) and 168. (3). Although the subsection 168 (2) is applicable, as the MLA-OHF site is located North of 60', therefore the subsections 168. (1) (a), 168. (1) (b) (ii), and 168. (1) (b) (iii) do not apply.

The *Canada Shipping Act* Response Organizations and Oil Handling Facilities Regulations (SOR/95-405) applies.

The Oil Handling Facilities Standards, TP12402 applies.

Pollutant Discharge Reporting Regulations, 1995 (SOR/95-351).

Vessel Pollution and Dangerous Chemical Regulations, (SOR 2012-69).

1.2 LINKS TO SABINA GOLD & SILVER CORP. SPILL CONTINGENCY PLAN

Spills of all types, both marine and land based are addressed in the Sabina Gold & Silver Corp. (Sabina), Back River Project, (The Project) "Spill Contingency Plan" (SCP) which is a separate document. The SCP addresses a wider scope of operations and includes storage areas other than the MLA-OHF. The SCP also addresses other materials including soluble solids such as ammonium nitrate prill, liquids such as

glycols and paints, corrosive liquids including sulphuric acid and sodium cyanide, compressed (inert and flammable) gas and other hazardous substances.

The MLA-OHF OPEP has been designed specifically to compliment the Back River Project, SCP document. The plan is not to be construed as to supersede existing emergency response plans, rather it is conceived to address the specifics of the fuel storage facility, the bulk incoming transfer of fuel and spill scenarios directly relating to this operation.

2. Planning Standards

In the preparation of the MLA-OHF OPEP, the standards as outlined in the Oil Handling Facility standards, TP 12402 have been employed.

2.1 FACILITY CATEGORY

Based on the expected upper ship to shore pumping rate of up to 450 m^3/hr, the MLA-OHF is classified as a Level 2 facility. Spill scenarios have been developed and are outlined in section 8 of this plan. As a scenario addressing a possible 5 m^3 spill exists, the minimum size of an oil pollution incident for which a response is described in this OPEP is 5 m^3.

2.2 GENERAL PLANNING GUIDELINES

Beyond the requirements of the CSA and the Oil Handling Facilities Standards, Sabina recognizes the unique nature of the geographical location and the challenges inherent in mounting a response to a pollution incident.

All spill contingencies for Bathurst Inlet must take into consideration the diverse elements that might define, simplify or even reduce the possibility of taking action. The harsh climate, the remoteness, transportation difficulties (for personnel and goods), limited availability of manpower in case of oil spills and the lack of infrastructure in case of a fire are all elements that can limit the response to take in this type of situation. Air transportation is the only transportation on a regular basis but weather conditions may not be favourable, rendering a quick response difficult.

In the preparation of this plan, existing documents relating to the site specifications (physical, natural and social conditions) have been utilized. In the preparation of the final plan and related Back River SCP, extensive consultations with local authorities shall be undertaken, with the goal of a cooperative response as an important part of an incident.

To specifically address the CSA and Oil Handling Facilities Standards, spill scenarios have been developed, taking into consideration among various factors the following:

1. The nature of the oil product in respect of which the scenario is developed.
2. The types of ships that are unloaded at the facility.
3. The tides and currents that prevail at the facility.
4. The meteorological conditions that prevail at the facility.
5. The surrounding areas of environmental sensitivities that would likely be affected by an oil spill.

6. The measures that will be implemented to minimize an oil pollution incident.
7. The time within which an effective response to an oil pollution incident can be carried out.

Several priorities have also been identified among which include:

1. The safety of the facility's personnel.
2. The safety of the facility.
3. The safety of the communities living adjacent to the facility.
4. The prevention of fire and explosion.
5. The minimization of the oil pollution incident.
6. The notification and reporting of the oil pollution incident.
7. The environmental impact of the oil pollution incident.
8. The requirements for cleaning up the oil pollution incident.

2.2.1 Response Time Standards

The operations and response structure at the MLA-OHF have been designed so that a rapid response to a spill incident can be carried out. All equipment and resources are strategically placed near the beach front, directly at the port operation site. Responders, workboats and other support equipment are on standby during all facility operations. The deployment of equipment and resources required to contain and control the oil, or where the oil cannot be contained, to control the quantity of oil involved in the incident, up to the minimum spill size of $5m^3$ as determined in accordance with Section 2 of the Oil Handling Facilities Standards, shall be on site and deployed on scene within 1 hour after the discovery of the oil pollution incident, unless deployment would be unsafe.

The equipment and resources required to recover and clean up the oil involved in the incident, up to the minimum spill size of 5 m^3 as determined in accordance with Section 2 of the Oil Handling Facilities Standards shall be deployed on scene as soon as practical and effective, within 6 hours of the oil pollution incident.

2.2.2 On-water Recovery

On-water recovery of spilled product shall be initiated immediately upon containment of free floating product. The skimming capacity projected for the MLA-OHF is capable of recovery of several times the required spill volume within the time standards after derating formula are applied.

2.2.3 Dedicated Facility Spill Response Equipment

The MLA-OHF shall be equipped with appropriate spill response equipment that provides *resident capability* for the response to spills in accordance with the scenarios that have been developed under this OPEP. Containment and recovery equipment inventories exceed the facility category planning standards and are especially appropriate for the potential spill volumes as outlined in the scenarios contained in the OPEP. A list of the equipment can be found in Annex 4.

3. Marine Laydown Area – Oil Handling Facility

3.1 GENERAL OVERVIEW AND SITE DESCRIPTION

The proposed MLA-OHF is situated on the western shore of southern Bathurst Inlet at approximately 66°38.59' N and 107°42.69' W. A site overview plan showing its location is presented in Annex 1.

3.2 OIL HANDLING FACILITY AND INFRASTRUCTURE

Construction activities at the MLA will provide for a new steel construction bulk fuel storage facility consisting of 4 steel tanks of 15 ML. A preliminary site plan of the projected MLA-OHF configuration is provided in Annex 2.

The bulk fuel storage facility located at the MLA shall be constructed in an impermeable secondary containment structure (lined and bermed containment area). The construction is in compliance with CCME's Environmental Code of Practice (CCME 2003; 2008), the fuel bulk fuel storage facility will be designed to have bermed spill containment with capacity equal to the volume of the largest tank plus 10% of the volume of the remaining tanks OR 110 % volume of the largest tank, whichever is greater.

The above basis is consistent with the document entitled "Design Rationale for Fuel Storage and Distribution Facilities" published by the Department of Public Works of the Northwest Territories (refer to Section 4.6 of those guidelines). The lining within the bermed area is an impervious HDPE liner membrane. The design of these facilities will be based on industry standards for installation, jointing, etc., the membrane to ensure its integrity.

The bulk fuel storage facility is connected to a shore receiving manifold by a 6 inch diameter steel pipeline. The pipeline is of welded construction. The pipeline is supported on appropriate stands and blocking. The pipeline is fully pressure tested and inspected each year prior to annual bulk cargo transfer operations.

Lighting is provided at the shore receiving manifold meeting the regulatory requirements of the Vessel Pollution and Dangerous Chemical Regulations, (SOR 2012-69). The bulk fuel storage facility is also equipped with lighting meeting the standards as set forth in the same regulation.

It is anticipated that a single ice-class fuel tanker will be used to deliver fuel to the MLA on an annual basis. Anchors will be used to secure the tanker offshore during off-loading. The MLA will have a Level 2 Oil Handling Facility (OHF) classification and an oil transfer rate of 450 m^3/hr is anticipated.

3.3 BATHURST INLET PHYSICAL ENVIRONMENT AND SENSITIVITIES

3.3.1 Inlet and Approaches

Bathurst Inlet is a deep fjord-type inlet along the northern coast of the Canadian mainland, within the territory of Nunavut. The entrance to the inlet is through Coronation Gulf between Cape Barrow (68°01' N, 110° 06' W) and Cape Flinders (68° 17' N, 108° 35' W), and the body extends over 200 km southwest into the mainland past the Arctic Circle. It has a large network of irregular shores, and is littered with numerous islands, islets and rocks, most of which are described in greater detail by the Canadian Hydrographic Service (1994). Melville Sound extends eastward from northern Bathurst Inlet into Elu Inlet.

The main channel of Bathurst Inlet is relatively narrow (~2 to 15 km) and deep, with depths generally between 100 and 200 m depth, and maximum depths over 300 m in the northern basin near Omingmaktok (Bay Chimo). The most characteristic oceanographic features of the channel are several sills spread along the inlet which result in rapid shoaling of the bathymetry to depths shallower than 50 m. The largest sill is near Manning Point at the centre of Bathurst Inlet, and the shallow bathymetry is accompanied by a narrowing of the channel width to less than 1.5 km between Quadyuk Island and the Tinney Hills. This sill approximately divides Bathurst Inlet in two major basins: the outer inlet that comprises all regions north of Manning Channel and contains the deeper, more complex bathymetry; and the inner inlet that runs landward from near Kingaok and has few islands and relatively simple structure with shallower depths between 100 and 150 m.

3.3.2 MLA-OHF Area

The MLA-OHF is proposed for the western shore of southern Bathurst Inlet. The deeply indented rocky shorelines in the region lead to steep bathymetry with narrow near-shore areas, a consequence of the inlet cutting through the massive granite rocks that characterize the surrounding Bathurst Hills Ecoregion. Hence, the MLA site consists of a long cobble/sand beach with a steep shoreline consisting of limited shallow areas (i.e., < 10 m) and follows a general 120 - 125° WSW heading. The water shelf extends orthogonally from the shore at a steep slope of approximately 20% to depths below 50 m about 240 m offshore. Beyond this distance, the seabed slopes more gently to depths below 150 m in the main inlet channel.

3.3.3 Bathymetric and Marine Data

Limited bathymetric and marine data is available for the Bathurst Inlet site. Charts 7791, 7792 and 7793 cover most of the area; however data within the shallow beach areas is limited. Sabina will conduct additional soundings of the area prior to initiating shipping activities. Risk mitigation will also be achieved by ensuring adequate distance between ship and shore and ensuring safe anchoring by accounting for vessel swing related to water depths. Sabina will align on methodologies for bathymetric surveys of the areas with Canadian Hydrographic Service.

The measured tidal heights for the inlet are small, with a maximum tidal range for spring tides (new and full moon) of around 0.4 m, and between 0.1 and 0.3 m for neap tides (first and third quarter moons).

Bathurst Inlet water circulation during open-water season is influenced by winds rather than by tides, with tidal currents likely significantly weaker than the down-slope density flows originating from freshwater discharge at the inlet surface.

The marine environment at the proposed Bathurst Inlet Bulk Storage Facility is characterized as a sheltered waters environment. As has been noted at the site, the prevailing winds generally provide sea conditions of onshore waves, varying in height from flat calm to less than 0.65 metre in average winds of less than 30 km/hr. Bulk transfer procedures established jointly by the OHF and the charterer preclude the transfer of bulk product when conditions become excessive, i.e., wave heights greater than approximately 0.7 m. This enhances the possibility of deploying pollution gear should an incident occur.

3.3.4 Meteorological Data

The Back River Project Atmospheric Environment Study (Volume 4) baseline data has been used to help in project design, for assessing potential effects on air quality, and for understanding trends in climate change.

The climate in the project area is characterized by extremes and is primarily subject to cold, dry Arctic air masses and American continental air masses from the south.

Long-term meteorological data are collected at Environment Canada – Meteorological Service of Canada (EC-MSC) meteorological stations. The closest currently operating stations are Lupin CS and Kugluktuk A and CS meteorological stations. Climate normal data (arithmetic averages of climate elements over a prescribed 30-year interval) have been used from these EC-MSC stations. The most updated climate normals and extremes currently offered by EC are based on Canadian climate stations with at least 15 years of data between 1982 and 2010.

Project-specific meteorological baseline data collection commenced in August 2004 at the Goose meteorological station that is located within the Goose property. This station continues to be operational. Meteorological data are also available from the Bathurst Inlet Port and Road (BIPR) Project meteorological station, which has been located near the MLA in Bathurst Inlet since 2001.

The climate at the MLA consists of a winter period (October to May) of extremely cold mean monthly temperatures ranging from -33.0ºC to -1.3ºC and a cool spring, summer and fall period (June to September) with mean monthly temperatures ranging from -0.3ºC to 14.5ºC.

Precipitation climate normals in the regional area range from 249.4 to 299.2 mm per year. Project meteorological station precipitation was measured as rainfall during the summer period only (June, July, August, and September), when temperatures were above freezing. During the 2006 to 2011 monitoring period, summer monthly rainfall ranged from 0 mm (September 2006) to 102 mm (August 2008). The summer total rainfall between June and September ranged from 4 mm (2006) to 211 mm (2008).

Wind speed data was collected during the measurement period (2006 to September 2012) specifically at the BIPR meteorological station. For the open shipping season, during the summer season (June to September), winds predominantly came from the north and northwest, 17% and 15% of the time respectively, more than 5 m/s 45% of the time but less than 9 m/s approximately 86% of the time. On average, wind speeds during the summer were slightly slower than winter wind speeds.

3.3.5 Ice Conditions

Historically, consolidated first-year ice covers Bathurst Inlet from October to June. Ice break-up usually occurs in the first few weeks of July, after which open waters prevail until thin new ice forms around mid-October.

Environment Canada data documents the average sea ice freeze-up and break-up dates within the Canadian Arctic for the past 30 years. There has been significant temporal and spatial variation in the timing of break-up and freeze-up in southern Bathurst Inlet, as well as in the amount of ice present year-to-year. Environment Canada data is well documented for the area and includes the areas of Barrow Strait, Franklin Strait, and the area between Queen Maud and Coronation Gulfs. Ice data indicates an open shipping season of more than 60 days in the area of the MLA.

Observational evidence from the last few decades indicates that sea ice in the Arctic has been thinning and retreating earlier than historical reports (Stroeve et al. 2012). Most ice concentration records in the last 8 years have been lower than historical averages. The strongest changes occurred in the summer for the more northern straits, with several ice-free periods recently recorded where ice used to be present year-round. In 2012, Arctic sea ice was at the lowest recorded levels since ice monitoring by satellite began three decades ago (NSIDC 2012).

Ships sailing to Bathurst Inlet from eastern Canada must transit Transport Canada Zone 6, which has the most restricted entry season of any of the sixteen Arctic waters zones, except for the High Arctic. Passage from the western approaches transit zones 11 and 12. Bulk fuel deliveries at the MLA-OHF shall be limited to the period of open water only, and by ships of appropriate ice class for the shipping zones transited.

3.3.6 Sensitivities

As noted in Section 3.3.2 above, the MLA consists of a long cobble/sand beach with a steep shoreline consisting of limited shallow areas (i.e., < 10 m) and follows a general 120 - 125° WSW heading. The water shelf extends orthogonally from the shore at a steep slope of approximately 20% to depths below 50 m about 240 m offshore. Beyond this distance, the seabed slopes more gently to depths below 150 m in the main inlet channel.

The 2013 Bathurst Inlet Marine Diesel Fuel Spill Modeling Report (Rescan, 2013) was completed to predict the fate of potential diesel fuel spills near the MLA in Bathurst Inlet during the open-water season (i.e., ~July to October). The spills were assumed to originate near the MLA. The fuel spill modeling undertaken also addresses the potential for environmental damage from diesel spills resulting from transportation and storage of fuel near the proposed Back River MLA.

In open-water diesel spills, a fraction of the diesel fuel becomes entrained into the upper water column immediately under slicks by direct solution or by entrainment of small oil droplets through current and wave action (Mackay et al. 1980; Kuiper and Van den Brink 1987; ITOPF 2011). Diesel fuel concentrations in this cloud of oil-contaminated water depend on the oil properties and the level of mixing energy (winds/waves). In theory, these concentrations may initially exceed the toxic thresholds of marine species present in the spill area. As the diesel fuel spreads under the influence of water currents, turbulent diffusion and weathering processes, the hydrocarbon concentrations within it are reduced. In time, these diesel fuel concentrations will fall below the threshold levels that cause toxicity to living organisms and ultimately decline to background levels.

The diesel volume scenarios presented in the study were modeled under hundreds of different wind conditions, from which spill probability distribution figures were drawn. Most of the diesel deposits were limited to the southern portion of the modeled inlet, and over two-thirds of the diesel quickly weathered out within the first 10 days of all simulations. In the detailed simulations prepared for the study, the diesel high probability distributions and spread resulting from a 20 kL diesel spill were only recorded directly near the MLA; diesel very rarely spread in the areas outside of the MLA.

Marine birds are one of the more vulnerable and sensitive of marine organisms to all types of oil spills.

However, unlike cruder distillates, diesel spills (particularly small ones ≤ 20,000 L) usually have limited impacts on marine bird wildlife due to the oil's high volatility (NOAA 2013). While diesel is highly toxic when in direct contact with marine birds, the number of birds affected is usually small due to the short residence times on surface waters.

Numerous marine bird species have been documented in southern Bathurst Inlet (Rescan 2012b, 2013b). Ordered from commonly (i.e., over >200 individuals counted) to rarely (i.e., less than 30 individuals) observed, these are: Canadian goose; red-breasted merganser; greater scaup; black, white-winged and surf scoters; herring and glaucous gulls; long-tailed duck; pacific, red-throated and yellow-billed loons; and the common eider. Amongst these populations, the glaucous gull, long-tailed duck and common eider are all listed as sensitive species in Nunavut (CESCC 2010).

Aside from the eider, all of these species have been recorded to forage and/or nest within a few kilometres of the MLA and in multiple areas around southern Bathurst Inlet. The observations occurred mainly in the late summer and fall when a number of birds were present in marine habitats for molting and staging purposes.

The approximate locality of each bird population within the study area has been included in the figures presented in Annex 3 of this OPEP. The birds were grouped up in a few basic taxons to simplify the color scheme: duck (incl. mergansers, scaups, scoters and long-tailed duck), goose, gull and loon.

Any large groups of marine birds that were documented during baseline studies from 2010 to the present during any time of the year were thus mapped (Rescan 2012b, 2013b). Large groups are defined as any observation of a group of more than 10 individuals for any species of duck, loon, or gull, or any observation of a group of more than 25 individuals of a goose species.

In the assessments, the most apparent feature of Figure 5.3-1 contained in Annex 3 is the lack of bird populations located near the MLA, which has by far the highest spill probabilities. Only a medium flock of geese and a brief observation of an unidentified fowl have been recorded within 4 km of the on land MLA infrastructure. Conversely, the highest proportion of bird observations in the inlet is located in the small cove just south the MLA, which is seasonally inhabited by large groups of ducks and geese. Diesel particles appear to reach the cove only in <10% of simulations, and the results of the simulations indicate it would take several hours before a spill would reach the area. It is logical that birds would favour the southern cove relative to the MLA shoreline for nesting grounds, as the cove is relatively sheltered from the main currents driving the circulation in the main Bathurst Inlet channel. The alongshore currents near the MLA will disperse spills northwards.

Two other bird areas could potentially interact with diesel fuel spills: the northern shores directly across the main channel from the MLA, and the shores surrounding the peninsula to the south of the MLA. The former is largely inhabited by duck populations that span over 10 km of the coast. The diesel residual probabilities there still remain relatively low with respect to the MLA coast, some small areas can have probabilities as high as 30%, but on average most of the coast probabilities are <10%. The peninsula to the south, on the other hand, is far enough south to receive little diesel fuel overall, with only a few patches of <5% probabilities present.

The spill modeling report summarizes that the wind conditions, current regime and overall spill volume play a critical role in determining the fate of diesel spills within southern Bathurst Inlet. Regardless of diesel amounts, spills occurring in mild to moderate wind conditions generally did not progress past a few kilometres from the source location. Sabina has conducted a shipping sensitivity analysis (Appendix V7-6A) that commits to adhering to various setback distances for key marine species. With these setbacks in place and the low residual spill probabilities provided, a tactical response plan showing fuel spill dispersion modelling results relative to local sensitivities was not deemed a requirement at this time.

Preventive measures such as strict criteria for acceptable conditions for discharge are outlined in cargo transfer procedures and in Section 9 of this plan. Preventive booming following any spill to protect sensitive areas of significant bird populations will be considered as outlined in the scenarios presented in Section 8 of this plan. The hazing techniques and wildlife protection procedures as outlined in Section 7.4 of this plan are of utmost importance.

4. Site Activities

4.1 BULK OIL TRANSFER, SHIP TO SHORE

Bulk fuel deliveries will take place during the open shipping season and volumes and frequency of deliveries will depend on a number of factors including but not limited to: size of ships, fuel consumption rates, operational constraints, etc. A single bulk fuel transfer from ship to shore annually is anticipated.

It is anticipated that the total annual volume of the bulk fuel transfers shall be 60 ML and will take place between the months of late August through early October. The fuel transfers shall take place by means of either a single or double 4-inch floating hose with an approximate length of approximately 1000 metres deployed between the vessel and the connecting flange on the shore. The products are then transferred through the pipeline to the above mentioned bulk storage facility. A steel pipeline of 6" diameter connects between the shore manifold and the tank farm.

The tides are not a major risk factor at this location. Wind force and direction are the dictating environmental factors during bulk transfer and criteria for acceptable conditions for discharge are outlined in cargo transfer procedures.

The ship to shore transfer operation at Bathurst Inlet is largely similar to other cargo discharge operations in the North and involves bulk transfer by floating hose of two types of fuel (Jet A and Ultra Low Sulphur Diesel – ULSD). It is expected that once cargo operations are underway, the ship will discharge at a rate of up to 450 m^3/hour depending on the number of hoses used and also final obtainable pumping rate.

The tanks shall take varying times to fill, depending on which tank is filled and also the final pumping rates obtained. Accurate reconciliation of discharge & fill volumes through regular communication between ship and shore personnel is required to ensure the safe transfer of fuel and prevent any overfilling that could result in a spill.

The bulk transfer procedures are fully detailed in the standard operating procedure in Annex 5.

4.2 OTHER MLA-OHF OPERATIONS

Other than the planned bulk fuel and transfers, no other port operations involving fuel are anticipated at the MLA-OHF under normal operations.

Dry cargo sealift operations are anticipated to occur at the MLA, however these will be separate from the operations of the bulk fuel storage facility and are not considered in this Oil Pollution Emergency Plan.

5. General Response to Marine Spill Emergencies

In order to effectively manage emergency response, Sabina has implemented a detailed emergency response structure that is applicable to all emergencies.

5.1 LEVELS OF EMERGENCY

Escalating levels of emergency are described in the Sabina SCP, which is a separate document. The SCP addresses a wider scope of operations and includes storage areas other than the MLA-OHF. The management of emergencies throughout the project requires varying degrees of response, effort and support. The impact on normal business operations will also differ as will the requirements for investigation and reporting.

Irrespective of reporting thresholds or usual escalating response levels to varying spill volumes dictated elsewhere in Sabina plans, all marine spills at the Bulk Fuel Storage Facility regardless of volumes shall be managed at the highest level of response as outlined in the Sabina emergency response system. The usual regulatory reporting requirements are to be strictly adhered to as outlined in Section 7 of this plan.

5.2 RESPONSE MANAGEMENT STRUCTURE

All spill procedures and response functions are to be implemented through the Emergency Response Management Team.

Table 5.2-1 presents the management team responsible for overseeing emergency spill response operations and their contact information.

Table 5.2-1. Sabina Gold & Silver Corp. Emergency Management Team Contacts

Role	Primary	Alternate
Emergency Response Coordinator		
Phone:	TBA	TBA
Alternate Phone:		
Email:		
Incident Commander		
Phone:	TBA	TBA
Alternate Phone:		
Email:		
Environmental Superintendent		
Phone:	TBA	TBA
Alternate Phone:		
Email:		
Safety Superintendent		
Phone:	TBA	TBA
Alternate Phone:		
Email:		
Environmental Coordinator		
Phone:	TBA	TBA
Alternate Phone:		
Email:		

Note: The Table will be completed once a construction decision is made.

Once a spill event is reported, the Incident Commander establishes a specific strategy for containing and controlling the spill and to initiate the clean-up activities. Other site personnel may act as technical advisers before and during the intervention. The trained Emergency Response Team will conduct all emergency spill response operations under the direction of the Incident Commander. During the clean-up phase of the intervention other site personnel (e.g., heavy equipment operators, labourers) could be involved in the intervention.

The Emergency Response Organizational Chart is provided as Figure 5.2-1.

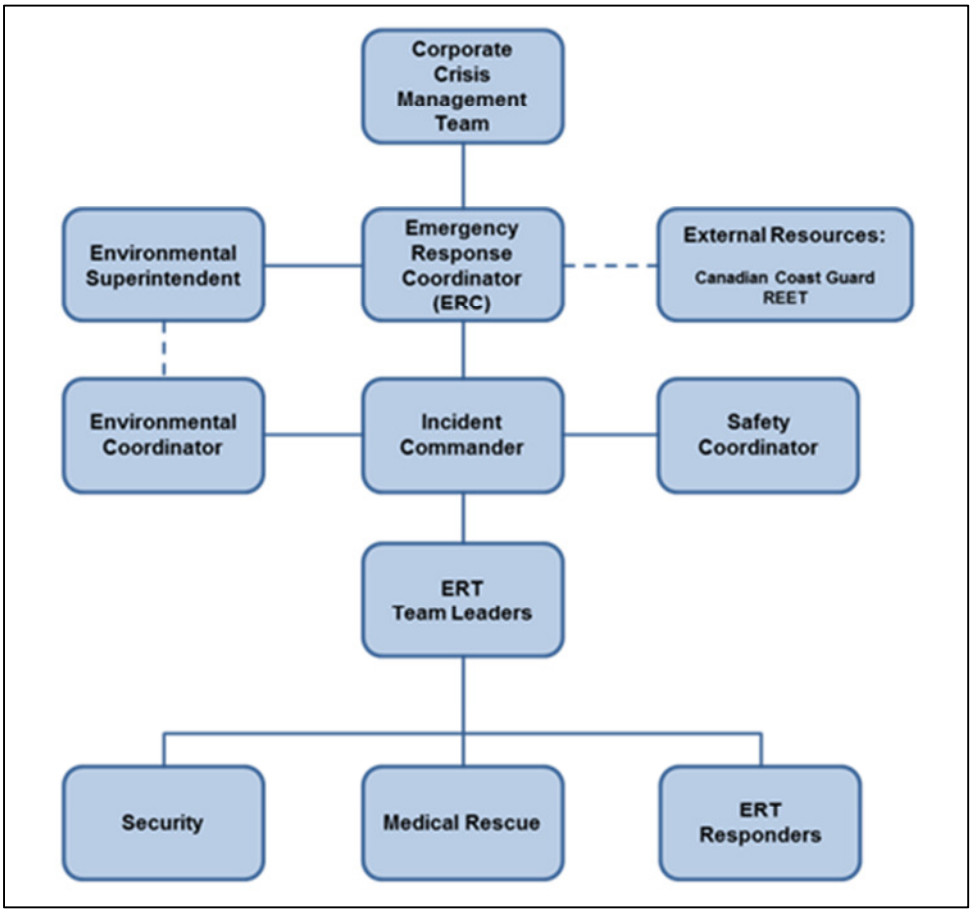

Figure 5.2-1. Marine Spill Response Organizational Chart

5.3 EMERGENCY RESPONSE TEAM

The Emergency Response Team will be structured from a worker volunteer base at site. With different work schedules, it will be necessary to have enough team members to maintain sufficient numbers of responders at site at all times.

5.4 EQUIPMENT AND PERSONAL PROTECTION

In order to provide adequate response in case of spill events, Sabina maintains the appropriate type and quantity of response equipment and materials onsite.

Spill kits are strategically placed primarily in areas of fuel handling to facilitate immediate first response in the event of a hydrocarbon release to land. A complete list of spill response equipment is found in Annex 4 of this plan.

In addition to the spill response material, a variety of mobile heavy equipment including excavators, front-end loaders, bulldozers, haul trucks, small workboat for in land water use, and marine support boat are available to aid in spill response and recovery efforts.

5.5 COMMUNICATION

Effective communication systems are critical to the success of emergency responses. Personnel involved, from first person on scene to the ER Coordinator rely on the ability to quickly relay accurate information.

Communications available at the project site during an emergency are listed below.

- Hand-held radios.
- Telephone.
- Satellite Phone.
- Internet.

5.5.1 Hand-held Radio Communication

During an emergency, the primary communications link between all emergency response personnel is through radio communication. Additionally, other individuals involved in emergency response will also carry hand-held radios as part of their regular work requirement.

During an emergency, radio communications should be kept to a minimum. If radio silence is requested, security personnel, upon receiving instruction by the ER Coordinator or Incident Commander, will announce this. This ensures open and free communications among personnel involved in the actual response.

5.5.2 Telephone Communication

During an emergency, telephone communications will be used to:

- Notify internal personnel and resources.
- Notify external personnel and resources.

To supplement radio communications, the site telephone system may be used to alert site personnel during an emergency response.

Communications links with Corporate Sabina office may also be required during some emergency situations. Constant communications links will be established by telephone where offsite assistance is required (from Sabina, or external resources such as medical practitioners or SAR/Coast Guards).

5.6 COMMUNICATION WITH THE PUBLIC

Only authorized Sabina Senior Management shall provide external communication to the public during emergencies.

Local residents, community leaders, other stakeholders, and non-governmental agencies will be contacted as appropriate. The designated officer(s) will coordinate dissemination of information to the media whenever necessary.

6. Roles and Responsibilities

The initial stage of any emergency is critical. An effective and timely response is essential to prevent an emergency situation from escalating to a higher level. Therefore, all personnel must be fully aware of their individual duties and responsibilities as they are presented in this plan.

Specific responsibilities and duties of the personnel involved in emergency response are outlined below.

6.1 EMERGENCY RESPONSE COORDINATOR – (ERC)

For the purpose of this response plan, the ERC will be the General Manager or his designate if absent. ERC duties during an emergency are detailed as follows:

- The Emergency Response Coordinator (ERC) will ensure coordination of ERT support systems.
- Upon being notified of an emergency, the ERC will initiate response activities and assess the situation based on current information from the Incident Commander.
- Activate the emergency response process and escalate according to the severity of incident.
- The ERC will coordinate all activities. In the event the ERC leaves his post, the ERC will designate an individual to coordinate in his absence.
- Ensure that the appropriate area manager/s has been notified.
- Provide internal notification as applicable based on the level of emergency.
- Provide instruction to ensure that appropriate external resources are notified.
- Receive information from the Incident Commander and ensure appropriate resources are made available.
- Provide support for the acquirement of additional supplies and resources as requested by the Incident Commander.
- Contact departmental resources via radio as required during the emergency response.
- Provide internal notification of the “all clear.”
- Ensure the coordination and establishment of an emergency debriefing session.
- Review incident log and post response incident report.
- Post incident debrief with Incident Commander.
- Provide necessary information to Public Relations for a media statement release if required.
- Complete a report on the events surrounding the incident.
- Coordinate collection of all incident notes, reports, statements and log of events.
- End the event in ER System.

6.2 ENVIRONMENT SUPERINTENDENT

The duties of the Environment Superintendent during an emergency are detailed as follows:

- Contact the ER Coordinator and muster accordingly.
- At the order of the ER Coordinator, notify the required external regulatory agencies.
- Document all actions and decisions.
- Assist the Incident Commander in evaluating the initial situation and assessing the magnitude of the spill.
- Assist in developing an overall plan of action.
- Collect photographic records of the spill event and clean-up efforts.
- Prepare a root cause analysis and an incident investigation for major spills.
- Report to the ER Coordinator and provide recommendations on resource requirements (additional manpower, equipment, material) to complete the clean-up effort.
- Provide liaison with management to keep them informed of clean-up activities.
- Obtain additional required resources not available onsite for spill response and clean-up.
- Act as the spokesperson with government agencies as appropriate.
- Document the cause of the spill and effectiveness of the clean-up effort, and recommend the appropriate measures to prevent a recurrence of the spill.
- Prepare and submit follow-up documentation required by appropriate regulators.
- Ensure that the spill is cleaned up and follow-up communication and reports are filed with the AANDC and Land Administrator. Ensure that the spill reports submitted to Land Administrator include photographic records and an updated map showing Universal Transverse Mercator (UTM) coordinates, date, and amount and nature of the spill.
- Participate in post-emergency debriefing.
- Assist in the accident/incident investigation process.
- Complete Government Agencies notification process.
- Ensure that all involved departments complete reporting process.

For marine spills at the OHF, the Sabina Environment Superintendent will be accessible to the Canadian Coast Guard during the entire incident.

6.3 INCIDENT COMMANDER

The Incident Commander is the site lead administrator for the ERT, responsible for ensuring the necessary emergency response equipment and adequate level of training for ERT members. The Incident Commander directs the ERT at the scene as ERT Leader. In the absence of the Incident Commander, a senior team member will be designated in his place. The following duties during an emergency are performed by the Incident Commander:

- Muster accordingly and brief team members.
- Report to the scene of the emergency.
- Take charge of the scene.

- Evaluate the details of the emergency as presented by those on scene. Assess the immediate situation, confirm the level of emergency and notify the ERC.
- Maintain contact with the ERC and provide support in coordination of the response.
- Direct ERT members in their respective tasks as required
- Contact departmental resources via radio as required during the emergency response.
- Request internal/external resources as required.
- Advise ERT on aspects of internal/external support as they are received.
- Develop a written log of events indicating instructions given, action taken and outcomes achieved.
- Announce the 'all clear' to the ERC when the emergency has ended.
- Lead the emergency debriefing session.
- Ensure that all ERT equipment is returned to original order and/or replaced to ensure future rapid response.
- Provide assistance with ongoing investigation.
- Prepare a written report on response activities.

6.4 ENVIRONMENTAL COORDINATOR

The Environmental Coordinator shall liaise with Incident Commander to advise on direction of environmental response efforts once the scene has been assessed by the Incident Commander and any medical and/or fire emergencies are under control.

The Environmental Coordinator will:

- Immediately proceed to the scene of the incident.
- Make recommendations for response methods and resources based on area sensitivities and incident severity through the Incident Commander as necessary.
- Make recommendations for additional resources through the Incident Commander as necessary.
- Participate in post-emergency debriefing.
- Maintain a log of events, actions, and outcomes.

6.5 SAFETY COORDINATOR

The duties of the Safety Coordinator during an emergency are detailed as follows:

- Contact the ERC.
- Respond to the scene and make direct contact with the Incident Commander.
- Establish perimeters around the area of the emergency and direct appropriate resource personnel responsible for traffic flow.
- Assist with identifying and assessment of potential hazards of the ERT response and notify the Incident Commander.
- Ensure appropriate personal protective equipment for involved ERT and non-ERT personnel.

- Note pertinent information that may be relative to the investigation.
- Secure the area in coordination with site security.
- Participate in post-emergency debriefing.
- Assist in the accident/incident investigation and complete report.

6.6 EMERGENCY MEDICAL PERSONNEL

Duties during an emergency are as follows:

- Respond when required as directed by the Incident Commander.
- Responsible for all decisions of medical-related situations on-site.
- Responsible for assessing, administering and delegating emergency medical care.
- Advise the Incident Commander of the number and condition of any ill/injured personnel.
- Advise the ER Coordinator of off-site resources required.
- Maintain a log of events, actions and outcomes.
- Participate in an emergency debriefing session.

6.7 EMERGENCY RESPONSE TEAM

All Emergency Response Team members shall receive training to ensure that they have the required skills to provide an appropriate, safe and adequate response minimizing the impact of a spill on the environment.

6.8 SECURITY

Security personnel, or their designates, are key in an emergency response in that they will receive an initial notification of an emergency and provide first communications to essential personnel and secure the area.

Duties during an emergency are as follows:

- Security will report muster and evacuation status to the Incident Commander and await further instruction.
- Provide traffic and personnel control at scene as directed by the Incident Commander.
- Assist in controlling access to the emergency area.
- Maintain open radio communication (via radio or telephone intercom system).
- Keep a written record of events throughout incident.
- Relay notification of ‘all clear” order when directed by Incident Commander.
- Maintain Security of the scene as directed by the ER Coordinator or Incident Commander.
- Direct all off-site inquiries regarding the emergency to the ER Coordinator or designate.
- Participate in a debriefing session for the emergency response.

7. General Spill Procedures

The response to spills begins immediately when the spill has been detected. In all cases immediately upon detection of a spill, all transfer operations are to be shut down and not restarted in any manner that would interfere with the immediate, effective and sustained response to the oil pollution incident.

This plan clearly outlines the notification procedure and the roles and responsibilities of the management and spill response team. All emergency telephone numbers are clearly listed and the persons are contacted as needed and according to the priority of the incident. The contact list is included in Table-5.2-1.

The response team, following a spill, must ensure that personnel safety is their first priority. First and foremost evaluate the risks as quickly as possible to guarantee that appropriate measures are taken to prevent or reduce the risk of injury to personnel, to avoid fire or explosion, to protect property and to minimize the damage to the environment. It is important to contain the spill or to start cleaning up as quickly as possible to stop the spill from contaminating a greater area.

Full details of the properties and hazards associated with potential spills of all products are found on the Material Safety Data Sheets (MSDS) in Annex 8 of this plan.

When responding to spills, all procedures and safety methods in handling the products must be observed. The following specific measures must be followed with spills on water or on land:

Take personal protective safety measures. Personal protective equipment must be worn at all times during response operations.

Close all electrical sources.

Take all appropriate measures to ensure personnel safety and the safety of the facility.

Request help to control personnel access, vehicles and close the area. Never enter inside and/or within the radius of the contaminated area. Have a fire extinguisher close by. If a fire starts extinguish the fire only if it is safe for you and that you were trained to do so without exposing yourself to unnecessary risks.

Through the spill training initiative, all spill response personnel will be fully briefed on the procedures to be followed to report a spill and initiate spill response. The first person to notice a spill will take the following steps:

1. Immediately warn other personnel working near the spill area.
2. Evacuate the area if the health and safety of personnel is threatened.
3. Notify an appropriate supervisor, who will initiate the spill response operations.
4. In the absence of danger and before the spill response team arrives at the scene, take any safe and reasonable measure to stop, contain and identify the nature of the spill.

All spill response actions carried out by the spill response team will follow these general procedures:

- **Cease Transfer Operations -** In all cases immediately upon detection of a spill, all transfer operations are to be shut down and not restarted in any manner that would interfere with the immediate, effective and sustained response to the oil pollution incident.
- **Source Control** - Reduce or stop the flow of product without endangering anyone. This may involve very simple actions such as closing shore valves, sealing a puncture hole with almost anything handy (e.g., a rag, a piece of wood, tape, etc.), raising a leaky or discharging hose at a level higher than the product level inside the tank.
- **Control of Free Product** - Prevent or limit the spread of the spilled material. Accumulate/concentrate spilled product in an area to facilitate recovery. Barriers positioned down-gradient of the spill will slow or stop the progression of the spill. Barriers can consist of absorbent booms, dykes, berms, or trenches (dug in the ground). Deployment of floating booms to contain a marine spill should be carried out by the spill response team as soon as safe and practical.
- **Protection** - Evaluate the potential dangers of the spill in order to protect sensitive ecosystems and natural resources. Block or divert the spilled material away from sensitive areas where possible.
- **Clean up the Spill** – Recover and containerize as much free product as possible. Recover contaminated soil, and water. Pressure-wash contaminated bedrock surfaces, shorelines, ice and recover as much as possible oily water for containerization and/or treatment.
- **Report the Spill** - Provide basic information such as date and time of the spill, type and amount of product discharged, location and approximate size of the spill, actions already taken to stop and contain the spill, meteorological conditions and any perceived threat to human health or the environment. Reporting requirements are presented in Section 7.3 of this plan.

7.1 HEALTH AND SAFETY

Sabina and its senior management are committed to ensuring the health, safety and welfare of its employees, contractors and visitors. As a consequence of this, Sabina requires all personnel to regard accident prevention and working safely as a collective individual responsibility.

Sabina conducts all site activities in accordance with all applicable Federal and Territorial health and safety regulations. The following applicable health and safety regulations apply to the activities described in this Oil Pollution Emergency Plan:

- *Northwest Territories, Nunavut Worker's Compensation Act* - Provides the territorial legislation covering the health and safety of workers in Nunavut.
- *Mine Health and Safety Act and Regulations (Nunavut)* - Provides specific health and safety guidelines for mines operating in Nunavut: Section 2(1) Duties and Responsibilities (the Owner).
- *Canada Labour Code Part II* – Provides federal regulations for the health and safety of workers involved in shipping and marine port operations.

Sabina requires and provides WHMIS training for all employees and contractors throughout the Back River Project: *Mine Health and Safety Act* and Regulations, Part VI Regs. Training 6.03.

It is also a requirement for supervisory personnel to hold level 1 or level 2 certification as required by the *Mine Health and Safety Act*: *Mine Health and Safety Act* and Regulations, Part V Regs. Supervision.

Comprehensive general training is provided to spill responders throughout the project in relation to inland spills. In addition, specific training with relation to safety during response to marine spills is provided to all responders through Sabina's marine spill training program. All responders who are involved in marine operations shall participate in the training as outlined in section 9 of this Oil Pollution Emergency Plan.

7.1.1 Personal Protective Equipment – Requirements

For all responders, personal protective equipment requirements (PPE) shall be as follows:

- MLA Site Services (non-water operations, no contact with spilled product):
  - Hard hat.
  - CSA-approved work boots.
  - Safety glasses.
  - Leather work gloves.
  - Orange/yellow retro reflective vests.
- MLA Site Services (non-water operations, possible contact with spilled product):
  - Hard hat.
  - CSA-approved work boots.
  - Safety glasses.
  - Orange/yellow retro reflective vests or rain wear.
  - PVC rain suit.
  - Nitrile work gloves.
- Workboat and shoreline responders (beach or on-water operations, possible contact with spilled product):
  - Safety vest
  - Hard hat.
  - CSA-approved work boots.
  - Safety glasses.
  - PVC rain suit.
  - Nitrile work gloves.
  - Approved personal flotation device.

7.2 COORDINATION WITH CANADIAN COAST GUARD AND OTHER GOVERNMENTAL AGENCIES

7.2.1 Canadian Coast Guard

The response to spills at the MLA-OHF shall be managed in coordination with the Canadian Coast Guard whom are the lead response agency north of 60°.

The *Central & Arctic Regional Response Plan (2008)* and the *Kitikmeot Region, Nunavut Area Plan* outline the Canadian Coast Guard's response capability for the region. This plan is a component of the *Canadian Coast Guard National Response Plan, which* is the responsibility of the Director of Safety and Environmental Response Systems, Ottawa. It establishes the framework and the procedures, by which Central & Arctic Region will prepare for, assess, respond to and document actions taken in response to

pollution incidents in this Region. This capability and the information contained in the Coast Guard plans are considered a valuable resource in the planning and response to spills at the MLA-OHF.

In 2007, the CCG undertook an evaluation of risk and requirements for additional Arctic pollution response equipment, in consultation with key partners and clients, purchased and placed Arctic Response Packs in 19 communities throughout the Arctic. These Arctic Response Packs provide communities with on-site equipment to use in the event of a small scale pollution incident in their waters. Arctic Response Packs are located in Cambridge Bay, Kugluktuk and Gjoa Haven. Each of the new Arctic Community Packs contains surface booms and accessories, shoreline cleanup kits, small vessels and outboard motors and trailers, and in select communities, beach flushing kits.

Along with the deployment of the Arctic Response Packs, the Canadian Coast Guard was to provide training where the Arctic Community Packs are located (Transport Canada 2014). Community residents can therefore play a role in helping the lead response agency, the Canadian Coast Guard, should a marine spill occur.

7.2.2 Environment Canada – National Environmental Emergencies Centre

The Canadian Coast Guard (lead agency) with primary jurisdiction for the spill oversees and monitors response and recovery efforts by the responsible party and further, may request that Environment Canada provide scientific and technical advice to inform response actions that will reduce the environmental impact of the spill. Additionally, Environment Canada has legislative responsibility to address pollution incidents that impact federally managed resources such as fish and wildlife under the Fisheries Act and the Migratory Birds Convention Act, as well as hazardous substances regulated by the Environmental Emergency Regulations. Environment Canada may issue directions under its legislative mandate if the environment is not being adequately protected and, when warranted take over the lead agency role.

In the event of a polluting incident that requires Environment Canada’s involvement, the National Environmental Emergencies Centre (NEEC) is Environment Canada’s focal point for the provision of scientific advice, such as weather forecast, contaminant dispersion and trajectory modeling, fate and behaviour of hazardous substances, the establishment of clean-up priorities and techniques, as well as the protection of sensitive ecosystems and wildlife such as migratory birds and fish. Environment Canada's Emergency officers have Hazardous Materials (HAZMAT) expertise that enables response in the event of spills involving hazardous materials.

7.2.3 Other Governmental Agencies

At all times, the response to spill incidents shall be coordinated with the various agencies as listed in Figure 5.2-1.

7.3 REPORTING REQUIREMENTS

Three individual reporting requirements are applicable in the case of all marine spills. Procedures for each are outlined herewith:

7.3.1 Canadian Coast Guard Reporting Requirements

All spills of a marine nature will be reported to the Canadian Coast Guard (Central and Arctic region) 1-800-265-0237 (24-hour). The fax number for transmission of the written report is (519) 337-2498.

Reporting of marine spills shall be in accordance with Transport Canada Guideline TP-9834E, “Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and /or Marine

Pollutants." Detailed harmful substances report requirements are outlined in Appendix A-2 of the guideline, a copy of which is included in Annex 9 of this plan.

7.3.2 Reporting to Transport Canada

The Vessel Pollution and Dangerous Chemical Regulations, (SOR 2012-69) require that any spills be reported to the nearest office of Transport Canada as follows:

Jaideep Johar
Manager, Technical services
Transport Canada, Marine Safety
Prairie and Northern Region
Tel: (204) 984-8618
Cell: (204) 880-0754
Email:joharj@tc.gc.ca

Craig D. Miller
Manager, Marine Safety (PNR)
Transport Canada
PO Box 8550, 344 Edmonton Street, Winnipeg, MB, R3C 0P6
Email: craig.miller@tc.gc.ca
Tel: (204) 984-0397
Fax: (204) 984-8417

Reporting of marine spills shall be in accordance with Transport Canada Guideline TP-9834E, "Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants." Detailed harmful substances report requirements are outlined in Appendix A-2 of the guideline, a copy of which is included in Annex 9 of this plan.

7.3.3 Government of Nunavut Reporting Requirements

Quantities of hazardous substances spilled that require reporting are listed in Schedule B of the Nunavut Spill Contingency and Reporting Regulation.

After the initial field emergency response to the spill event, spills are reported to the 24-hour Spill Report Line:

24-Hour Spill Report Line
spills@gov.nt.ca
Tel: (867) 920-8130
Fax: (867) 873 6924

Failure to report a spill can lead to fines. The Kitikmeot Inuit Association (KIA) Lands Administrator will also be promptly notified at (867) 983-2458 or via e-mail. Similarly, the AANDC Water Resources Officer will be promptly notified of the spill event at (867) 982-4308 or via e-mail.

It is the responsibility of the Environmental Supervisor on behalf of the Operations Manager to prepare the proper reports and transmit them to regulatory authorities.

The spill event is reported in writing using the standard NWT-NU Spill Report Form.

In the event of a spill involving the marine carrier delivering bulk fuel, Sabina will ensure that the subcontractor reports any spill event under its responsibility.

7.4 WILDLIFE PROTECTION PROCEDURES

In response to a spill event, techniques used to prevent wildlife from becoming oiled or contaminated, by preventing animals from entering the contaminated area, will consist of hazing and other deterrents. This will be accomplished using a combination of both audible and visual devices, including but not limited to:

- Pyrotechnics, i.e., shell crackers, screamers, propane cannons for shore based spills.
- Visual scare tactics, i.e., helicopters, emergency response vessels or other water vessels.
- Broadcast sounds, i.e., Breco Bird Scarer designed to float with an oil spill.
- Exclusion, i.e., netting applied in smaller contaminated areas

These techniques need to be set in place immediately after a spill occurrence so as to minimize environmental impact.

The size of the spill and location in relation to sensitive wildlife areas must be assessed at the time of the event as to correctly apply the appropriate level of deterrence. Only workers trained in the safe and proper use of certain hazing equipment will be permitted to haze wildlife. Personal Protective Equipment will be worn by all personnel using equipment, as per manufactures instructions, and that the minimum will include the use of eye and ear protection. Other workers in the vicinity of such devices should also use ear protection or remain a safe distance away. Hazing through the use of pyrotechnics should not be used too close to dry vegetation or flammable spill materials due to fire hazard.

Hazing should be equal and continuous in all contaminated areas to prevent wildlife from being hazed into an area where they may be in danger. It is also important to ensure that hazing efforts do not cause already contaminated animals to scatter and techniques are applied as soon as possible to prevent wildlife from contacting spills off the surface of waters (if applicable).

All emergency response vessels shall be equipped with deterrent devices to ensure timely response in case of a spill occurrence off-shore. To prevent habituation, variation of hazing techniques will be used such as changing the location, appearance and types of hazing or using a combination of hazing techniques.

Efforts shall be made to collect alive or dead oiled wildlife. In the event of a spill occurring in or around a water body, shorelines and beaches shall be inspected for contaminated wildlife to be collected. Emergency Response vessels shall be equipped with dip-nets, large plastic collecting bags for dead wildlife, and cardboard boxes or cloth bags for live oiled wildlife. To ensure alive oiled wildlife be dealt with humanely, capture and handling of wildlife shall only be done by trained and permitted individuals. Gloves shall be worn when handling contaminated wildlife (leather gloves for raptors and mammals, latex/rubber gloves for ducks and small shorebirds). Wildlife will be kept individually within cloth bags or ventilated cardboard boxes and label the date and time animal was found, name of finder, location and name of species, if known. Wildlife treatment facilities will then be contacted for advisement on treatment. All contaminated wildlife will be held in a warm quiet place until treatment. The Canadian Wildlife Services (CWS) will be consulted to determine the most humane treatment strategy to be implemented for live oiled wildlife, whether rehabilitation or euthanization.

For wildlife mortalities each carcass shall be bagged and labeled individually. The date and time animal was found, name of finder, location and name of species, if known shall be documented. CWS shall be consulted and approval obtained prior to disposing of any dead wildlife. Contact information for experts in bird hazing and bird exclusion, oiled bird rehabilitation, and, permits needed to haze, salvage, hold and clean, or euthanize birds, are shown in Table 7.4-1.

Table 7.4-1. Emergency Contacts in Case of Spills Affecting Wildlife

Name	Location	Phone Number	Purpose
Canadian Wildlife Services (CWS)	TBA	TBA	Knowing and providing information on the migratory bird resource and species at risk (under CWS jurisdiction) in the area of a spill (this includes damage assessment and restoration planning after the event) Minimizing the damage to birds by deterring unoiled birds from becoming oiled Ensuring the humane treatment of captured migratory birds and species at risk by determining the appropriate response and treatment strategies that may include euthanization or cleaning and rehabilitation.
Cobequid Wildlife Rehabilitation Centre	Brookfield, NS	1-902-893-0253	Provide veterinary care and rehabilitation for wildlife
Nunavut Emergency Management	PO Box 1000, Station 700 Iqaluit, NU X0A 0H0	1-800-693-1666	Nunavut Emergency Management is responsible for developing the territorial emergency response plans, coordinating general emergency operations at the territorial and regional levels, and supporting community emergency response operations.
International Bird Rescue	International	1-888-447-7143	Wildlife rehabilitation specialists, can manage all aspects of wildlife response

7.5 TREATMENT AND DISPOSAL

Plastic sacks, steel drums, or other appropriate containers as approved by the Environmental Supervisor are used to contain and transport contaminated soil for treatment. Depending on the nature of the spilled contaminant, the soil may be treated for remediation on site, or shipped to a licensed facility for treatment and disposal. Contaminated soil resulting from the spill of hazardous chemicals will be treated as a hazardous waste and shipped to a licensed facility for treatment and disposal. Temporary storage of contaminated materials is within lined berms.

8. Spill Scenarios and Response Strategies

Sabina is committed to planning for spills at the MLA-OHF using an analysis of possible spill scenarios. The potential incident analysis is based on real projected operations, and potential quantities spilled are based on pumping rates and estimated times to halt pumping operations.

In the development of the scenarios the following constant factors have been applied:

- The type of ship that is employed for the bulk fuel delivery is a conventional double hulled, multi-compartment petroleum tanker, between 120 to 135 metres in length. The tanker is anchored at a safe distance from the MLA-OHF beach head and approximately 1,000 metres of floating hose is deployed between ship and shore.

- As outlined in Section 3.2 of this plan, two products are received at the facility. Both products, JET A1 and Ultra Low Sulphur Diesel (ULSD) are classified as non-persistent combustible hydrocarbons and will behave in a similar fashion if spilled. The response to a spill of either of these products shall be carried out in the same fashion. Full details of the properties and hazards associated with these products are found on the Material Safety Data Sheets (MSDS) in Annex 8 at the end of this plan.
- Both products are of relative low viscosity, are clear to yellow in color and will float readily when spilled. It should be anticipated that any spillage will rapidly spread when spilled and a high rate of evaporation will occur. Wind will be the most important factor in promoting the spread of the product on the water surface.
- Where environmental sensitivities are mentioned in the scenarios, these relate to the area sensitivities as outlined in Annex 3 of this plan.
- Local topography plays an important part in wind direction and force, but it is generally noted at the MLA that the most common wind direction is from the north and northwest, 17% and 15% of the time respectively, more than 5 m/s 45% of the time but less than 9 m/s approximately 86% of the time. On average, wind speeds during the summer were slightly slower than winter wind speeds.
- As is indicated in the plan, upon discovery of spillage, any manner of pumping operations are ceased.

General response time limits should be observed for each action as follows:

- Deployment of containment boom: 0-1 hours following the spillage event; and
- Deployment of skimming equipment: 0-6 hours following the spillage event.

During ship to shore discharge of the product, the floating hose is inspected on a regular basis by boat. Stoppers and absorbents are available in case they are needed. The ship has a Shipboard Oil Pollution Emergency Plan (SOPEP), appropriate response gear on board and the crew is fully trained in its use.

There is a person on watch at the shore manifold at all times during discharge and in direct radio communication with the vessel. Furthermore, there is a pressure alarm installed on the pipeline during discharge to validate the system. Any leak or malfunction and resulting drop in line pressure would trigger the alarm. In addition, a visual gauge is installed at the manifold and the manifold watchman will perform regular pressure monitoring. The pipeline will be inspected visually and regularly by walking alongside of it. All discharge hoses are hydrostatically tested annually, clearly marked and identified and certificates are submitted to the OHF prior to discharge.

All spills within the bulk fuel storage facility zone would be retained within the bermed area. During the filling of the tanks (unloading of the vessel) continuous monitoring takes place. At all times there is a person on watch during discharge and in contact with the vessel.

In the presentation of the spill scenarios in this section, it is implied that the initial spill response actions outlined in section 7 above have first and foremost been addressed. The scenarios are designed moreover for the purpose of identifying the appropriate specific actions and therefore the related resources required for a given incident.

Detailed spill response scenarios related to ship to shore fuel transfer, and the appropriate actions and resources required, are outlined in Table 8-1.

Table 8-1. Ship to Shore Fuel Spill Response Scenario Actions and Resources Required

Source of Discharge	Potential Loss	Appropriate Actions	Resources Required
Coupling or hose break / malfunction at the ship's manifold	20 – 1,200 litres	1. Deploy containment boom as required to control migration of spill. Consideration of protection booming of beach front, or sensitive areas as defined in Annex 3 of the OPEP depending on wind direction, tides and marine conditions present. Typical deployment lengths of 50 metres are anticipated for this task. (Multiple lengths should be used when required). 2. Deploy skimmer and recover spill. 3. Final recovery of spill using sorbents if necessary. 4. Monitor any free floating oil that is unable to be contained. 5. Notifications of local authorities.	Boat – Sabina near shore workboat - 3 responders Boom – 100 metres and accessories, additional booms if necessary to provide shoreline protection Shore crew to deploy from container – 3 responders
Coupling leaking or hose rupture along length of hose between ship and shore manifold	20 – 5,000 litres	1. Deploy containment boom to control migration of spill. Consideration of protection booming of beach front, or sensitive areas as defined in Annex 3 of the OPEP depending on wind direction, tides and marine conditions present. Typical deployment lengths of 50 metres are anticipated for this task. (Multiple lengths should be used when required). 2. Deploy skimmer and recover spill. 3. Final recovery of spill using sorbents if necessary. 4. Monitor any free floating oil that is unable to be contained. 5. Notifications of local authorities.	Boat – Sabina near shore workboat - 3 responders Boom – 100 metres and accessories, additional booms if necessary to provide shoreline protection Shore crew to deploy from container – 3 responders
Leak at shore manifold connection	20 - 1,200 litres	1. Deploy containment boom to control migration of spill. Typical deployment lengths of 50 metres are anticipated for this task. (Multiple lengths should be used when required). 2. Deploy skimmer and recover spill. 3. Final recovery of spill using sorbents if necessary. 4. Monitor any free floating oil that is unable to be contained 5. 5: Notifications of local authorities.	Same marine response, shore based response deploy berms and sorbents 3 additional shore responders MLA site services

(continued)

Table 8-1. Ship to Shore Fuel Spill Response Scenario Actions and Resources Required (completed)

Source of Discharge	Potential Loss	Appropriate Actions	Resources Required
Failure of flange or coupling Vehicle Accident involving pipeline or shore based hose length	20-5,000 litres	Land spill only: 1. Immediately install portable berms under leaking or damaged line where possible. 2. If portable berms are not feasible, contain and recover oil spill using dykes or trenches. 3. Prevent the oil from reaching natural drainage paths leading to the ocean. 4. Collect free-product for temporary storage. Excavate contaminated soil, store and manage appropriately. Marine response if necessary: 1. Deploy containment boom to control migration of spill. Consideration of protection booming of beach front, or sensitive areas as defined in Annex 3 of the OPEP depending on wind direction, tides and marine conditions present. Typical deployment lengths of 50 metres are anticipated for this task. (Multiple lengths should be used when required). 2. Deploy skimmer and recover spill. 3. Final recovery of spill using sorbents if necessary. 4. Monitor any free floating oil that is unable to be contained. 5. Notifications of local authorities.	Land spill only: Response by MLA site services Recover free products with sorbents, pumps within temporary berms Earth moving equipment available for berming, etc. Boat – Sabina near shore workboat - 3 responders Boom – 100 metres and accessories, additional booms if necessary to provide shoreline protection Shore crew to deploy from container – 3 responders MLA site services

Bulk Fuel Storage Facility

The bulk fuel storage facility located at the MLA shall be constructed in an impermeable secondary containment structure (lined and bermed containment area). The construction is in compliance with CCME's Environmental Code of Practice (CCME 2003; 2008), the fuel bulk fuel storage facility will be designed to have bermed spill containment with capacity equal to the volume of the largest tank plus 10% of the volume of the remaining tanks OR 110 % volume of the largest tank, whichever is greater.

The above basis is consistent with the document entitled "Design Rationale for Fuel Storage and Distribution Facilities" published by the Department of Public Works of the Northwest Territories (refer to Section 4.6 of those guidelines). The lining within the bermed area is an impervious HDPE liner membrane. The design of these facilities will be based on industry standards for installation, jointing, etc., the membrane to ensure its integrity.

Detailed spill response scenarios related to bulk fuel storage facility, and the appropriate actions and resources required, are outlined in Table 8-2.

Table 8-2. Bulk Fuel Storage Facility Spill Response Scenario Actions and Resources Required

Source of Discharge	Potential Loss	Appropriate Actions	Resources Required
Leaking Tank or piping/valves	20-500 litres	Isolate and patch accordingly, berm or portable berms	Patch kits/ portable berms Response by MLA site services Recover free products with sorbents Berm designed with fuel recovery to sump and engineered oil water separator

** Potential loss estimated based on pumping rate and anticipated response time to shut down pumping operations*

8.1 RESPONSE STRATEGIES – LARGE SPILLS

For the purposes of this plan, spills less than 5 m^3 are to be handled by MLA-OHF response operations. MLA personnel shall deploy the resident on-site equipment as outlined in the plan.

If the spill is larger than 5 m^3 and depending on the specific circumstances, the Emergency Response Coordinator shall determine if it is necessary to increase the response capability by requesting third party assistance. Where this support is deemed necessary, the Emergency Response Coordinator shall immediately request this assistance while ensuring ongoing mitigation of spill impact to the extent possible while awaiting additional resources and assistance from the third party responder.

The choice of third party responder and any contractual arrangements (if required) is a commercial element of the project and shall be determined at a future date prior to commencement of operations. The choice of a third party responder shall be commensurate with the required capabilities under the regulations.

9. Preventive Measures

It is Sabina policy to prevent any accidental spillage and all prior efforts shall be made to minimize the risk of incidents and impact to the environment. Sabina shall constantly update the facility, shall have adequate safety equipment at the site and provide comprehensive training to its employees, contractors and visitors with the goal of avoiding spills and to minimize their impact if they should occur.

Sabina shall contract the entire fuel delivery and transfer operation to the ship operator. The ship operator has established transfer procedures meeting all of the required regulations for Arctic bulk fuel transfers. All ship personnel involved in the transfer shall possess appropriate Supervision of an Oil Transfer Operation (SOTO) certifications. The ships maintain pollution response equipment onboard and are trained in its use.

Furthermore, Sabina has established standard operating procedure in relation to the bulk fuel transfer – (Annex 5), that provides safeguards and immediate alarm in the event of failures during the operation.

9.1 TRAINING - GENERAL

Sabina ensures that personnel involved during a response receive training for their own safety, public safety, and that they have the required skills to minimize the impact of a spill on the environment.

The personnel directly linked to spill response operations will receive training to familiarize themselves with the environmental emergency plan. These personnel will also re-examine the manual of the OPEP on a yearly basis according to their duties and responsibilities. All training is recorded in the training register and kept up to date in the OPEP binder.

The personnel directly linked to spill response operations, contract employees and the other responders identified in the environmental emergency plan should take part in the yearly training program. It shall be ensured that training is carried out to ensure adequate numbers of responders at all levels are available on both work shifts.

All workboat operators and crews shall possess a Pleasure Craft Operator Competency Card.

9.1.1 Training Content

Spill training shall be provided on site prior to transfer operations for all personnel to be involved in the management and response to possible spills.

Sabina Emergency Response Coordinator shall possess spill management training to a level commensurate to the duties required of the position.

Responder training is to be of a combined theoretical presentation (classroom) and also of hands on nature (equipment deployment exercise).

The major components of this training program shall include:

- Classroom Training:
  - Introduction and overview of marine spill response.
  - Review of Sabina general spill response plan and integration of it to marine response.
  - Review of Marine Oil Pollution Emergency Plan elements.
  - Short review of oil spill behaviour and operational parameters / limitations for marine spill response operations.
  - Spill assessment.
  - Basic safety for spill responders to marine oil spills, presentation of video – small craft safety practices.
  - Basic oil boom deployment, presentation of video and booming techniques / guidelines.
  - Marine and shoreline recovery operations.

- Hands-on Training and Deployments:
  - Hands on review with participants of Sabina inventory of spill equipment.
  - Hands on instruction - boom connections, tow bridles, rope handling, basic knots and attachment of deployment accessories.
  - Simulated deployment of booms and related gear on water using appropriate vessels.
  - Debriefing and lessons learned.

9.1.2 Short Notice Training

In the event of a large spill the personnel requirements may exceed those that have received the specific responder training as outlined in Section 9.1.1 above. Due to the remoteness of the site, volunteers are not anticipated. MLA site services personnel shall be employed as additional responders.

Although all site services personnel possess WHMIS training, additional short notice training shall be carried out for these new responders on an as needed basis. Certain modules of the responder training shall be delivered on site to these personnel selected specifically from the training outlined in Section 9.1.1 above. The Incident Commander shall determine which modules are pertinent to each group of additional responders and shall be responsible for assuring adequate training for each group.

9.2 EXERCISES

Following the annual delivery of the spill training as outlined in Section 9.1 a comprehensive spill exercise shall be undertaken. The exercise is structured to test the readiness of management, responders and to practice and validate the logistics of the deployment of spill gear. The exercise content shall be different from year to year so that it can validate the various elements of the plan and the response over a three year period. Some of the factors that shall be evaluated include but are not limited to:

- Activation of the emergency plan.
- Management response.
- Internal and external notifications.
- Site safety.
- Communications.
- Equipment deployment to a specific scenario.
- Reporting and co-ordination with outside agencies.
- Exercise coordination with Canadian Coast Guard;.
- Exercise coordination with ship.

9.3 SPILL PREVENTION MEASURES

9.3.1 Bulk Fuel Storage Facility

Normal operation procedures of Sabina include many inspections that are performed regularly and kept on records. Any discrepancies noted are documented and investigated. Corrective measures are then applied.

9.3.2 Bulk Fuel Transfer

Several preventive measures are in place to minimize risk of spills during bulk fuel transfer including:

- The bulk fuel storage facility, pipeline and all related equipment and infrastructures are inspected prior to the bulk cargo transfer and the inspection methods are documented as a standard operating procedure.
- Complete bulk cargo transfer procedures have been established, a copy of which is found in Annex 5 of this OPEP.
- As required by the applicable legislation the ship has a comprehensive Shipboard Oil Pollution Emergency Plan (SOPEP) and a copy of this plan has been reviewed by Sabina.
- In addition to the legislative requirements, the charterer has implemented a shipboard spill response training program and performs routine exercises in spill response operations.
- The ship carries a compliment of spill response equipment as listed in Annex 6 of the OPEP and this equipment is ready at the ship's rail at all times for deployment during cargo operations.
- Sabina oil spill response equipment is on the beach, ready for immediate deployment at all times during cargo operations.
- The workboats and trained responders are available at all times during cargo operations for spill equipment deployment.
- Standard transfer procedures include hourly inspections by workboat of the floating hose for leaks or defects.
- During transfer operations the shore manifold is manned at all times.
- A low pressure alarm is installed at the shore manifold that is highly sensitive to differences in pressure during pumping. Any loss in the system will cause a drop in manifold pressure and results in an audible alarm, which is immediately reported by the manifold personnel.
- The bulk fuel storage facility is monitored at all times by Sabina personnel during the transfer.
- The pipeline is inspected hourly on foot during the transfer operation.

9.4 RESPONSE EQUIPMENT AUDITING

As part of the annual exercise program, a scenario based deployment of spill gear is carried out. Prior to the exercise all gear is inspected, its condition is evaluated and any defects or missing equipment is replaced. The equipment audit is documented in the training register in Annex 7.

9.5 OIL POLLUTION RESPONSE PLAN UPDATES

The Oil Pollution Emergency Plan (OPEP) will be scrutinized at least once a year to take into consideration any amendments of the legislation, new characteristics of the site, the equipment on site, new policies of the company, environmental issues and also new staff and particulars of team members. Furthermore following an exercise or an incident, the OPEP will be evaluated and modified accordingly.

Even if there is no change to be brought to the OPEP it will be updated at least once a year. The corrected version of the plan will then be sent to the responsible person on site to ensure that the team at the site always has an updated version of the plan in case their intervention is needed.

9.5.1 Update Registry

The Oil Pollution Emergency Plan (OPEP) shall be updated, reprinted and redistributed when changes are made as noted above. The plan carries the latest version identified by date. If plan amendments result in a reprinting, all old versions of the plan shall be recalled and destroyed accordingly.

9.5.2 Plan Distribution

In addition to distribution within Sabina all modified versions of the plan shall be submitted to Transport Canada accordingly.

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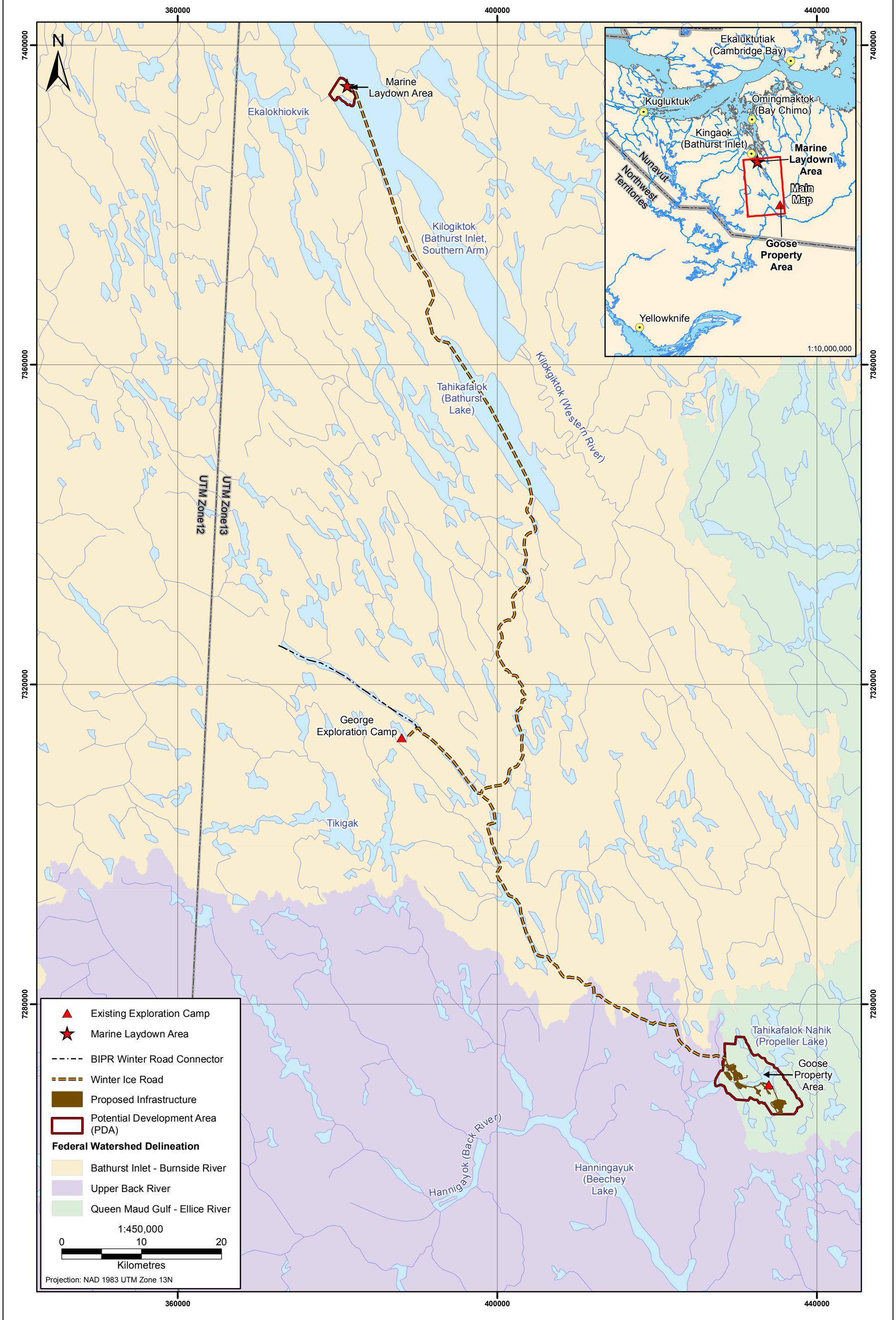
Annex 1
Site Overview Plan

Sabina
GOLD & SILVER CORP.

GIS # BR_FEIS_NA_tab_WinterIceRoadCorridor

August 04 2015



Annex 1

Sabina
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Winter Ice Road Corridor Overview

Annex 2

Bulk Fuel Storage Facility Overview

Sabina
GOLD & SILVER CORP.

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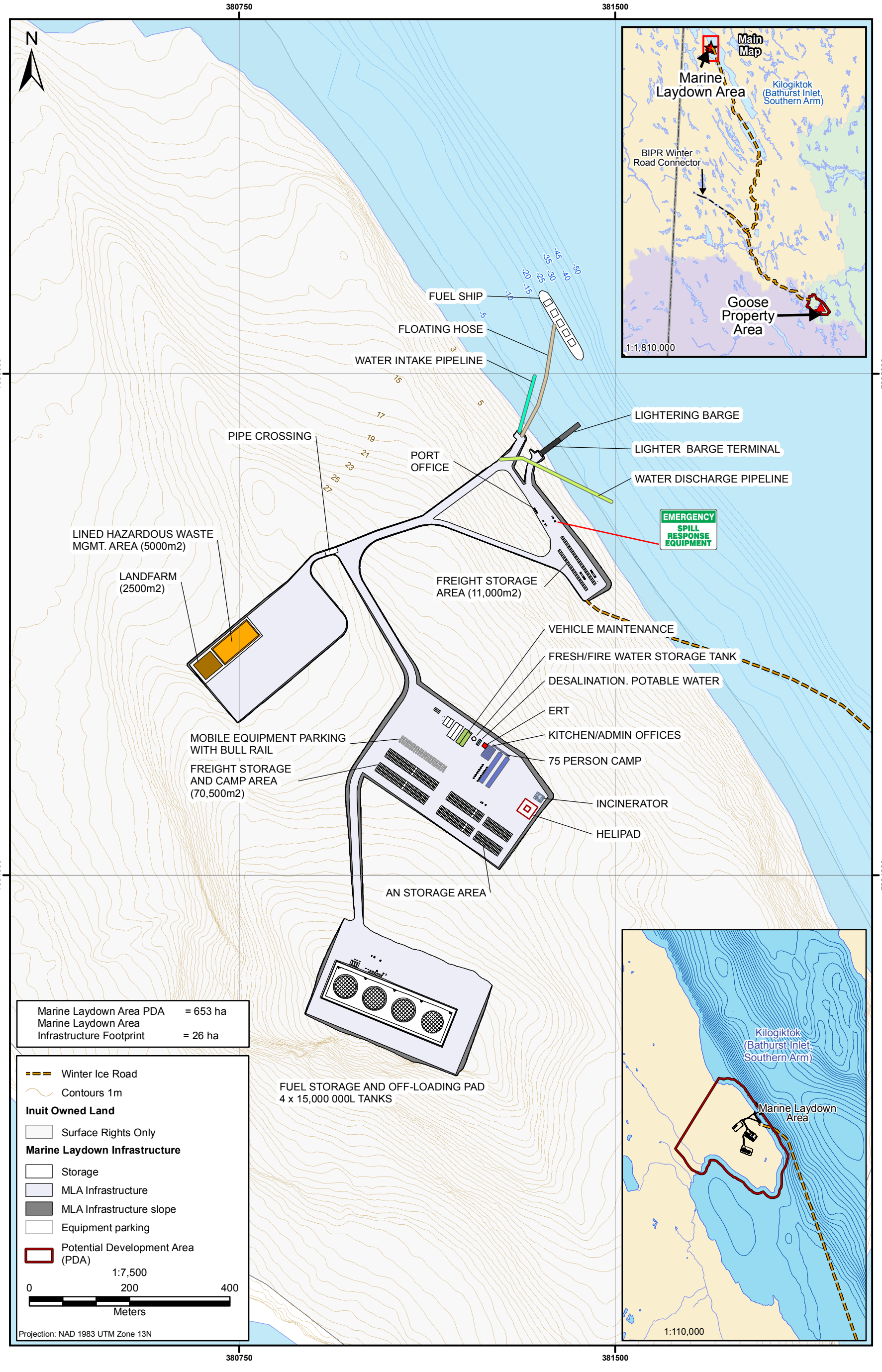
August 04 2015



Annex 2

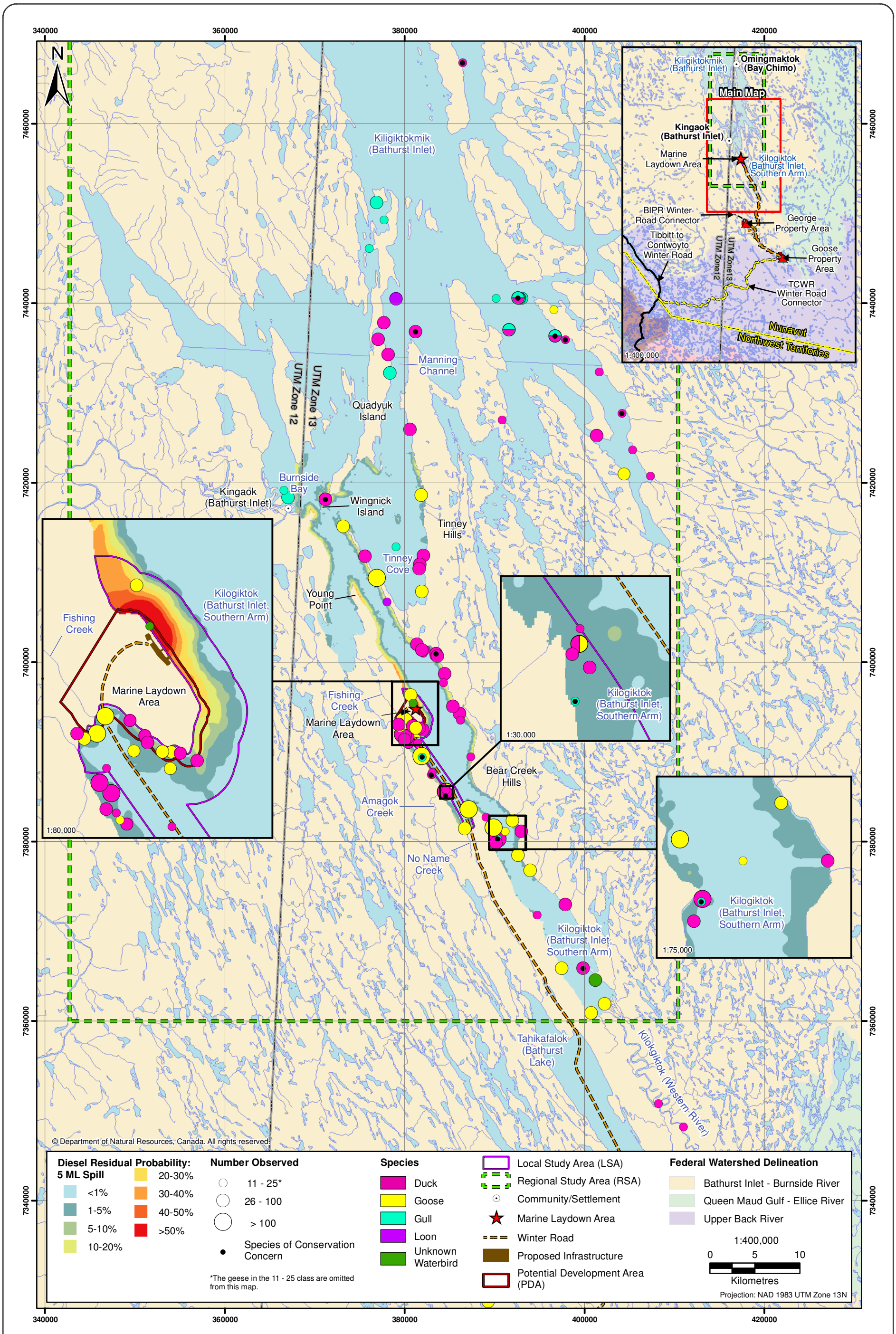
Sabina GOLD & SILVER CORP.

Potential Development Area and Layout
Marine Laydown Area

Annex 3
Sensitivity Zones

Sabina
GOLD & SILVER CORP.

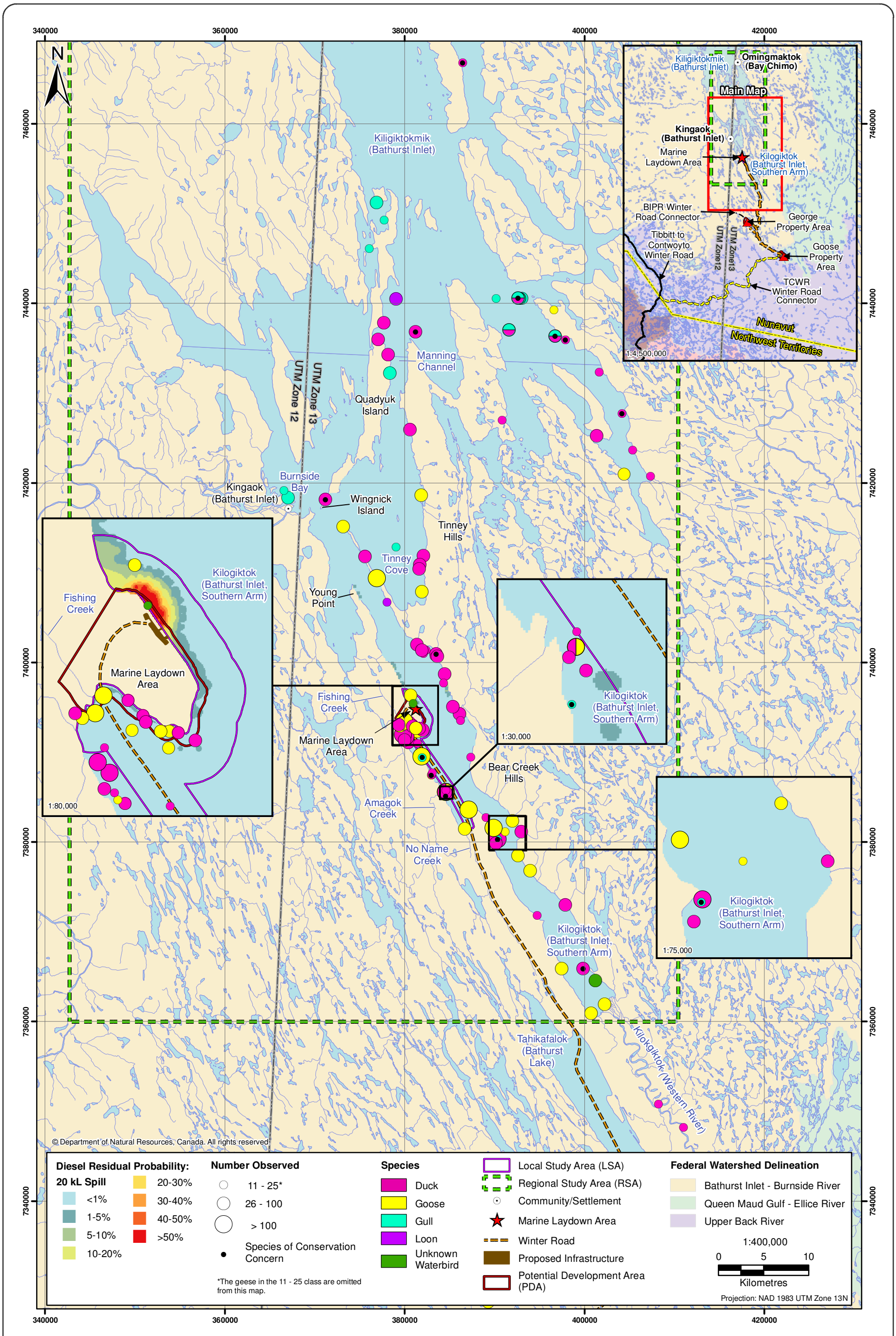
PROJECT # 0194096-0040 GIS # BAC-23-224 January 03 2014



Sabina GOLD & SILVER CORP.

5 ML Spill Sensitivity in Relation to Migratory Bird Staging Areas in Bathurst Inlet

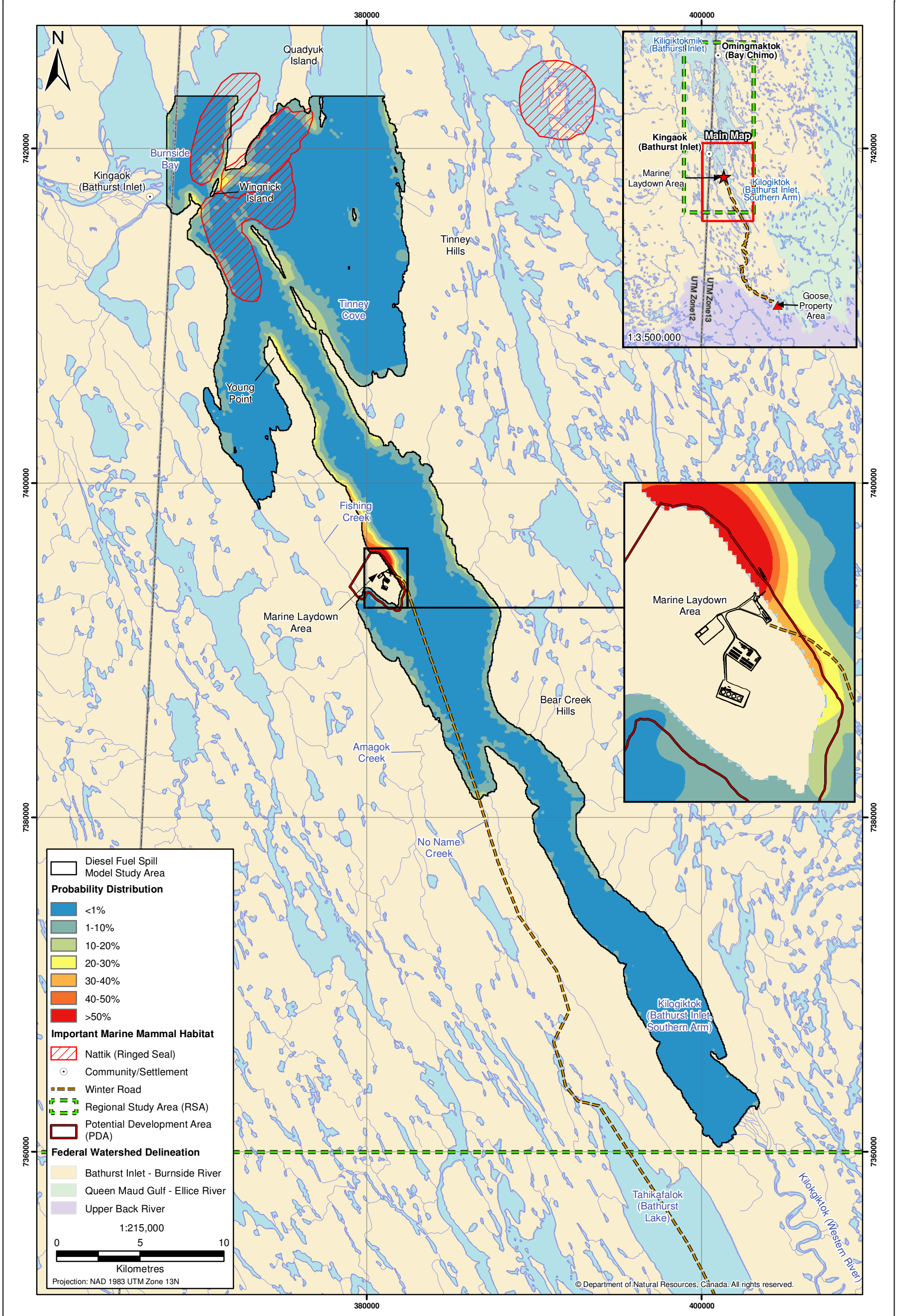
PROJECT # 0194096-0040 GIS # BAC-23-237 June 18 2015



Sabina GOLD & SILVER CORP.

20 kL Spill Sensitivity in Relation to Migratory Bird Staging Areas in Bathurst Inlet

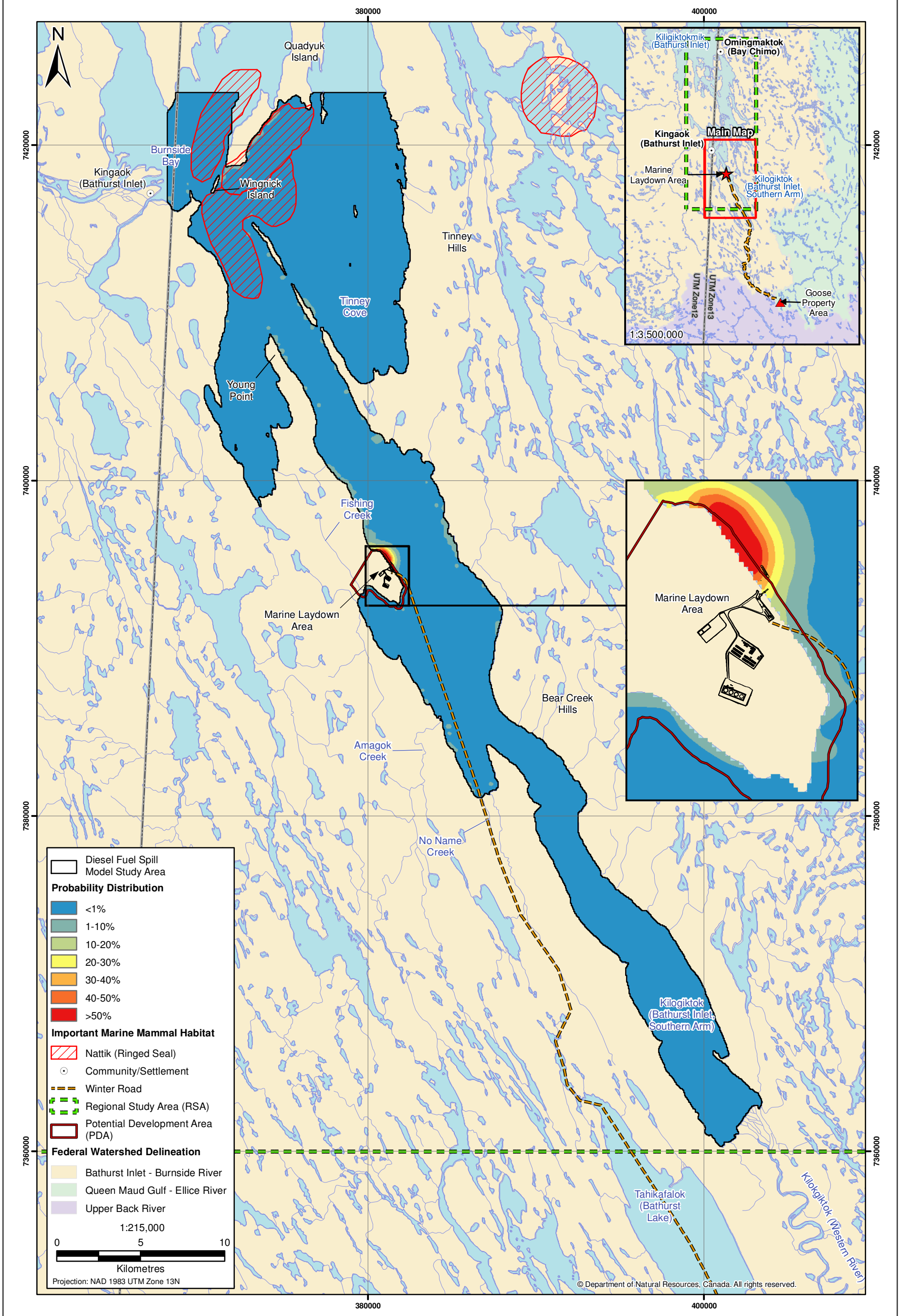
PROJECT # 0194096-0040 GIS # BAC-23-336b July 08 2015



Sabina GOLD & SILVER CORP.

5 ML Diesel Fuel Spill Shore Residual Probability Distribution after Ten Days in Relation to Marine Mammal Habitat in Bathurst Inlet (New as of June 2015)

PROJECT # 0194096-0040 GIS # BAC-23-336d July 08 2015



Sabina GOLD & SILVER CORP.

20 kL Diesel Fuel Spill Shore Residual Probability Distribution after Ten Days in Relation to Marine Mammal Habitat in Bathurst Inlet (New as of June 2015)

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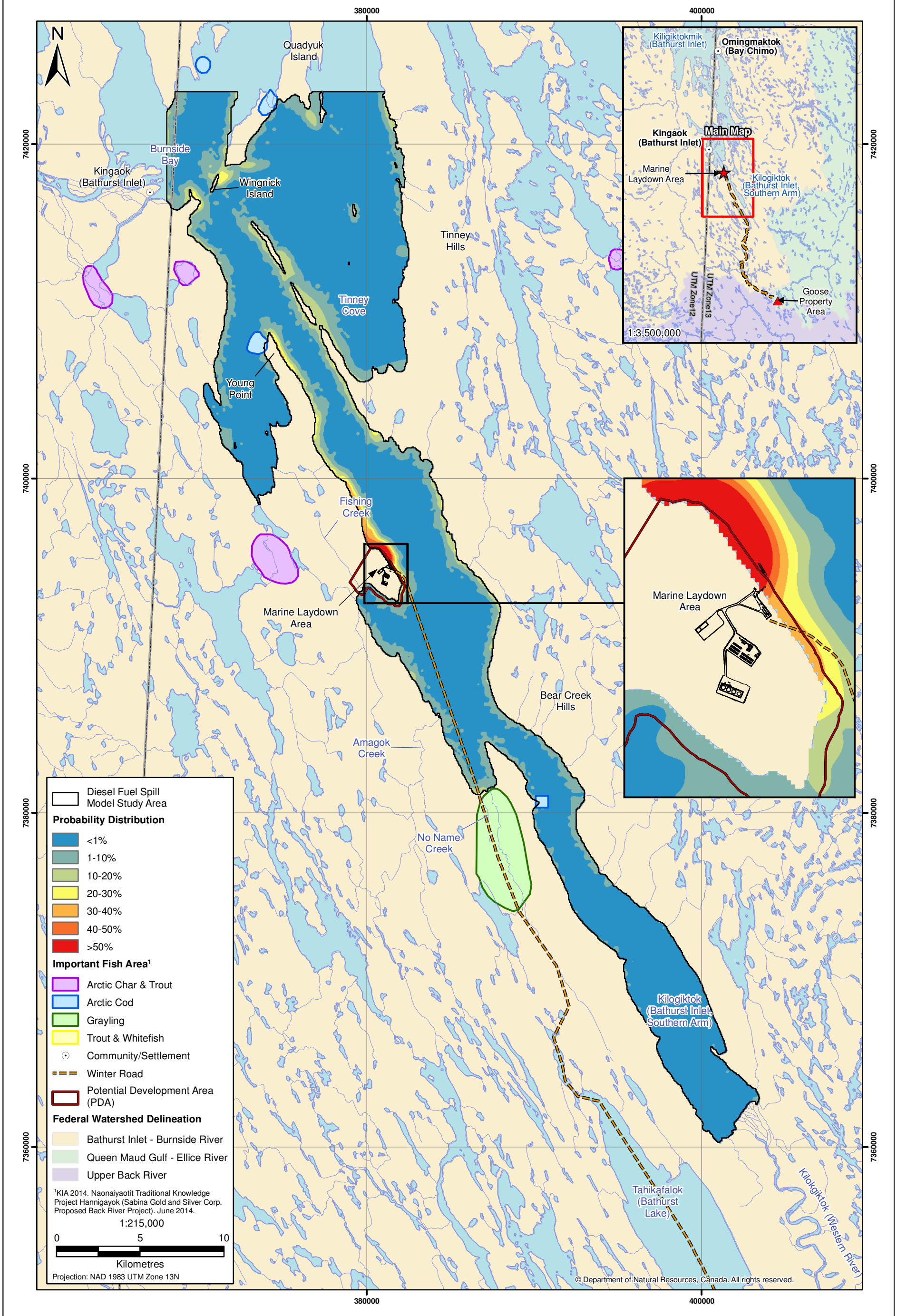
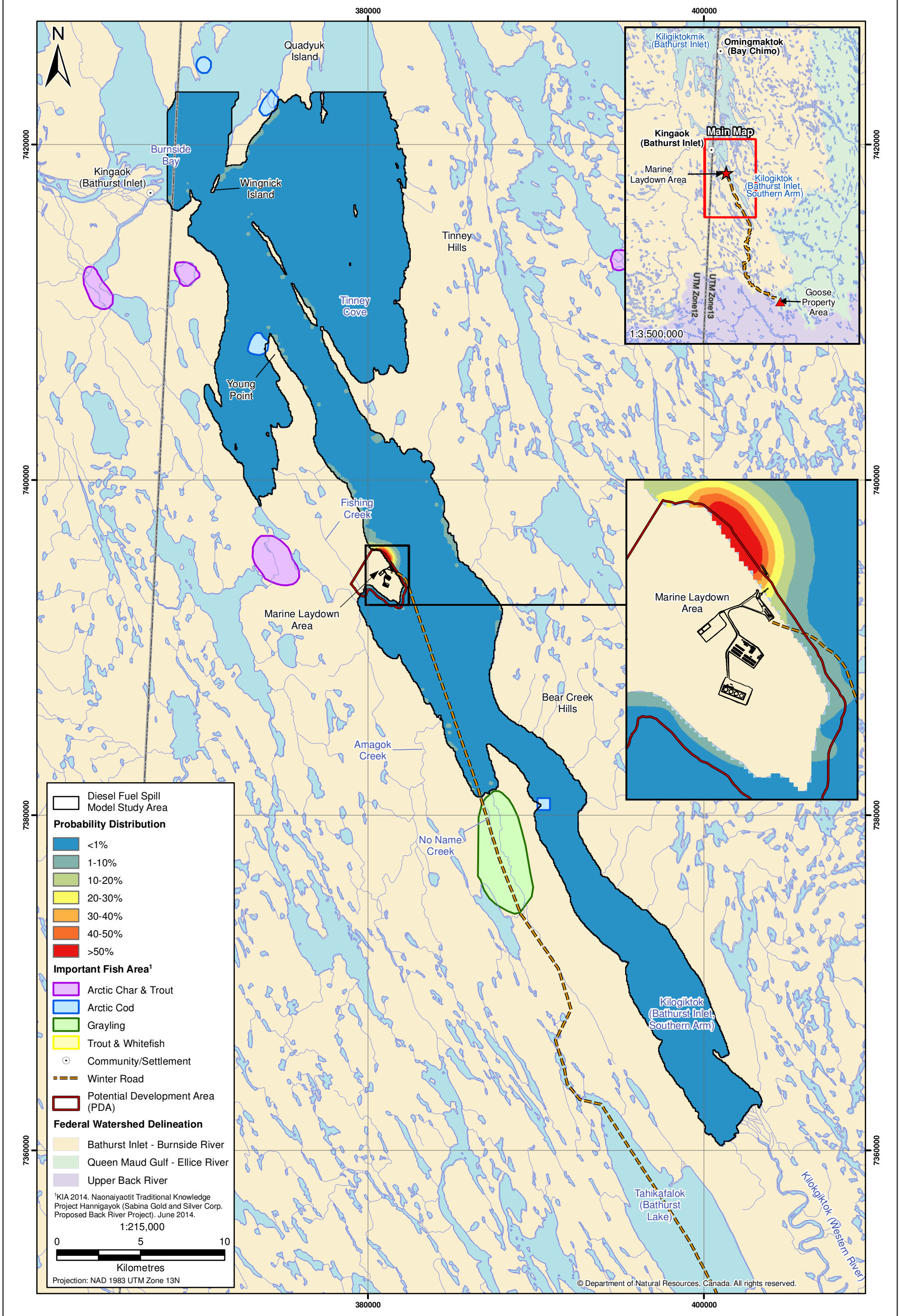


Sabina GOLD & SILVER CORP.

5 ML Diesel Fuel Spill Shore Residual Probability Distribution after Ten Days in Relation to Important Inuit Fishing Areas in Bathurst Inlet (New as of June 2015)

PROJECT # 0194096-0040 GIS # BAC-06-243d July 08 2015



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20 kL Diesel Fuel Spill Shore Residual Probability Distribution after Ten Days in Relation to Important Inuit Fishing Areas in Bathurst Inlet (New as of June 2015)

Annex 4

Resident Spill Response Equipment

Sabina
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RESIDENT OIL SPILL RESPONSE EQUIPMENT
MARINE LAYDOWN AREA – OIL HANDLING FACILITY

Quantity	Description
1	Oil containment boom 300 meters – 24 Inch Fence type
4	Anchor kits for anchoring boom in place
4	Towing bridal for oil boom
4	Spill response unit – X Large Land
4	Overpack spill kit
50	12 kg. Bags granular absorbant
6	0.5m X 0.5m x 15 cm Arctic mini berm for under fittings
6	1m x 1m x 15 cm Arctic mini berm for under fittings
1	1500 Gallon Portable Tank
25	Bales Sorbent Pads
25	Bales Absorbant booms
1	Aluminium workboat with outboard engine, equipped with towing post and related equipment for boom deployment
1	Skimmer and diesel driven power pack, suitable for recovery of distillates – Capacity 7.5 tonnes per hour
12	Rakes for beach cleaning
12	Perforated shovels for sorbent recovery
12	Pitch forks with screens for sorbent and debris recovery
12	Approved flotation devices
1	Minimum 10 ton sand stockpile for spill berming operations

Additional Response Equipment Available from Project Stockpiles:

Mobile Equipment	
Grader	Winch Trucks
Cranes	Pickup Trucks
Snowmobiles	Generator Sets
Vacuum Truck	Fire Truck
Loaders	Aluminium Boats
Backhoes	Fuel Trucks
Bulldozers	Bobcats
Forklifts	Haul Trucks
Water Trucks	Snow Cats
Excavators	
Temporary Containment Systems	
Booms	Spill Kits
Drums	Spill Absorbent Material
Tanks	Silt Fencing
Tailings Management Area	
Emergency Transportation	
Aircraft (helicopter)	Snowmobiles
4-Wheel Drive Vehicles (ex. Pickup trucks)	Boats
ATVs	
Communication Equipment	
Radios	Fax
Telephone	Wireless Communication Systems

Mobile Spill Kit Equipment	
Spill Pump	White oil spill pads
Pump accessories	Universal booms
Vacuum ends	Cell U-Sorb
Tubing or pipes for vacuum or pumping	Sphagsorb
45 gallon top	Wedge wood
Diesel fuel jerry can	Plug patties
Spill kit accessory	Quattrex bags
Drums opener	Hand shovel
Wescot (to open empty drum screw)	Ice breaker chisel
Empty drums	Sledge hammer
Drums berms	Rod bars
Tarps	

Annex 5

Bulk Cargo Transfer Procedures

Sabina
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MARINE LAYDOWN AREA – OIL HANDLING FACILITY - PROCEDURES

Procedure:	**Bulk Ship to Shore Fuel Transfer**			**Procedure No:**	
Revision:		**Effective:**	October 2013	**Replaces:**	
Issued By:					
Project:	Back River Project				

PURPOSE AND SCOPE

To establish a standard procedure for the safe transfer of fuel from bulk fuel tanker ships to the Marine Laydown Area – Oil Handling Facility (MLA-OHF).

GENERAL:

The safe transfer of fuel is made in compliance with various regulatory laws, guidelines & organizational standards. This procedure outlines the operational scope of fuel transfers at the facility, details the various standards to be followed and outlines specific roles & accountabilities to ensure a safe transfer of fuel and to prevent cargo/fuel spillage, and any resulting environmental damage.

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GENERAL SAFETY

Wear approved P.P.E. - Safety glasses; hard hat; safety boots;

Key Safety Requirements:

- Ignition sources: Fuels are highly flammable. Smoking or open ignition sources are not permitted within 10 meters of ship to shore connections, fuel manifolds or within the fuel farm berm.

- High pressure piping: The pressurization of fuel transfer lines, manifolds and fuel farm piping can reach pressures of 700 kPa (100 psi). No person is permitted to create a break in a pipe or open any part of the pressurized system without the written consent of the Sabina Fuel Transfer Master once the Pre-Transfer Operation (Section 4.0) has been initiated.

- Environmental spill response: Prompt and correct local response are required in the event of a spill to safeguard life and property; and lessen the environmental impact of the spill.

- Communication: Good communication between all parties involved in the fuel transfer is essential for a smooth transfer, and are vital in the event of an incident.

Summary of Operation.

The ship to shore transfer operation at Bathurst Inlet is similar to other cargo discharge operations in the North, however, there are some unique aspects that require specific procedures be followed and understood by all personnel involved in the discharge operation.

Construction activities at Bathurst Inlet will provide for a new steel construction bulk fuel storage facility consisting of 4 steel tanks at 10 ML and one at 5 ML

The MLA-OHF shall be constructed in an impermeable secondary containment structure (lined and bermed containment area). The construction is in compliance with CCME's Environmental Code of Practice (CCME 2003; 2008), the fuel bulk fuel storage facility will be designed to have bermed spill containment with capacity equal to the volume of the largest tank plus 10% of the volume of the remaining tanks OR 110 % volume of the largest tank, whichever is greater.

The above basis is consistent with the document entitled "Design Rationale for Fuel Storage and Distribution Facilities" published by the Department of Public Works of the North West Territories (refer to section 4.6 of those guidelines). The lining within the bermed area is an impervious HDPE liner membrane. The design of these facilities will be based on industry standards for installation, jointing, etc., the membrane to ensure its integrity.

The MLA-OHF is connected to a shore receiving manifold by a 6 inch diameter steel pipeline. The pipeline is of welded construction. The pipeline is supported on appropriate stands and blocking. The pipeline is fully pressure tested and inspected each year prior to annual bulk cargo transfer operations.

Lighting is provided at the shore receiving manifold meeting the regulatory requirements of the Vessel Pollution and Dangerous Chemical Regulations, (SOR 2012-69). The bulk fuel storage facility is also equipped with lighting meeting the standards as set forth in the same regulation.

Bulk fuel deliveries will take place during the open shipping season and volumes and frequency of deliveries will depend on a number of factors including but not limited to: size of ships, fuel consumption rates, operational constraints etc. Multiple bulk fuel transfers therefore from ship to shore annually are anticipated.

It is anticipated that the total annual volume of the bulk fuel transfers shall be in the order of approximately 30- 45 ML and will take place between the months of late August through early October. The fuel transfers shall take place by means of either a single or double 4 inch floating hose with an approximate length of approximately 1000 meters deployed between the vessel and the connecting flange on the shore. The products are then transferred through the pipeline to the above mentioned bulk storage facility through a 6 inch steel pipeline.

Accurate reconciliation of discharge & fill volumes through regular communication between ship & shore personnel is required to ensure the safe transfer of fuel & prevent overfilling within the tank farm that could result in a spill.

There are a number of work groups involved in the transfer of fuel. The workgroups and applicable procedures are listed below:

Work Group	Description of Applicable Regulation, Guideline or Procedure
Sabina / Shipper	MLA-OHF - Procedures
Sabina	Sabina Gold & Silver Corp. - Spill Contingency Plan (SCP) Sabina Gold & Silver Corp. - Oil Pollution Emergency Plan (OPEP)
Shipper	Cargo Operations at Bathurst Inlet Guidelines
Shipper	Arctic, General Port Operation Guidelines
Sabina / Shipper	Transport Canada – Arctic Waters Oil Transfer Guidelines.
Shipper	Arctic Shipping Pollution Prevention Regulations (ASPPR), under the Arctic Waters Pollution Prevention Act (AWPPA). This covers ship standards and activities in waters north of the 60th parallel.
Shipper	Arctic Waters Pollution Prevention Regulations (AWPPR) under the AWPPA. This covers the ship owner's liability provisions regarding spillage of waste
Shipper	Oil Pollution Prevention Regulations (OPPR), under the Canada Shipping Act.
Shipper	Vessel Pollution and Dangerous Chemical Regulations, (SOR 2012-69)
Shipper	Shipboard Oil Pollution Emergency Plan (SOPEP)

RESPONSIBILITY

Role	Accountability	By When	Comments
Sabina - Operations Manager or Designate	Complete PHA on Draft Procedure	In advance of annual Bulk Fuel Sealift	
Sabina Fuel Transfer Master	Implementation of all supplier accountabilities as described in this procedure, all regulatory requirements and organization procedures	As specified	
Sabina Fuel Transfer Master	Inspection of shore fuel transfer system piping	Every 4 hours upon start of fuel transfer	
Supplier Oil Transfer Supervisor	Notify Prairie & Northern Region, Maritime in Ottawa, via NORDREG of the plans for oil transfer operations in arctic waters	In advance of Bulk Fuel Sealift	
	Implementation of all supplier accountabilities as described in this procedure, all regulatory requirements and organization procedures	As specified	
All personnel involved in Bulk Fuel Transfer	Initiate Stop Transfer or Emergency Stop Transfer upon identification of conditions listed in this procedure	As required immediately	

DEFINITIONS

Shipper: The owner and the operations personnel of the bulk fuel tanker ship engaged under contract to Sabina Gold & Silver Corp. to ship & transfer fuel to the Bathurst Inlet fuel farm shore manifold

Receiver: Sabina Gold & Silver Corp

1.0 PROCEDURE

GENERAL

1.1 A Process Hazard Analysis (PHA) will be conducted annually on this procedure by all parties involved in the Bulk Fuel Transfer Procedure in advance of the Bulk Fuel Sealift. The purpose of the PHA is to identify potential hazards not already covered in this procedure or with the methodology and to implement the appropriate controls commensurate with the level of risk associated with the hazard.

1.2 Upon arrival of the bulk tanker at Bathurst Inlet and prior to commencement of any operation including supplier equipment mobilization, all organizations & work groups involved in the Bulk Tanker Fuel Transfer to the MLA-OHF will meet to:

- Identify the supplier fuel transfer supervisor and Sabina fuel transfer master to all personnel involved in the operations
- Review this procedure.
- Inform each party involved of the dimensions of the other's key facilities, such as manifold/fuelling station location, maximum & minimum draught, shore manifold connections, and jetty/shore characteristics such as tides, bollards, mooring and positioning aids, hidden hazards
- Inform all participating personnel of their duties and responsibilities during the transfer, and ensure they are versed in emergency procedures, and know the fuel spill contingency plan to be followed in the event of an incident.
- Upon completion of the meeting, the ship Captain and/or 1st mate will come ashore to inspect the installation.

1.3 Communication: Reliable, clear and consistent communication is essential for a smooth transfer operation, and is vital in a crisis situation. The following communication standards are to be followed:

- The language of the workplace at the facility is English. All communication is to be in English.
- A dedicated radio frequency will be used by personnel directly involved in the transfer. The supplier will provide radio's on the ship's dedicated frequency to the receiver's shore personnel.
- The radio is only to be used for fuel transfer communication
- All cargo volumes are to communicated in cubes or cubic meters
- The following standard signals should be used in all transfer operations

- STANDBY TO START TRANSFER
- START TRANSFER
- SLOW DOWN TRANSFER
- STAND BY TO STOP TRANSFER
- STOP TRANSFER
- EMERGENCY STOP OF TRANSFER
- EMERGENCY SHUTDOWN OF TRANSFER
-

If any of the following conditions occur, the transfer should be stopped immediately:

- LOST COMMUNICATIONS
- LOSS OF ABILITY TO MONITOR HOSE TO SHORE
- SIGN OF SPILLAGE, OR DAMAGE TO HOSES AND COUPLINGS
- ANY DETECTION OF ACCUMULATED GASES
- MAJOR INCREASE IN WIND AND/OR SWELLS (SUPPLIER)
- WHEN AN ELECTRICAL STORM IS PRESENT OR PREDICTED
- SEVERE DETERIORATION IN ICE OR VISIBILITY CONDITIONS (SUPPLIER)
- HELICOPTER LANDINGS OR TAKE OFFS WITHIN 500 METERS
- ANY OTHER SITUATION DEEMED DANGEROUS BY THE FUEL TRANSFER SUPERVISOR OR SABINA FUEL TRANSFER MASTER.

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2.0 LAND / SHORE - SAFETY AND ENVIRONMENTAL CONTROLS

2.1 The receiver will ensure the following safety controls are in place prior to and during fuel transfer:

- "No smoking/no naked lights or flames" warning signs will be posted at all the shore manifolds and at the entrance to and around the perimeter of the MLA-OHF berm.
- Fire extinguishers will be prepared for rapid deployment in the area of the shore manifold and the fuel farm before commencing transfer
- The shore hose landing, handling and manifold area is free of obstructions and hazards
- Road access to the beach area will be restricted to prevent vehicles from crossing the hose
- Manifolds, bollards and deadmen are adequate and clearly marked for visibility
- All personnel involved in the fuel transfer using radios will be on the same channel or frequency
- Ensure that all personnel know they have the right to suspend operations at any time, if they decide it is necessary.
- Fuel Transfer Piping Isolation: The pressurization of fuel transfer lines, manifolds and fuel farm piping can reach pressures of 700 kPa (100 psi). No person is permitted to create a break in a pipe or open any part of the pressurized system without the written consent of the Sabina fuel transfer Master.
    - Each time the fuel transfer system requires a break in the line, flange to be opened, a component to be removed or any other service that requires the opening of a line even downstream of a valve, a non-routine JSA must be

conducted by the SABINA Fuel Transfer Master and the workgroups doing the work.

- The work may only proceed upon written confirmation by the SABINA Fuel Transfer Master.

- Burning & Welding is not permitted on any component associated with shore manifold, pipeline, or fuel farm equipment without the written consent of the Sabina fuel transfer Master. A non-routine JSA must be conducted by the Sabina fuel transfer master and the personnel involved in the hot work.

2.2 The receiver will ensure the following environmental controls will be in place prior to and during fuel transfer:

- Ensure that all personnel know they have the right to suspend operations at any time in the event of a spill or, any loss of control or potential loss of control that may result in a spill
- Fuel transfer will be stopped immediately in the event of any drip, flow, leak or seep in to soil or water during fuel transfer. Fuel transfer operations will cease until leaks to soil or water have been eliminated.
- Emergency spill response kits will be positioned at the shore manifold, along the pipeline and at the fuel berm
- The SABINA emergency spill response equipment will be positioned in close proximity to the shore manifold at the beach area with boom (and towing bridle attached) ready to deploy.
- As an additional contingency, a front end loader, excavator or other appropriate earth moving equipment will be readily available to the SABINA transfer master at Bathurst Inlet during the fuel transfer.
- All personnel directly engaged in the fuel transfer are familiar with the Sabina emergency spill response protocol.
- Sabina will initiate & implement all land based spill response plans.
- A drip tray or lined berm will be place under the shore manifold connection.

3.0 SEA / SHIP - SAFETY & ENVIRONMENTAL CONTROLS

3.1 The supplier will implement all safety controls as are required under the applicable regulation, guideline or supplier procedure documented in the “Summary of Operation” above.

3.2 Land / shore – safety & environmental controls (Section 2.0) will be reviewed with the supplier’s oil transfer supervisor and shore crew.

3.3 The supplier is accountable under the following circumstances for the implementation of their fuel spill contingency plan (including containment and remediation) during the bulk fuel sealift:

- All spills to salt water
- The salt water component of all spills that originate from land and make their way to salt water.

3.4 The supplier shall demonstrate that they have previously carried out adequate shipboard emergency spill response simulation/training exercises

3.5 The supplier is accountable for completing the Arctic Oil Transfer Guideline Checklist and will provide a copy to Sabina Iron upon completion of the fuel transfer to the MLA-OHF.

4.0 PRE-TRANSFER PREPARATION & OPERATIONS

4.1 Pre-transfer preparation may commence at any time during the day – However, cargo transfer operation may only start during daylight hours.

4.2 Prior to the supplier connecting the hose to the shore manifold, the supplier oil transfer supervisor and SABINA fuel transfer master will complete and sign off on the appropriate pre-transfer preparation & operations checklist to confirming all requirements are completed.

4.3 Once the ship hose is connected to the shore manifold the following tasks can be completed:

- The supplier will complete and certify a pressurized air test of the transfer hose.
- The receiver may request the supplier to conduct an air pressure test on the shore manifold, piping and distribution piping within the berm. **It is critical that all tank isolation valves be closed prior to pressurizing the line.** The shore lines must hold pressure for 1 minute. If pressure cannot be held, an inspection of the entire line must be made to determine the location of the leak prior to discharging cargo. The receiver will certify that an air pressure test was completed.

5.0 TRANSFER OPERATIONS

5.1 The cargo transfer operation may only start during daylight hours.

5.2 Sabina fuel transfer master will announce impending fuel transfer on ship to shore communication and to other personnel at Bathurst Inlet

5.3 The Sabina fuel transfer master shall ensure that:

(a) the supervisor of the transfer operation on board the vessel has reported readiness for the transfer operation to begin;

(b) continuous communication is maintained with the supervisor on board the vessel; and

(c) the manifold valves and the tank valves within the fuel farm are not closed until the relevant pumps are stopped, if the closing of the valves would cause dangerous over-pressurization of the pumping system.

- **Cargo hose/shore line pigging procedures**

    - Great care must be taken to ensure that NO air be allowed to blow unrestricted into the shore cargo tanks. When pigging the cargo hose and clearing it of product, all stations must be coordinated to determine when the pig reaches the shore manifold and when the pig reaches the tank farm.

    - Drain the air pressure off the cargo hose back into a dry drip pan (it is the preferred method). In order to prevent air being splashed onto personnel a canvas or plywood screen can be set up. Where it is impracticable to drain into a manifold drip tray or an empty drum, we may then drain the air pressure off the cargo hose back into an empty cargo tank or slop tank onboard ship. Under no circumstances shall air be bled off in any great quantity into the shore tanks.

    - Normal operations would have the Jet-A discharged ashore first. The hose will then be blown with a 4 inch pig from ship to shore manifold, and again blown with a 6 inch pig until it reaches the tank farm. (This point is determined by prior arrangement with the ship and shore personnel). The hose will then be bled off and the hose will then be cleared.

    - This procedure will ensure that the hose/shore line has been cleared of all traces of Jet-A. The diesel will then be discharged ashore as the last cargo.

    - Upon completion of discharge of a cargo the pigging of the hose/shore line should be done in two steps as follows:

Ship to Shore Manifold – 4 inch floating hose:

1. Cargo pump stop
2. Cargo manifold close
3. Squeeze the cargo hose about 3ft from the manifold
4. Drain that section of the cargo hose
5. Ensure the hose is well secure
6. Disconnect the hose, insert the pig, reconnect the hose
7. Notify the shore manifold that you are ready to launch the pig
8. When the shore manifold is ready to receive the pig, open the air
9. When the air pressure is at 70psi, release the pig by opening the hose squeezer
10. The air pressure should be maintained at approximately 70psi
11. If the pig gets stuck, notified the shore manifold then increase the air pressure by 10psi and wait 2 to 5 minutes
12. If the pig is still stuck repeat the above but do not exceed 100psi

13. Once the pig is at the shore manifold pig catcher shut the air immediately, close the valve to the 6 inch shore pipeline isolating any remaining product between shore manifold and tank farm in the 6 inch shore pipeline.

14. Bleed the air from the hose.

Shore Manifold to Tank farm – 6 inch steel pipeline

15. Open the 6 inch pig launcher at the shore manifold and insert a pig.

16. Notify the shore manifold that you are ready to launch the pig

17. When the shore manifold is ready to receive the pig, open the air

18. When the air pressure is at 70 psi, release the pig by opening the 6 inch valve at the shore manifold

19. The air pressure should be maintained at approximately 70psi

20. If the pig gets stuck, notify the tank farm then increase the air pressure by 10 psi and wait 2 to 5 minutes

21. If the pig is still stuck repeat the above but do not exceed 100psi

22. Once the pig is at the tank farm pig catcher shut the air immediately, close the valve to the tank

23. Bled the air from the hose.

5.4 Fuel transfer rates should initially start off low in the 30-40m3/hr range and then ramp up slowly as the fill methodology advances. The maximum fuel transfer rate allowed the MLA-OHF is 149 m3/hr

5.5 Upon commencement of fuel discharge to the fuel farm tanks, the entire length of the MLA-OHF fuel transfer piping system from the shore manifold to the fuel berm will be inspected for leaks, and every hour thereafter so long as the fuel transfer system is charged. The Fuel Transfer Piping System Inspection Log will be submitted to the SABINA fuel transfer master at the end of each shift.

5.6 Jet A fuel will be transferred first to prevent contamination with diesel

5.7 The fuel transfer hose and shore pipe will be cleared of Jet A by pigging following the completion of Jet A fuel transfer

5.8 Diesel fuel will be transferred to the fuel farm.

5.9 Upon completion of the fuel transfer operations, the entire hose and pipeline shall be cleared of product by the pigging procedure outlined in 5.2 above

6.0 POST-TRANSFER OPERATIONS

6.1 The shore manifold open end will be capped to prevent any accidental discharge of fuel.

6.2 Upon completion of the fuel transfer operation, the hard pipe line will be isolated from the fuel farm at a point inside the fuel farm through the installation of a spade or by physically breaking & installing a blank flange or cap on both ends

6.3 The hard piped transfer line will be opened at the shore manifold to drain any remaining fuel that may have accumulated.

6.4 The SABINA fuel transfer master will sign off the MLA-OHF Fuel Transfer Checklist indicating that this procedure has been completed and the bulk fuel transfer to the MLA-OHF is complete

6.5 The supplier will provide Sabina Iron with a copy of the Suppliers statement of facts (record of ship activities) from the fuel transfer process.

7.0 REFERENCES AND RELATED DOCUMENTS

7.1 PHR Forms

7.2 Non-Routine JSA

7.3 Fuel Transfer Checklists

7.4 MLA-OHF plans and layout

ARCTIC WATERS OIL TRANSFER **CHECKLIST FOR BARGE TRANSFERS**

	BARGE - PROCEEDURE	CHECK	SUPPLIER		RECIPIENT		COMMENTS
		YES	INITIAL	DATE	INITIAL	DATE	
1.	Has the General Checklist for All Transfers been completed?						
2.	Is the dis charge pump as close as possible to suction pipe of the discharge tank?						
3.	Check hard line hose between pump and tank (if fitted)?						
4.	Check couplings on discharge between pump and recipient?						
5.	Do not exceed the following: a) maximum list (P & S) b) maximum trim (FWD & AFT)						
6.	Are barge tank diagrams and pipe schematics available?						
7.	Are fenders between the barge and other vessel?						
8.	Is barge equipment bonded to barge structure?						
9.	Are fire screens installed in ullage openings?						
10.	Are all valves closed and hoses stowed after completion of transfer?						

ARCTIC WATERS OIL TRANSFER

TRANSFER PARTICULARS

VESSEL / STATION INFORMATION			Location:	
	Supplier	Recipient	Start Date	
Vessel / Station Name			Start Time	
Officer in Charge			Finish Date	
Title			Finish Time	

OPERATIONS	
Transfer Type:	Connection Type (eg 2/4 bands):
Total Length of Hose (m):	Number of Hose Sections:
Diameter (m):	Test Pressure (kPa):
Purge Method: Nitrogen / Air	Pig Used: Yes / No
Boom deployed before transfer: Yes / No	If yes, type:
Work Boat used: Yes / No	
Hose Strain Relief System used: Yes / No	

PRODUCT INFORMATION				WEATHER CONDITIONS
Type	Quantity	Start Time	Finish time	Ice:
				Wind Force (knots):
				Wind Direction:
				Sea State:
				Visibility:
				Light Conditions:

COMMUNICATIONS	
Primary Method:	(VHF/UHF CHAN/FREQ)
Backup Method:	(PHONE, RADIO, ETC)
Language Used:	

ARCTIC WATERS OIL TRANSFER **GENERAL CHECKLIST FOR ALL TRANSFERS**

GENERAL PROCEEDURE	CHECK	SUPPLIER		RECIPIENT		COMMENTS
	YES	INITIAL	DATE	INITIAL	DATE	
1. Pre-transfer P.A. Announcement made?						
2. All personnel involved are informed & adequately trained? A designated person in charge on duty at all times during the transfer operation?						
3. Language agreed to?						
4. All communications including Backup System tested?						
5. Is fire fighting equipment tested, available & are fire screens in place?						
6. Are all regulations for transfer unders tood and observed and "NO SMOKING, NAKED LIGHTS or FLAMES" signs posted?						
7. Are flashlights "intrinsically safe" and approved?						
8. Are window type A.C. units switched off?						
9. Are exterior doors and ports leading to main deck closed?						
10. Is equipment, tools & material required for transfer available at hand?						
11. Is containment equipment and absorbent material available?						
12. Has Transfer Emergency Shutdown been tested?						
13. Hoses to be used have been checked for:						
a) correct diameter & length to reach other station,						
b) chafing, cracks or other deformation,						
c) damaged fittings,						
d) blanking of hoses,						
e) continuity.						
14. All repair work at either station stopped. (if dangerous for transfer)						
15. Inert gas system is fully operational (if fitted).						

GENERAL PROCEEDURE	CHECK	SUPPLIER		RECIPIENT		COMMENTS
	YES	INITIAL	DATE	INITIAL	DATE	
16. Main transmitting aerials and radar scanners are used with due care .						

GENERAL PROCEEDURE	CHECK	SUPPLIER		RECIPIENT		COMMENTS
	YES	INITIAL	DATE	INITIAL	DATE	
17. All craft alongside are authorised and following hazard warnings, etc.						
18. Is hose test certificate or records available for inspection?						
19. Have weather and ice report s been determined?						
20. Are gas concentration accumulations in still air conditions monitored?						
21. Are all scuppers plugs in place?						
22. Are main decks free of standing water?						
23. Were manifolds drained before removing blanks?						
24. Are pressure gauges ready and in place?						
25. All sea valves on cargo systems closed?						
26. Are drip cans and trays in place, and empty?						
27. Is lighting adequate for all transfer requirements?						
28. Is mooring watch being monitored?						
29. Are spill reporting procedures understood?						
30. Are all tank vents free of blockage?						
31. Have Pressure/Vacuum Relief (PVR) valves been checked?						
32. Has a post-transfer PA announcement been made?						
33. Are International signals being displayed? (if required)						
34. Has a written procedure and the sequence of the transfer been agreed upon?						
35. Is there a clear understanding of the watch and shift arrangement?						
36. Will there be sufficient personnel a vailable at all times to monitor the transfer operation, tend cargo hose and mooring lines and take appropriate action in an emergency?						

Annex 6

Spill Response Equipment Onboard Ship

Sabina
GOLD & SILVER CORP.

Certificate / License	Qty min.	Island Tdr		ITB Rel		ITB Res		ITB Sup		ITB Vcr	
		Qty	Loc	Qty	Loc	Qty	Loc	Qty	Loc	Qty	Loc
Containment Boom	1000’	-	PC	-	PC	-	PC	-	PC	-	PC
Boom Towing Bridles	2	-	PC	-	PC	-	PC	-	PC	-	PC
Absorbent Boom 4" x 10'	10	-	PC	-	PC	-	PC	-	PC	-	PC
Absorbent Pads (100 per Bale)	6	-	PC	-	PC	-	PC	-	PC	-	PC
Absorbent Pads (Bales)	4	-	ER	-	ER	-	ER	-	ER	-	ER
Absorbent Pads (Bales)	1	-	CMR	-	CMR	-	CMR	-	CMR	-	CMR
Open Headed Barrels (empty)	4	-	PC	-	PC	-	PC	-	PC	-	PC
Pad/Barrel Ringer	1	-	PC	-	PC	-	PC	-	PC	-	PC
Aluminum Shovels	3	-	PC	-	PC	-	PC	-	PC	-	PC
Aluminum Pitch Fork	2	-	PC	-	PC	-	PC	-	PC	-	PC
Heavy Duty Plastic Bags	200	-	PC	-	PC	-	PC	-	PC	-	PC
Anchor Assemblies	4	-	PC	-	PC	-	PC	-	PC	-	PC
Garbage Pails 100 ltr.	4	-	PC	-	PC	-	PC	-	PC	-	PC

ER – Engine Room
CMR – Cargo Monitoring Room
PC – Pollution Container

TYPICAL ARCTIC SHIPBOARD POLLUTION CONTROL GEAR

Quantity	Description
1200 Feet	Oil Pollution boom, 24 inch
4	Towing kits for oil pollution boom
1	Oil skimmer, suction or oleophillic type complete with pumps and hoses
2	Workboats for boom deployment and skimmer operations
10	Bales sorbent Booms (40 ft per bale)
10	Bales sorbet pads
2	Anchor kits for booms
1	Assorted drums or portable storage for recovered product on workboats

Annex 7

Training Register and Exercise Documentation

Sabina
GOLD & SILVER CORP.

OIL HANDLING FACILITY - OIL POLLUTION EMERGENCY PLAN TRAINING REGISTRY

Course Title	Participant Name	Organization	Date	Completion Y/N	Comments

Annex 8

Material Safety Data Sheets

Sabina
GOLD & SILVER CORP.

Material Safety Data Sheet

WHMIS	Product name	TDG Road/Rail
	Diesel / Furnace oil	

Section 1. Identification

Chemical name : Fuel oil, No 2

Other means of identification : Gasoil - unspecified

Code : 0101

CAS number : Not applicable.

Relevant identified uses of the substance or mixture and uses advised against

Supplier's details : ÉNERGIE VALERO INC
1801Avenue McGill College
13è étage
Montréal, Québec
H3A 2N4

Emergency telephone number with hours of operation. : **Canutec (24 heures)**
613-996-6666

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE LIQUIDS - Category 4
SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2B
CARCINOGENICITY - Category 2

Percentage of the mixture consisting of ingredient(s) of unknown toxicity: 15%

GHS label elements

Hazard pictograms :

Signal word : Warning

Hazard statements : Combustible liquid.
Causes skin and eye irritation.
Suspected of causing cancer.

Precautionary statements

Prevention : Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Wear protective gloves. Wear eye or face protection. Keep away from flames and hot surfaces. - No smoking. Wash hands thoroughly after handling.

Section 2. Hazards identification

Response : IF exposed or concerned: Get medical attention. IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing. Wash contaminated clothing before reuse. If skin irritation occurs: Get medical attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.

Storage : Store locked up. Store in a well-ventilated place. Keep cool.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture Mixture

Ingredient name	%	CAS number
Fuel oil, No 2 Fuel oil, No 2	100 100	68476-30-2 68476-30-2

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

Peut contenir du sulfure d'hydrogène

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes skin irritation.

Section 4. First aid measures

Ingestion : Irritating to mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:
irritation
redness

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media : Do not use water jet.

Specific hazards arising from the chemical : Combustible liquid. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. Runoff to sewer may create fire or explosion hazard.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
sulfur oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Section 6. Accidental release measures

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not ingest. Avoid breathing vapor or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

United States

Occupational exposure limits

Section 8. Exposure controls/personal protection

Ingredient name	Exposure limits
Fuel oil, No 2	**ACGIH TLV (United States, 6/2013). Absorbed through skin.** TWA: 100 mg/m³, (measured as total hydrocarbons) 8 hours. Form: Inhalable fraction and vapor
Fuel oil, No 2	**ACGIH TLV (United States, 6/2013). Absorbed through skin.** TWA: 100 mg/m³, (measured as total hydrocarbons) 8 hours. Form: Inhalable fraction and vapor
Fuel oil, No 2	**ACGIH TLV (United States, 6/2013). Absorbed through skin.** TWA: 100 mg/m³, (measured as total hydrocarbons) 8 hours. Form: Inhalable fraction and vapor

Canada

Occupational exposure limits		TWA (8 hours)			STEL (15 mins)			Ceiling			
Ingredient	List name	ppm	mg/m³	Other	ppm	mg/m³	Other	ppm	mg/m³	Other	Notations
Fuel oil, No 2, measured as total hydrocarbons	US ACGIH 6/2013	-	100	-	-	-	-	-	-	-	[1] [a]
Fuel oil, No 2, as total hydrocarbons	AB 4/2009	-	100	-	-	-	-	-	-	-	
	BC 7/2013	-	100	-	-	-	-	-	-	-	[1] [b]
Fuel oil, No 2, measured as total hydrocarbons	ON 1/2013	-	100	-	-	-	-	-	-	-	[1] [c]
Fuel oil, No 2, measured as total hydrocarbons	US ACGIH 6/2013	-	100	-	-	-	-	-	-	-	[1] [a]
Fuel oil, No 2, as total hydrocarbons	AB 4/2009	-	100	-	-	-	-	-	-	-	
		-	100	-	-	-	-	-	-	-	[1] [b]
Fuel oil, No 2, measured as total hydrocarbons	ON 1/2013	-	100	-	-	-	-	-	-	-	[1] [c]
Fuel oil, No 2, measured as total hydrocarbons	US ACGIH 6/2013	-	100	-	-	-	-	-	-	-	[1] [a]
Fuel oil, No 2, as total hydrocarbons	AB 4/2009	-	100	-	-	-	-	-	-	-	
		-	100	-	-	-	-	-	-	-	[1] [b]
Fuel oil, No 2, measured as total hydrocarbons	ON 1/2013	-	100	-	-	-	-	-	-	-	[1] [c]

[1]Absorbed through skin.
Form: [a]Inhalable fraction and vapor [b]Inhalable vapour and aerosol [c]Total hydrocarbons

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.

Skin protection

Section 8. Exposure controls/personal protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid.

Color : Not available.

Odor : Characteristic.

Odor threshold : Not available.

pH : Not available.

Melting point : -40 to 6°C (-40 to 42,8°F)

Boiling point : 141 to 462°C (285,8 to 863,6°F)

Flash point : Closed cup: >56°C (>132,8°F)

Evaporation rate : Not available.

Flammability (solid, gas) : Not available.

Lower and upper explosive (flammable) limits : Lower: 0,5%
Upper: 5%

Vapor pressure : Not available.

Vapor density : Not available.

Relative density : 0,879

Solubility : Not available.

Partition coefficient: n-octanol/water : Not available.

Auto-ignition temperature : 225°C (437°F)

Decomposition temperature : Not available.

Viscosity : Kinematic (40°C (104°F)): 0,015 cm^2/s (1,5 cSt)

Aerosol product

Heat of combustion : -42,8 kJ/g

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Section 10. Stability and reactivity

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

Incompatible materials : Reactive or incompatible with the following materials:
oxidizing materials

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Fuel oil, No 2	LD50 Oral	Rat	12 g/kg	-
Fuel oil, No 2	LD50 Oral	Rat	12 g/kg	-
Fuel oil, No 2	LD50 Oral	Rat	12 g/kg	-

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
Fuel oil, No 2	Eyes - Mild irritant	Rabbit	-	0,5 minutes 100 milligrams	-
	Skin - Moderate irritant	Rabbit	-	24 hours 500 milligrams	-
Fuel oil, No 2	Eyes - Mild irritant	Rabbit	-	0,5 minutes 100 milligrams	-
	Skin - Moderate irritant	Rabbit	-	24 hours 500 milligrams	-
Fuel oil, No 2	Eyes - Mild irritant	Rabbit	-	0,5 minutes 100 milligrams	-
	Skin - Moderate irritant	Rabbit	-	24 hours 500 milligrams	-

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Section 11. Toxicological information

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes skin irritation.

Ingestion : Irritating to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:
irritation
redness

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : Suspected of causing cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Section 12. Ecological information

Bioaccumulative potential

Not available.

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT Classification	TDG Classification	Mexico Classification	ADR/RID	IMDG	IATA
UN number	UN1202	UN1202	UN1202	UN1202	UN1202	UN1202
UN proper shipping name	Diésel	Diésel	Diésel	Diésel	Diésel	Diésel
Transport hazard class(es)	3	3	3	3	3	3
Packing group	III	III	III	III	III	III
Environmental hazards	No.	No.	No.	No.	No.	No.
Additional information	This product may be re-classified as "Combustible Liquid," unless transported by vessel or aircraft. Non-bulk packages (less than or equal to 119 gal) of combustible liquids are not	-	-	**Special provisions** 640 (E)	-	-

Section 14. Transport information

	regulated as hazardous materials.					

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not applicable.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: All components are listed or exempted.
United States inventory (TSCA 8b): All components are listed or exempted.

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Fire hazard
Immediate (acute) health hazard
Delayed (chronic) health hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
Fuel oil, No 2	100	Yes.	No.	No.	Yes.	Yes.
Fuel oil, No 2	100	Yes.	No.	No.	Yes.	Yes.

State regulations

Massachusetts : None of the components are listed.

New York : None of the components are listed.

New Jersey : None of the components are listed.

Pennsylvania : The following components are listed: FUEL OIL

Canada

WHMIS (Canada) : Class B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).
Class D-2B: Material causing other toxic effects (Toxic).

Section 15. Regulatory information

Canadian lists

Canadian NPRI : None of the components are listed.

CEPA Toxic substances : None of the components are listed.

Canada inventory : All components are listed or exempted.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Inform Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

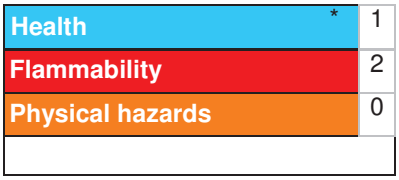
International lists

Canada : All components are listed or exempted.

Europe : All components are listed or exempted.

Section 16. Other information

Hazardous Material Information System (U.S.A.)



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Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

Section 16. Other information

Indicates information that has changed from previously issued version.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Annex 9

Transport Canada – TP-9834E
"Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and /or Marine Pollutants"

Sabina
GOLD & SILVER CORP.

Transport Canada Transports Canada

TP 9834E
(07/2009)

Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants

2ND EDITION
JULY 2009

TC-1003421

Canada

Responsible Authority	Approval
The Director Operations and Environmental Programs is responsible for this document, including any change, correction, or update.	Director Operations and Environmental Programs Marine Safety

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INTRODUCTION

These Guidelines comply as far as practicable with the general principles and standard reporting format procedures described in Resolution A.851(20) of the 20th Session of the Assembly of the International Maritime Organization (IMO), adopted 27 November 1997, as amended by Resolution MEPC.138(53).

The intent of these Guidelines is to enable the proper authorities to be informed without delay so that appropriate action may be taken when:

1. any incident occurs involving the loss, or likely loss, overboard of packaged dangerous goods in the sea; or
2. any incident occurs giving rise to pollution, or threat of pollution to the marine environment, as well as of assistance and salvage measures; or
3. any oil pollution incident occurs involving the loading or unloading of oil to or from a vessel at an oil handling facility.

The *Pollutant Discharge Reporting Regulations, 1995* stipulate that a vessel's master or owner must make reports required under the Regulations in the manner described in these Guidelines or IMO Resolution A.851(20). The Regulations also stipulate that the operator of an oil handling facility must make reports in a manner described in these Guidelines. These Guidelines should then be used in conjunction with the *Pollutant Discharge Reporting Regulations, 1995* when harmful substances and/or marine pollutants are involved. Where any discrepancy exists between the regulations and the Guidelines, the requirements of the regulations shall prevail.

1. ABBREVIATIONS

HF	High Frequency
IMO	International Maritime Organization
MARPOL	*The International Convention for the Prevention of Pollution from Ships*, 1973, and the *Protocols* of 1978 and 1997, as amended from time to time
MF	Medium Frequency
UN	United Nations
UTC	Coordinated Universal Time
VHF	Very High Frequency

2. DEFINITIONS

2.1 In these Guidelines,

"dangerous goods" means goods that by reason of their nature, quantity or mode of stowage are either singly or collectively liable to endanger the lives of the passengers or imperil the vessel and includes all substances determined by the Governor in Council, in regulations made by him, including the *Cargo, Fumigation and Tackle Regulations*, to be dangerous goods; *(marchandises dangereuses)*

"harmful substance in packaged form" means any substance which is identified as a marine pollutant in the International Maritimes Dangerous Goods Code (IMDG Code); *(substance nuisible en colis)*

"in bulk" means in a hold or tank that is part of the structure of the vessel, without any intermediate form of containment; *(en vrac)*

"incident" includes the discharge of a pollutant, a dangerous good or a harmful substance in packaged form or their anticipated discharge; (*incident)*

"marine safety inspector" means a person appointed as a marine safety inspector under section 11 of the *Canada Shipping Act, 2001; (inspecteur de la sécurité maritime)*

"marine communications and traffic services officer" means a person designated as a marine communications and traffic services officer by the Minister of Fisheries and Oceans under subsection 126(2) of the *Canada Shipping Act, 2001; (fonctionnaire chargé des services de communications et de trafic maritimes)*

"packaged form" means the forms of containment specified for harmful substances or dangerous goods in the International Maritimes Dangerous Goods Code (IMDG Code); *(en colis)*

"pollution prevention officer" means a person designated as a pollution prevention officer pursuant to section 14 of the *Arctic Waters Pollution Prevention Act*; *(fonctionnaire chargé de la prévention de la pollution)*

"waters under Canadian jurisdiction" means the internal waters of Canada as described in section 6 of the *Oceans Act*, the territorial sea of Canada as described in section 4 of the *Oceans Act* and the exclusive economic zone of Canada as described in section 13 of the *Oceans Act*, , and includes the shipping safety control zones prescribed pursuant to section 11 of the *Arctic Waters Pollution Prevention Act*. *(eaux de compétence canadienne)*

3. HOW TO MAKE A REPORT

3.1 The report should be transmitted in the following manner:

1. when an incident occurs involving a vessel in waters under Canadian jurisdiction, the report shall be made with the highest possible priority and using the quickest means available to a marine safety inspector, or for incidents occurring in a shipping safety control zone, to a pollution prevention officer;
2. when the vessel referred to in paragraph 3.1.1 is in a radio telecommunications area that is covered by Canadian Coast Guard Marine Communications and Traffic Services, the report should, where expedient, be routed through that system to a marine communications and traffic services officer;
3. when an incident occurs involving a Canadian vessel outside waters under Canadian jurisdiction, the report should be made to the nearest coastal State through an appropriate coast station, preceded by the safety signal (if the incident affects the safety of navigation), or by the urgency signal (if the incident affects the safety of the vessel or persons);
4. on appropriate frequencies (in the bands 405-525 kHz, 1605-2850 kHz or 156-174 MHz);
5. when the vessel is not within reach of a MF or VHF coast station, to the most appropriate HF coast station or on the relevant maritime satellite communication system;
6. when the vessel is within or near an area for which a vessel reporting system has been established, to the designated shore establishment responsible for operation of that system;
7. the format and procedures should, when practicable, comply with the relevant requirements of Section A2 in the Appendix, *Standard Reporting Format and Procedures*; and
8. in addition to any report referred to in paragraph 3.1.1, when an oil pollution incident occurs involving a vessel at a designated oil handling facility, the operator of the oil handling facility shall:
    1. report with the highest possible priority and using the quickest means available, to the federal emergency telephone number identified in the facility's oil pollution emergency plan;
    2. report in writing any incident involving oil to the Transport Canada Marine Safety office nearest to the facility; and
    3. report, when practicable, in compliance with the relevant requirements of Section A2 of the Appendix, *Standard Reporting Format and Procedures*.

4. CONTENT OF REPORT

4.1 Reports should contain the specific information listed in Section A3 of the Appendix, *Detailed Reporting Requirements*.

5. SUPPLEMENTARY REPORT

5.1 Particulars not immediately available should be inserted in a supplementary message or messages.

5.2 When harmful substances and/or marine pollutants are involved, a supplementary message should follow immediately or as soon as possible after the initial report. Information that is essential for the protection of the marine environment, as appropriate to the incident, should be included. That information should include Items P, Q, R, S and X, as listed in Section A2 of the Appendix.

6. PROBABILITY OF DISCHARGE

6.1 The probability of a discharge resulting from damage to the vessel or its equipment is a reason for making a report. In judging whether there is such a probability and whether a report should be made, the following factors, among others, should be taken into account:

1. the nature of the damage, failure or breakdown of the vessel, machinery or equipment; and
2. sea and wind state and also traffic density in the area at the time and place of the incident.

6.2 It is recognized that it would be impracticable to lay down precise definitions of all types of incidents involving probable discharge which would warrant an obligation to report. Nevertheless as a general guideline, the master of the vessel should make reports in cases of:

1. damage, failure or breakdown which affects the safety of vessels. Examples of such incidents are collision, grounding, fire, explosion, structural failure, flooding, cargo shifting; and
2. failure or breakdown of machinery or equipment which results in the impairment of the safety of navigation. Examples of such incidents are failure or breakdown of steering gear, propulsion plant, electrical generating system, essential shipborne navigational aids.

7. REPORT ON ASSISTANCE OR SALVAGE

7.1 The master of any vessel engaged in or requested to engage in an operation to render assistance or undertake salvage should report, as far as practicable, Items A, B, C (or D), E, F, L, M, N, P, Q, R, S, T, U, X of the *Standard Reporting Format* (Appendix). The Master should ensure that the coastal State is kept informed of developments.

APPENDIX

A1. PROCEDURES

A1.1 Reports should be sent as follows:

Dangerous Goods Report - Packaged form (DG)	When an incident takes place involving loss, or likely loss overboard of packaged dangerous goods, including those in freight containers, portable tanks, road and rail vehicles and shipborne barges, into the sea.
Harmful Substances Report in Bulk (HS)	When an incident takes place involving the discharge or probable discharge of oil (Annex I of MARPOL) or noxious liquid substances in bulk (Annex II of MARPOL).
Harmful Substances Report - packaged form (MP)	In the case of loss or likely loss overboard of harmful substances in packaged form, including those in freight containers, portable tanks, road and rail vehicles and shipborne barges, identified in the *International Maritime Dangerous Goods Code* as marine pollutants (Annex III of MARPOL).

A2. STANDARD REPORTING FORMAT AND PROCEDURES

A2.1 Sections of the reporting format which are inappropriate should be omitted from the report.

A2.2 Where language difficulties may exist, the languages used should include English, using where possible the *Standard Marine Navigational Vocabulary.*

A2.3 Alternatively, the *International Code of Signals* may be used to send detailed information. When the International Code is used, the appropriate indicator should be inserted in the text, after the alphabetical index.

A2.4 For route information, latitude and longitude should be given for each turn point, expressed as in Item C below, together with type of intended track between these points, for example “RL” (rhumb line), “GC” (great circle) or “coastal”, in the case of coastal sailing the estimated date and time of passing significant points expressed by a 6 digit group as in Item B below.

Telegraphy	**Telephone (alternative)**	**Function**	**Information Required**
Name of system (e.g., AMVER/ MAREP/ ECAREG/ NORDREG/ WESTREG)	Name of system (e.g., AMVER/ MAREP/ ECAREG/ NORDREG/ WESTREG)	System Identifier	Ship Reporting system or nearest appropriate coast radio station
DG	Dangerous goods report – packaged form	Type of report	Dangerous goods report – packaged form

Telegraphy	Telephone (alternative)	Function	Information Required
HS	Harmful substances report - in bulk	Type of report	Harmful substances report - in bulk
MP	Harmful substances report - packaged from	Type of report	Harmful substances report - packaged from
A	Vessel (alpha)	Vessel identity	Name, call sign or ship station identity, and flag
B	Time (bravo)	Date and time of event	A 6 digit group giving day of month (first two digits), hours and minutes (last four digits). If other than UTC state time zone used
C	Position (charlie)	Position	A 4 digit group giving latitude in degrees and minutes suffixed with N (north) or S (south) and a 5 digit group giving longitude in degrees and minutes suffixed with E (east) or W (west); or
D	Position (delta)	Position	True bearing (first 3 digits) and distance (state distance) in nautical miles form a clearly identified landmark (state landmark)
E	Course (echo)	True course	A 3 digit group
F	Speed (foxtrot)	Speed in knots & tenths of knots	A 3 digit group
G	Departed (golf)	Port of departure	Name of last port of call
H	Entry (hotel)	Date, time and point of entry into System	Entry time expressed as in (B) and entry position expressed as in (C) or (D)
I	Destination and ETA (india)	Destination and estimated time of arrival	Name of port and date time group expressed as in (B)
J	Pilot (juliet)	Pilot	State whether a deep sea or local Pilot is on board
K	Exit (kilo)	Date, time and point of exit from system or arrival at the vessel's destination	Exit time expressed as in (B) and exit position expressed as in (C) or (D)
L	Route (lima)	Route information	Intended track
M	Radio communications (mike)	Radio communications	State in full names of stations/frequencies guarded

Telegraphy	**Telephone (alternative)**	**Function**	**Information Required**
N	Next report (november)	Time of next report	Date time group expressed as in (B)
O	Draught (oscar)	Maximum present static drought in metres	4 digit group giving metres and centimetres
P	Cargo (papa)	Cargo on board	Cargo and brief details of any dangerous cargoes as well as harmful substances and gases that could endanger persons or the environment (See *Detailed Reporting Requirements*)
Q	Defect, damage, deficiency, limitations (quebec)	Defects/damage deficiencies/ other limitations	Brief details of defects, damage, deficiencies or other limitations (See *Detailed Reporting Requirements*)
R	Pollution/ dangerous goods lost overboard (romeo)	Description of pollutant or dangerous goods lost overboard	Brief details of type of pollution (oil, chemicals, etc.) or dangerous goods lost overboard; position expressed as in (C) or (D) (See *Detailed Reporting Requirements*)
S	Weather (sierra)	Weather conditions	Brief details of weather and sea conditions prevailing
T	Agent (tango)	Vessel's representative and/or owner	Details of name and particulars of vessel's representative or owner or both for provision of information (See *Detailed Reporting Requirements*)
U	Size and type (uniform)	Vessel size and type	Details of length, breadth, tonnage, and type etc. as required
V	Medic (victor)	Medical personnel	Doctor, physician's assistant, nurse, no-medic
W	Persons (whiskey)	Total number of persons on board	State number
X	Remarks (x-ray)	Miscellaneous	Any other information - including as appropriate brief details of incident and of other vessels involved either in incident, assistance or salvage (See *Detailed Reporting Requirements*)

Telegraphy	Telephone (alternative)	Function	Information Required
Y	Relay (yankee)	Request to relay report to another system e.g., AMVER, AUSREP, JASREP, MAREP etc.	Content of report
Z	End of report (zulu)	End of report	No further information required

A3. DETAILED REPORTING REQUIREMENTS

A3.1 Dangerous Goods Reports - Packaged Form (DG)

A3.1.1 Primary report should contain Items, A, B, C (or D), M, Q, R, S, T, U, X of the *Standard Reporting Format*; details for Item R should be as follows:

R

1. Correct technical name or names of goods.
2. UN number or numbers.
3. IMO Hazard class or classes.
4. Names of manufacturers of goods when known, or consignee or consignor.
5. Types of packages including identification marks. Specify whether portable tank or tank vehicle, or whether vehicle or freight container or other cargo transport unit containing packages. Include official registration marks and numbers assigned to the unit.
6. An estimate of the quantity and likely condition of the goods.
7. Whether loss floated or sank.
8. Whether loss is continuing.
9. Cause of loss.

A3.1.2 If the condition of the vessel is such that there is danger of further loss of packaged dangerous goods into the sea, items P and Q of the *Standard Reporting Format* should be reported; details for P should be as follows:

P

1. Correct technical name or names of goods.
2. UN number or numbers.
3. IMO Hazard class or classes.
4. Names of manufacturers of goods when known, or consignee or consignor.
5. Types of packages including identification marks. Specify whether portable tank or tank vehicle, or whether vehicle or freight container or other cargo transport unit containing packages. Include official registration marks and numbers assigned to the unit.
6. An estimate of the quantity and likely condition of the goods.

A3.1.3 Particulars not immediately available should be inserted in a supplementary message or messages.

A3.2 Harmful Substances Reports - In Bulk (HS)

A3.2.1 In the case of actual discharge, primary HS reports should contain Items A, B, C (or D), E, F, L, M, N, Q, R, S, T, U, X of the *Standard Reporting Format*. In the case of probable discharge, item P should also be included. Details for P, Q, R, T and X should be as follows:

P

1. Type of oil or the correct technical name of the noxious liquid substances on board.
2. UN number or numbers if available.
3. Pollution category (X, Y or Z), for noxious liquid substances.
4. Names of manufacturers of substances if appropriate and known, or consignee or consignor.
5. Quantity.

Q

1. Condition of the vessel as relevant.
2. Ability to transfer cargo/ballast/fuel.

R

1. Type of oil or the correct technical name of the noxious liquid substances discharged into the sea.
2. UN number or numbers if available.
3. Pollution category (X, Y or Z), for noxious liquid substances.
4. Names of manufacturers of substances if appropriate and known, or consignee or consignor.
5. An estimate of the quantity of the substances.
6. Whether loss floated or sank.
7. Whether loss is continuing.
8. Cause of loss.
9. Estimate of the movement of the discharge or loss, giving current conditions if known.
10. Estimate of the surface area of the spill if possible.

T

1. Name, address, telex and telephone number of the vessel's owner and representative (charterer, manager or operator of the vessel or their agent).

X

1. Action being taken with regard to the discharge and the movement of the vessel.
2. Assistance or salvage efforts which have been requested or which have been provided by others.
3. The master of an assisting or salvaging vessel should report the particulars of the action undertaken or planned.

A3.2.2 Particulars not immediately available should be inserted in a supplementary message or messages.

A3.3 Harmful Substance Reports - Packaged Form (MP)

A3.3.1 In the case of actual discharges, primary MP reports should contain Items A, B, C (or D), M, Q, R, S, T, U, X of the *Standard Reporting Format*. In the case of probable discharge, Item P should also be included. Details of P, Q, R, T and X should be as follows:

P

1. Correct technical name or names of goods.
2. UN number or numbers.
3. IMO Hazard class or classes.
4. Names of manufacturers of goods when known, or consignee or consignor.
5. Types of packages including identification marks. Specify whether portable tank or tank vehicle, or whether vehicle or freight container or other cargo transport unit containing packages. Include official registration marks and numbers assigned to the unit.
6. An estimate of the quantity and likely condition of the goods.

Q

1. Condition of the vessel as relevant.
2. Ability to transfer cargo/ballast/fuel.

R

1. Correct technical name or names of goods.
2. UN number or numbers.
3. IMO Hazard class or classes.
4. Names of manufacturers of goods when known, or consignee or consignor.
5. Types of packages including identification marks. Specify whether portable tank or tank vehicle, or whether vehicle or freight container or other cargo transport unit containing packages. Include official registration marks and numbers assigned to the unit.
6. An estimate of the quantity and likely condition of the goods.
7. Whether lost goods floated or sank.
8. Whether loss is continuing.
9. Cause of loss.

T

1. Name, address, telex and telephone number of the vessel's owner and representative (charterer, manager or operator of the vessel or their agent).

X

1. Actions being taken with regard to the discharge and movement of the vessel.
2. Assistance or salvage efforts which have been requested or which have been provided by others.
3. The master of an assisting or salvaging vessel should report the particulars of the action undertaken or planned.

A3.3.2 Particulars not immediately available should be inserted in a supplementary message or messages.

A4. PRIMARY REPORT FORMS

A4.1 Dangerous Goods Report - Packaged Form (DG)

Function		**Report**
DG	Type of report	/DG//
A	Vessel identity	A/ /__ __ __ __//
B	Date and time of event	B/ __ __ __ __ __ __ Z //
C	Position	C/__ __ __ __N S __ __ __ __ __ E W//
D*	Position	D/ //
M	Radio communications	M/ //
P**	Cargo on board	P/*** //
Q**	Defect, damage, deficiency, other limitations	Q/ //
R	Description of dangerous goods lost overboard	R/*** //
S	Weather conditions	S/ //
T	Agent	T/ //
U	Vessel size and type	U/ //
X	Remarks	X/ //

* Report either Item C or D.

** Include if the condition of the vessel is such that there is danger of further loss of packaged dangerous goods into the sea.

*** See *Detailed Reporting Requirements* (Appendix A3.1).

A4.2 Harmful Substances Report - In Bulk (HS)

Function		**Report**
HS	Type of report	/HS//
A	Vessel identity	A/ /__ __ __ __//
B	Date and time of event	B/ __ __ __ __ __ __ Z //
C	Position	C/__ __ __ __N S __ __ __ __ __ E W//
D*	Position	D/ //
E	True course	E/ __ __ __ //
F	Speed in knots and tenths of knots	F/ __ __ __ //
L	Route information	L/ //
M	Radio communications	M/ //
N	Next report	N/__ __ __ __ __ __ Z//
P**	Cargo on board	P/*** //
Q	Defect, damage, deficiency, other limitations	Q/*** //
R	Description of dangerous goods lost overboard	R/*** //
S	Weather conditions	S/ //
T	Agent	T/*** //
U	Vessel size and type	U/ //
X	Remarks	X/*** //

* Report either Item C or D.

** Include in the case of a probable discharge.

*** See *Detailed Reporting Requirements* (Appendix A3.2).

A4.3 Harmful Substances Report - Packaged Form (MP)

Function		**Report**
MP	Type of report	/MP//
A	Vessel identity	A/ /__ __ __ __//
B	Date and time of event	B/ __ __ __ __ __ __ Z //
C	Position	C/__ __ __ __N S __ __ __ __ __ E W//
D*	Position	D/ //
M	Radio communications	M/ //
P**	Cargo on board	P/*** //
Q	Defect, damage, deficiency, other limitations	Q/*** //
R	Description of dangerous goods lost overboard	R/*** //
S	Weather conditions	S/ //
T	Agent	T/*** //
U	Vessel size and type	U/ //
X	Remarks	X/*** //

* Report either Item C or D.

** Include in the case of a probable discharge.

*** See *Detailed Reporting Requirements* (Appendix A3.3).

7. Site Water Monitoring and Management Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Site Water Monitoring and Management Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)	Reason/Comments	Author	Date
Chapter 7	All	George	Removed water management associated with George to reflect the updated Project plan.	Project Description changed.	MB	Oct 2015
Chapter 7	All	Groundwater inflows	Updated quantity and quality data to refine groundwater inflows to underground mines.	Increased data and updated mine plan.	SRK, MB	Oct 2015
Chapter 7	All	General Water and Tailings Management	Maximise In-pit disposal of tailings and mine contact water.	Reduce Project footprints and optimize water management	SRK, MB	Oct 2015
Chapter 7	All	Water use	Updated volumes to reflect current Project demands for domestic and industrial uses.	Updated Project Description, and increased hydrological understanding.	MB	Oct 2015
Chapter 7	All	Water sources	Drawing from Goose and Big Lake.	Updated Project needs.	MB	Oct 2015

BACK RIVER PROJECT
SITE WATER MONITORING AND MANAGEMENT PLAN

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Glossary and Abbreviations

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

AEMP	Aquatic Effects Management Plan
ANFO	ammonium nitrate fuel oil
ARD	acid rock drainage
CCME	Canadian Council of Ministers of the Environment
CPUE	catch per unit effort
DFO	Fisheries and Oceans Canada
EEM	Environmental Effects Monitoring
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
FEIS	Final Environmental Impact Statement
PAD	Permanent alteration to, or destruction of, fish habitat
HDPE	high-density polyethylene
MAC	maximum average concentration
masl	metres above sea level
mg/L	milligrams per litre
ML	metal leaching
MLA	Marine Laydown Area
MMER	Metal Mining Effluent Regulations
MSC	Meteorological Service of Canada
NH_3	ammonia
NIRB	Nunavut Impact Review Board
NP	neutralizing potential
NPAG	non-potentially acid generating
NWB	Nunavut Water Board
PAG	potentially acid generating
PPCF	post pillar cut-and-fill
QA	quality assurance
QC	quality control

RBC	rotating biological contractor
Sabina	Sabina Gold & Silver Corporation
SCS	Soil Conservation Service
SNP	surveillance network program
TF	Tailings Facility
TSF	Tailings Storage Facility
TSS	Total Suspended Solids
VEC	Valued Ecosystem Component
WQO	Water Quality Objective
WRSA	waste rock storage area
WSC	Water Survey of Canada

1. Introduction

This chapter describes the Site Water Monitoring and Management Plan (the Plan) that Sabina Gold & Silver Corp. (Sabina) will follow in the development and operation of the Back River Project (the Project). This plan and other management plans are intended to describe the ways in which Sabina will address or mitigate issues identified in the Final Environmental Impact Statement (EIS). The Plan outlines the approach and strategies for managing water at the Project. This includes provisions for the Marine Laydown Area (MLA) in southern Bathurst Inlet and the Goose Property.

The document is a discipline-specific biophysical management plan that forms part of Sabina's overall Environmental Management System (EMS) developed for the Project. It has been prepared in accordance with Section 9.4.4 of the Environmental Impact Statement (EIS) Guidelines issued by the Nunavut Impact Review Board (NIRB) to Sabina (NIRB 2013). It should be read in conjunction with other relevant EIS documents. At a minimum, the following related reports and plans should be resourced:

- Hydrogeological Characterization and Modelling Report (volumes 2, V2-7A);
- Water and Load Balance Report (Volume 2, Appendix V7-2H);
- Site-Wide Water Management Report (Volume 2, Appendix V7-2I);
- Fuel Management Plan (Volume 10, Chapter 4);
- Spill Contingency Plan (Volume 10, Chapter 5);
- Mine Waste Rock Management Plan (Volume 10, Chapter 9);
- Explosives Management Plan (Volume 10, Chapter 13);
- Borrow Pits and Quarry Management Plan (Volume 10, Chapter 16);
- Aquatic Effects Management Plan (Volume 10, Chapter 19);
- Tailings Management Plan (Volume 10, Chapter 22); and
- Mine Closure and Reclamation Plan (Volume 10, Chapter 29).

The information presented herein is current as of August 2015. The Site Water Monitoring and Management Plan is a living document and will be updated based on engineering design, management reviews, incident investigations, regulatory changes, or other Project-specific protocols. The Plan will be included in Sabina's future Type A Water Licence Application and may be updated prior to submitting the application pending comments from review of the FEIS. The Plan may be updated again prior to construction if instructed to do so by the NWB during the licensing process. The plan will be reviewed on a regular basis to incorporate any lessons learned, major changes to facility operation or maintenance, the outcome of detailed design, and environmental monitoring results. Any updates to the Plan will be filed with the Annual Report submitted under the Type A Water Licence.

Concepts in this document reflect the mine plan water management phases summarized as follows:

- Phase 1 – Mobilization and Construction (Project Years -3 to -1):
  - Pre-stripping in Umwelt Pit and stockpiling, construction of various water management facilities including the tailings storage facility (TSF), and staged dewatering of Llama and Umwelt Lakes;

- Phase 2, Stage 1 – Operations, TSF (Years -1 to 2):
  - TSF operation, mining in Umwelt, Llama, and Goose Main open pits, mining in Llama and Umwelt undergrounds;
- Phase 2, Stage 2 – Operations, Umwelt TF (Years 2 to 6):
  - Umwelt Tailings Facility (TF) operation, mining in Llama, Goose Main, and Echo open pits, and Llama, Umwelt, Goose Main, and Echo undergrounds;
- Phase 2, Stage 3 – Operations, Goose Main TF (Years 6 to 10):
  - Goose Main TF operation, mining in Umwelt, Goose Main, and Echo undergrounds;
- Phase 3, Stage 1 – Active Closure, Water Treatment (Years 10 to 12):
  - Active closure and earth-moving activities, passive filling of Llama, Umwelt, and Echo pits, recirculation treatment within Goose Main TF until full;
- Phase 3, Stage 2 – Passive Closure, Water Treatment (Years 13 to 18):
  - Passive filling of Llama, Umwelt, and Echo pits, recirculation treatment from Goose Main TF until full; and
- Phase 4 – Post-Closure (Year 19-23):
  - Final minimal earth-moving and reclamation activities, post-closure confirmatory monitoring.

2. Scope and Objectives

This document describes the procedures necessary to manage the quality and quantity of water interacting with Project components throughout the mine life. It includes management practices that limit the potential for adverse impacts to receiving waters, to aquatic ecosystems, and to fish and fish habitat. The Plan details:

- Regional climate and hydrology;
- Site water balances during mine operation;
- Water quantity thresholds and water quality discharge criteria;
- Water supply locations, volumes, and facilities;
- Sewage treatment and disposal facilities;
- Water management strategies during in-water construction;
- Water management during mine operation;
- Water management during mine closure;
- Applicable legislation and guidelines;
- The roles and responsibilities of the environmental team;
- Environmental protection measures including general water management strategies;
- The monitoring program;
- Checking and corrective actions;

- Record keeping and environmental reporting;
- A framework for the evaluation of plan effectiveness; and
- A quality assurance/quality control (QA/QC) program.

The Plan applies to Construction, Operations, Closure, and Post-Closure, and it includes the Goose Property, the Marine Laydown Area (MLA), and the winter ice roads connecting these locations.

The objective is to protect the following Valued Ecosystem Components (VECs):

- Surface Hydrology;
- Freshwater Water Quality;
- Freshwater Sediment Quality;
- Freshwater Fish/Aquatic Habitat;
- Freshwater Fish Community;
- Marine Water Quality;
- Marine Sediment Quality;
- Marine Fish/Aquatic Habitat; and
- Marine Fish Community.

The Plan is structured to ensure that the Project is: built as proposed; predicted adverse environmental effects are promptly mitigated; the applied mitigation measures are successful; and relevant laws and regulations are met. It outlines procedures for the reassessment, improvement, or reorientation of the Plan if determined at any point in the Project's development that it no longer meets the initial purpose or objective.

Results of monitoring identified in this plan will be publicly reported, and may feed into other ongoing regional initiatives or programs with relevant government organizations, or regional authorities.

3. Planning and Implementation

3.1 REGIONAL CLIMATE AND HYDROLOGY

Baseline meteorological and hydrometric programs have been initiated for the Back River Property (the Property) spanning the period from 2004 to 2014. Meteorological and hydrological conditions at the Project are described by Knight Piésold Ltd. (2013) and ERM Rescan Environmental Services Ltd. (ERM 2014).

Meteorological parameter estimates utilize the Goose Lake meteorological station located at elevation 277 m above sea level (masl). The data collected at this station were combined with historical data from the Meteorological Services of Canada (MSC) branch of Environment Canada, and used in conjunction with research conducted by Waterloo University and Environment Canada to develop long-term meteorological estimates for the Project.

Available site data was correlated to the corresponding monthly temperature data at the Lupin MSC station using a linear regression analysis. The resulting synthetic temperature record has a mean annual temperature of -11.3°C. The minimum and maximum mean monthly temperatures of -30.8°C and 11.4°C occur in January and July, respectively.

Regional wind speed data are not available near the Project area, so mean monthly values were derived from the measured Goose Property record. The mean annual wind speed on site is approximately 4.4 m/s, with the wind direction exhibiting strong seasonality. The maximum recorded wind gust during the monitoring period was measured at 30.7 m/s (111 km/h).

The mean annual precipitation at the Property is estimated to be 412 mm, with approximately 55% falling as rain and 45% falling as snow. This estimate takes into consideration potential rainfall undercatch at the Goose Property station and is calibrated to the long-term mean annual runoff derived for the Project area.

The annual long-term lake evaporation (including sublimation) in the region is about 324 mm and the strongest control on evaporation is net radiation. Annual actual evapotranspiration from the tundra is estimated to be approximately 199 mm (50% of potential evapotranspiration).

Hydrometric data are currently being collected at 25 stations in the immediate Project area. Of these stations, the Propeller Lake inflow (PL-H2) and outflow (PL-H1) stations were deemed to be the most complete and representative for the Property. The 2011 monitoring year had the longest continuous record, including spring freshet and late summer flows, and was therefore used in the development of long-term synthetic flow series for the Project area. Due to the incompleteness of the records, a regional analysis was conducted using 11 hydrometric stations from the Water Survey of Canada (WSC) to determine regional hydrologic trends. The Baillie River near the mouth of WSC station (10RA002) was found to be the most comparable regional station to the 2011 local hydrometric station records. The 26 years of flow data from Baillie River were corrected to the site, generating a continuous flow record for the Project. The resultant long-term mean annual runoff for the Project area is 149 mm. A frequency analysis was conducted to the corrected long-term Baillie River record to evaluate the annual runoff during a distribution of wet and dry years.

Return period unit peak flows were calculated using the index flood method, and using a precipitation based hydrology model with Soil Conservation Service (SCS) unit hydrographs and curve numbers. Curve numbers were calibrated for each return period using two smaller regional gauging stations from the Ekati Diamond Mine (SRK 2015a).

3.2 WATER SUPPLY LOCATIONS, VOLUMES, AND FACILITIES

3.2.1 Water Quantity Thresholds

Water quantity thresholds will be established by the Nunavut Water Board (NWB) within Sabina's Type A Water Licence. Sabina has identified the following thresholds in its FEIS:

- Winter water use from lakes will not exceed 10% of the available water calculated with an appropriate ice thickness, as outlined in the Fisheries and Oceans Canada (DFO) winter water withdrawal protocol (DFO, 2010);
- Intakes in fish-bearing waters will be equipped with fish screens in accordance with DFO's water intake guideline (DFO, 1995); and,

- Water meters will be installed to monitor water consumption and facilitate the development of detailed, site-specific management strategies to reduce water consumption.

3.2.2 Estimated Water Consumption

The intake locations and consumption rates during the various Project phases are summarized in Table 3.2-1. Water at the Goose Property will be drawn from Goose Lake and Big Lake. The proposed water intake locations at Goose Lake and Big Lake are shown on Figures 3.2-1 to 3.2-3 illustrating the water management layouts.

The MLA will be constructed on southern Bathurst Inlet. Construction of the MLA is expected to begin in Year -3 and will be completed at the beginning of the Operations Phase. Ocean water will be drawn from Bathurst Inlet and will be desalinated using a reverse osmosis plant. The desalination facility will discharge brine as a product of the desalination process. Discharge of brine water from the desalination plant will meet the CCME salinity guideline for the protection of marine life and will not cause the salinity of the receiving environment to fluctuate by more than 10% of the natural expected salinity (CCME 2015). The desalination plant is designed with an intake flow rate of 33 m^3/h and a discharge rate of 30 m^3/h. Assuming the fresh water plant product has a salinity of zero, the discharge from the plant is predicted to be 10% more saline, and therefore within the CCME salinity guideline at the point of ocean discharge. The discharged effluent is expected to mix in the receiving environment, and is not expected to be detectable beyond the outfall. The locations of the water intake and discharge are identified in the drawings provided in Volume 2, Appendix V2-7J. Consumption rates at the MLA during the various Project phases are summarized in Table 3.2-1.

Table 3.2-1. Water Supply Locations and Volumes by Project Phase

Project Area	Construction		Operations		Closure		Sources
	Daily (m^3/day)	Annual (m^3/year)	Daily (m^3/day)	Annual (m^3/year)	Daily (m^3/day)	Annual (m^3/year)	
Goose Property							
Domestic	211	77,068	148	54,057	7	2,557	Big Lake
Dust Suppression and Construction Use	400	146,100	4001	60,000	400	146,100	Goose Lake
Milling	-	-	900	328,725	-	-	Goose Lake
Marine Laydown Area							Bathurst Inlet (marine)
Domestic	48	17,520	48	17,520	-	-	
Dust suppression and Construction Use	24	8,760	24	8,760	-	-	
Winter Ice Road	-	675/km	-	675/km	-	-	Multiple Sources

1: Assumes five months water use each year for dust suppression.
****The values presented above align with the Water and Load Balance Report. However, volumes assessed in the FEIS Freshwater chapters were presented conservatively higher for Big Lake.*

3.2.3 Winter Ice Road

Overland access to the Project is possible between January and April each year. During the Mobilization and Construction phase, equipment, materials, and supplies delivered mainly overland via the winter ice road to Goose Property will be staged at the MLA. Annually, in early December, preparation for the winter ice road linking the MLA to the Goose Property will be undertaken. Once the winter ice road is ready for traffic, the equipment, material, fuel, and supplies staged at the MLA will be transported by

trucks over the winter ice road to Goose Property. It is expected that the transfers will occur annually between January and April.

3.2.4 Winter Ice Road Construction and Use

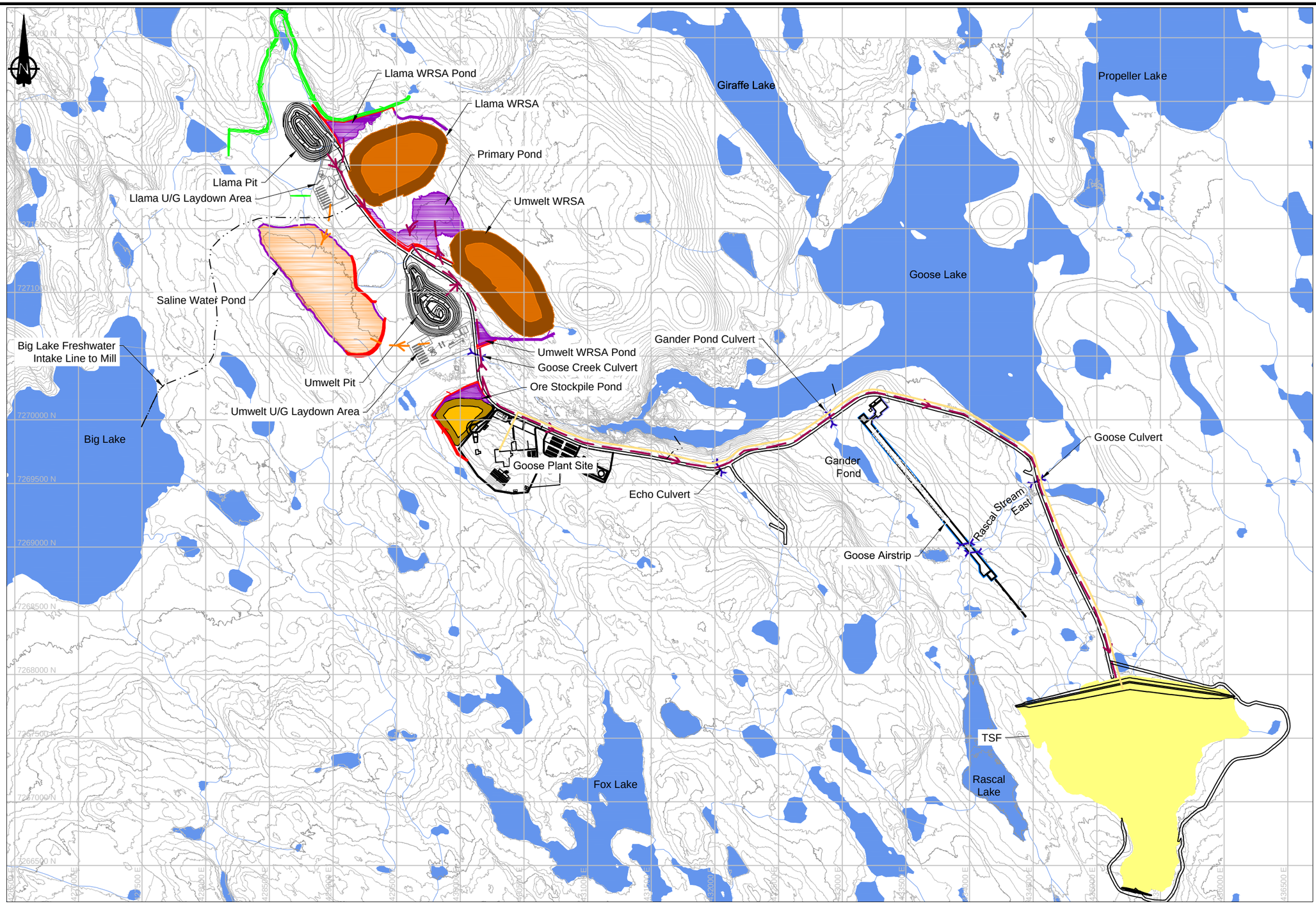
Winter ice road construction will adhere to the following guidelines based on DFO Operational Statements:

- Use existing trails or winter ice roads wherever possible as access routes to limit unnecessary clearing of additional vegetation and prevent soil compaction;
- Construct approaches and crossings perpendicular to the watercourse wherever possible;
- Construct ice bridge and snow fill approaches using clean, compacted snow and ice to a sufficient depth to protect the banks of the lake, river or stream;
- Install sediment and erosion control measures before starting work to prevent the entry of sediment into the watercourse. Inspect them regularly during the course of construction and decommissioning activities and make all necessary repairs if any damage occurs;
- Operate machinery on land or on ice and in a manner that minimizes disturbance to the banks of the lake, river or stream.
- Ensure that the intakes are sized and adequately screened to prevent debris blockage and fish mortality.
- Crossings do not impede water flow at any time of the year;
- When the crossing season is over and where it is safe to do so, create a v-notch in the centre of the ice bridge to allow it to melt from the centre and also to prevent blocking fish passage, channel erosion and flooding. Compacted snow should be removed from snow fills prior to the spring freshet;
- Stabilize any waste materials removed from the work site to prevent them from entering the lake, river, or stream. This could include covering spoil piles with biodegradable mats or tarps;
- The site should be stabilized using effective sediment and erosion control measures. In areas with permafrost, care should be exercised to ensure these measures do not cause thawing or frost heave.

Water withdrawal for the construction of ice roads will also adhere to these DFO guidelines taken from the *Protocol for Winter Water Withdrawal from Ice-Covered Waterbodies in the Northwest Territories and Nunavut* (DFO 2010):

- In one ice-covered season, total water withdrawal from a single waterbody is not to exceed 10% of the available water volume;
- In cases where there are multiple users withdrawing water from a single waterbody, the total combined withdrawal volume is not to exceed 10% of the available water volume; and
- Only waterbodies with maximum depths that are ≥1.5 m than their corresponding maximum expected ice thickness should be considered for water withdrawal.

Water for the winter ice roads will be drawn from various sources along the alignment of the winter ice road. The supply locations and consumption rates will be provided in a future version of this plan.



LEGEND

- Contact Water Event Pond
- Saline Water Pond
- Culvert Location
- Centerline of Creek
- Major Contour
- Minor Contour
- Road Infrastructure
- Intake Line
- Contact Water Diversion Berm (Unlined)
- Contact Water Diversion Berm (Lined)
- Non-Contact Water Diversion Berm (Unlined)
- Pumped Contact Water Pipeline
- Pumped Saline Water Pipeline
- Reclaim Water / Slurry Pipeline
- Waste Rock Storage Area
- Goose ROM Stockpile
- Active TSF

NOTES

1. Contours shown at 2m intervals.

REFERENCE

NAD83 UTM Zone 13.
NTS Mapsheet: 076

0m 300 600 900 1200

srk consulting

SRK JOB NO.: 1CS020.008
FILE NAME: 1CS020.008 - Goose_Phase 2-1.dwg

Sabina GOLD & SILVER CORP.

BACK RIVER PROJECT

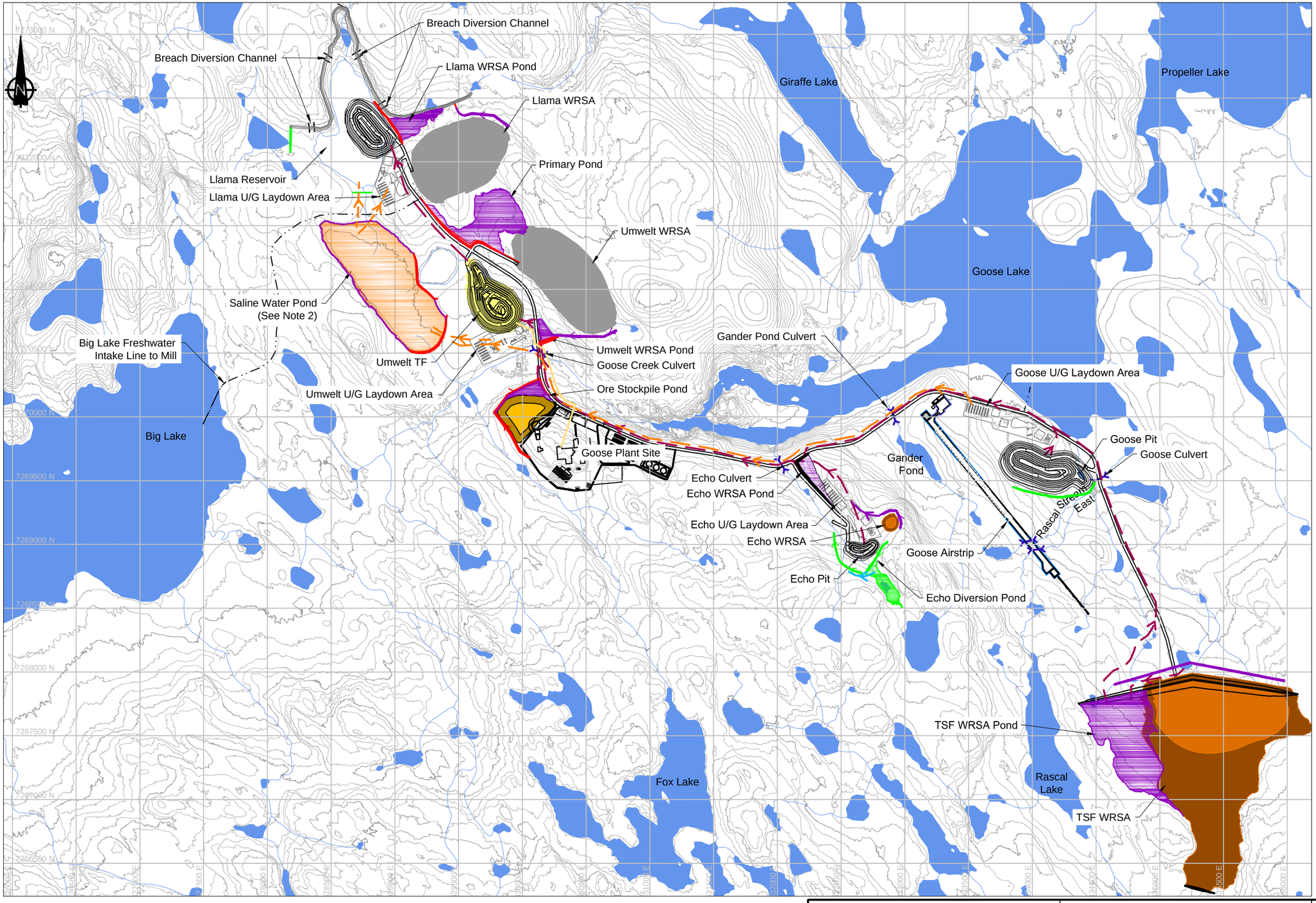
SITE WIDE WATER MANAGEMENT REPORT

PHASE 2, STAGE 1

TSF Operation
Year -1 to Year 2

DATE:	APPROVED:	FIGURE:
2015/08/21	EMR	3.2-1

P:\01_SITES\Back River\1040_AutoCAD\Water Management FEIS\1CS020.008 - Goose_Phase 2-1.dwg Plot Date: 11/5/2015 11:38 AM



LEGEND

- Contact Water Event Pond
- Saline Water Pond
- Non-Contact Water Event Pond
- Culvert Location
- Breach Location
- Centerline of Creek
- Major Contour
- Minor Contour
- Road Infrastructure
- Breached Berm
- Intake Line
- Contact Water Diversion Berm (Unlined)
- Contact Water Diversion Berm (Lined)
- Non-Contact Water Diversion Berm (Unlined)
- Pumped Contact Water Pipeline
- Pumped Saline Water Pipeline
- Pumped Non-contact Water Pipeline
- Reclaim Water/Slurry Pipeline
- Waste Rock Storage Area
- Goose ROM Stockpile
- Active TF
- Inactive TF
- Covered Waste Rock Stockpile Area

NOTES

1. Contours shown at 2m intervals.
2. Saline water from underground is pumped to Saline Water Pond. Once underground mining is complete, saline water is pumped back to underground.

REFERENCE

NAD83 UTM Zone 13.
NTS Mapsheet: 076

0m 300 600 900 1200

srk consulting

SRK JOB NO.: 1CS020.008
FILE NAME: 1CS020.008 - Goose_Phase 2-2.dwg

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BACK RIVER PROJECT

SITE WIDE WATER MANAGEMENT REPORT

PHASE 2, STAGE 2

Umwelt TF
Year 2 to Year 6

DATE:	APPROVED:	FIGURE:
2015/09/18	EMR	3.2-2

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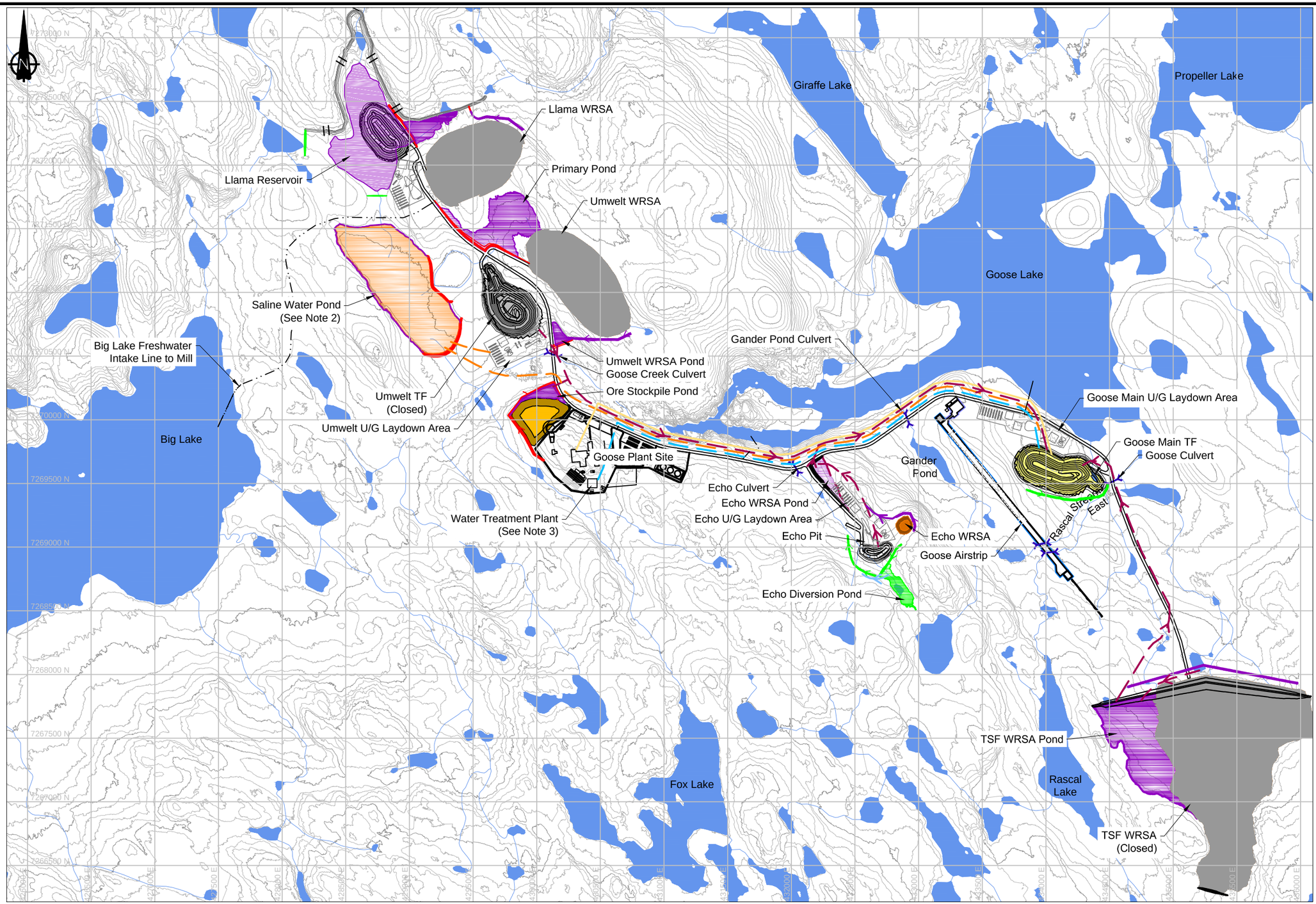

LEGEND

- Contact Water Event Pond
- Non-Contact Event Pond
- Saline Water Pond
- Culvert Location
- Centerline of Creek
- Major Contour
- Minor Contour
- Road Infrastructure
- Freshwater Intake line
- Contact Water Diversion Berm (Unlined)
- Contact Water Diversion Berm (Lined)
- Non-Contact Water Diversion Berm (Unlined)
- Breached Berm
- Water Treatment Pipeline
- Pumped Contact Water Pipeline
- Pumped Saline Water Pipeline
- Reclaim / Slurry Water Pipeline
- Pumped Non-Contact Water Pipeline
- Waste Rock Stockpile Area
- Covered Waste Rock Stockpile Area
- Goose ROM Stockpile
- Active TF
- Inactive TF
- Water Treatment Plant

NOTES

1. Contours shown at 2m intervals.
2. Saline water from underground is pumped to Saline water Pond. Once underground mining is complete, saline water is pumped back to underground and to Llama Reservoir.
3. Treated water from Goose TF is pumped back in parallel pipeline.

REFERENCE

NAD83 UTM Zone 13.
NTS Mapsheet: 076

0m 300 600 900 1200

srk consulting

SRK JOB NO.: 1CS020.008
FILE NAME: 1CS020.008 - Goose_Phase 2-3.dwg

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BACK RIVER PROJECT

SITE WIDE WATER MANAGEMENT REPORT

PHASE 2, STAGE 3
Goose TF
Year 6 to Year 10

DATE:	APPROVED:	FIGURE:
2015/08/21	EMR	3.2-3

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3.3 SEWAGE TREATMENT AND DISPOSAL

3.3.1 Sewage Discharge Criteria

Treated sewage effluent discharged by the Project will meet the discharge limits in Table 3.3-1. Distinct criteria are presented for land discharges (ultimately reporting to freshwater), discharges to the active tailings facility, and discharges to the tundra prior to entering the ocean.

Table 3.3-1. Treated Sewage Effluent Criteria

Parameter	Land Discharges - Freshwater Environment MAC[1] (mg/L)	Discharges to Tailings Facilities MAC[1] (mg/L)	Land Discharges - Marine Environment MAC[1] (mg/L)
BOD_5	30	100	100
Total Suspended Solids (TSS)	35	120	120
Fecal Coliform (CFU/100 mL)	1,000	10,000	10,000
Ammonia (NH_3-N)	4[1], 8[2]	Not applicable[3]	--
Phosphorus	4[1], 8[2]		--
Oil and Grease	No visible sheen		No visible sheen
pH	between 6.0 - 9.5		between 6.0 - 9.5
Toxicity	Not acutely toxic		Not acutely toxic

Notes:
[1] *MAC - Maximum Average Concentration.*
[2] *Maximum Grab Concentration.*
[3] *At the breach date of each tailings facility, the discharge will need to meet Metal Mine Effluent Regulation (MMER) discharge limits.*

3.3.2 Goose Property Sewage Treatment and Disposal

Sewage at the Goose Property will be treated using a package Wastewater Treatment Facility (WWTF), such as a Rotating Biological Contractor (RBC) or similar. The WWTF will be located in the Plant Site area and, during the Construction Phase, treated sewage effluent will be discharged to the tundra (Figure 3.5-1 and Appendix V2-7J). It will be land discharged to maximize attenuation distance prior to entering an outflow watercourse from Fox Lake and ultimately entering Goose Lake. Off-specification treated sewage during upset conditions will be discharged to the closest collection pond. Any discharges of sewage effluent from the collection pond will need to meet the applicable discharge criteria. In-pond treatment by coagulation can be applied if required as a contingency.

During Operations, effluent will be discharged to the active tailings management facility. During Closure and Post-Closure, the Goose Camp will convert to Pacto or incinerating toilets and effluent discharge will not be necessary. Sludge will be incinerated or landfilled.

3.3.3 Marine Laydown Area (MLA) Sewage Management

There will be no direct discharge of treated sewage effluent or camp greywater to the marine environment. The MLA camp will employ Pacto or incinerating toilets for all Project phases to avoid the need for a sewage treatment facility.

Greywater from domestic use will be pumped through an oil and grease separator prior to discharge to the tundra. It will be discharged through a designated pipeline to a relatively flat, non-channelized area on the tundra, north of the Laydown Area (Figure 3.3-1) and will ultimately flow into Bathurst Inlet. Water management at the MLA will consist of the following:

- Greywater will be discharged in an area of low slope to minimize velocities, encourage sheet flow, and minimize channelization;
- The discharge will be directed towards gravel beds or rock to reduce water velocities as appropriate; and
- To maximize attenuation, the expected flow path to the nearest receiving environment (Bathurst Inlet) is greater than 1.5 km. This is due to the gently sloping topography extending to the west and north of the discharge location.

Greywater will meet the ocean disposal criteria identified in Table 3.3-1.

3.4 WATER MANAGEMENT – GENERAL SITE RUNOFF

3.4.1 General Site Runoff

At the Goose Property, mine infrastructure and upstream catchments were delineated for the Project based on existing topography, footprints of mine infrastructure, and the Site Wide Water Management Report (Appendix V2-7I). The entire mine infrastructure area at the Goose Property will be 4.8 km^2, which is 6 % of the total Goose Lake watershed; all roads and surfaces will be constructed using geochemically suitable material. A total of 14 prediction nodes were utilized in the water balance (Appendix V2-7H) to describe the hydrology and water quality effects from the Project.

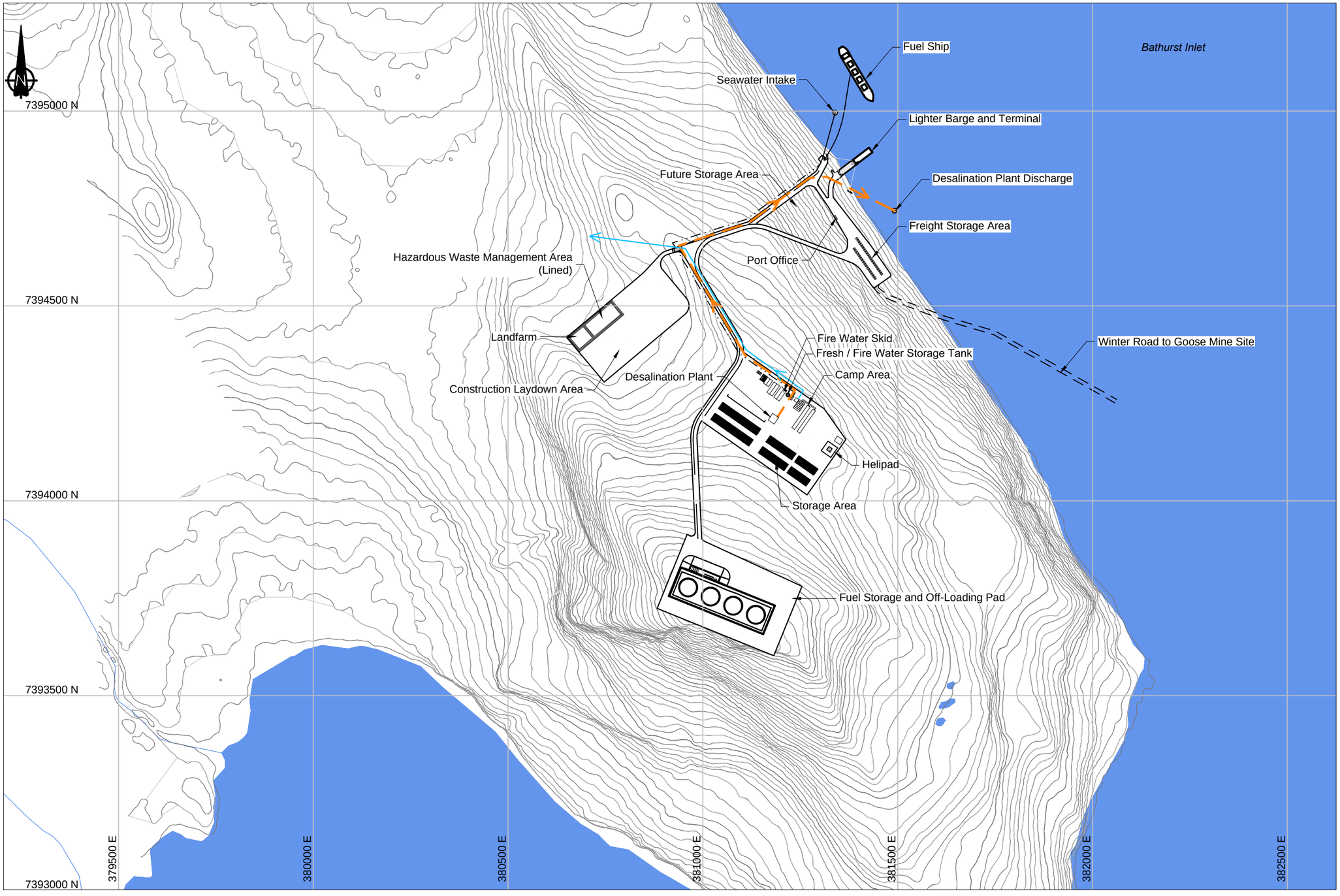
Site water is categorized into three types:

- Contact water, which is impacted by mine workings (waste rock, ore stockpile, pits, tailings, etc.);
- Non-contact water, which is runoff from undisturbed areas; and
- Saline water, which is the groundwater inflows to mining areas.
- Each category of water is managed separately throughout each Project phase. Contact water is contained in event ponds and tailings management facilities, and is transferred via diversions and pumped pipelines. Non-contact water is diverted off site through event ponds, pumped pipelines, berms, and culverts. Saline water is pumped from the underground facilities and stored in the Saline Water Pond, which during Closure is pumped back into mined-out underground workings or into the bottom of the Llama Pit, at then named the Llama Reservoir.
- Site runoff from the Plant Site area, and pads is expected to contain suspended solids due to erosion of ground surfaces, or oils and grease from heavy equipment. General site runoff will meet the discharge criteria presented in Table 3.4-1.

Table 3.4-1. Site Runoff Discharge Criteria

Parameter	Maximum Average Concentration (mg/L)	Grab Sample Maximum Concentration (mg/L)
TSS (Construction)	50[1]	100[1]
TSS (Operations)	15[2]	30[2]
Oil and Grease	No visible sheen[3]	No visible sheen[3]
pH	Between 6.0 and 9.5[3]	Between 6.0 and 9.5[3]

Notes:
[1] Source: Nunavut Water Board Water License No: 2AM-MRY1325 (2013)
[2] Source: Metal Mining Effluent Regulations (MMER)
[3]Source: Department of Environment, Government of Nunavut (2011). pH range narrowed for conservatism.



LEGEND

- Major Contour
- Minor Contour
- Intake Line
- Pumped Saline Water Pipeline
- Greywater Pipeline
- Proposed Road Infrastructure
- Laydown Pad
- Waterbody

NOTES

1. Contours shown at 2m intervals.

REFERENCE

NAD83 UTM Zone 13.
NTS Mapsheet: 096H

0m 100 200 300 400

srk consulting

SRK JOB NO.: 1CS020.008
FILE NAME: 1CS020.008 - MLA Phase 1&2.dwg

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BACK RIVER PROJECT

SITE WIDE WATER MANAGEMENT REPORT

PHASE 1 & 2
Construction and Operations
(Year -2 to Year 10)

DATE:	APPROVED:	FIGURE:
2015/09/18	EMR	3.3-1

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Ditching, berms, and sediment and erosion control measures such as sediment basins, rock flow check dams and rock armouring will be implemented (where appropriate) to manage the erosion of ground surfaces and reduce runoff of sediment into nearby waters. Discharge sites will be assessed during construction for stability and thaw-susceptibility to ensure the management structures are performing as designed. Environmental protection measures for site runoff are presented in Section 6. Water management strategies (as presented in Figures 3.2-1, 3.2-2, 3.2-3, and 3.3-1) will be updated prior to construction.

At the MLA, all roads and surfaces will be constructed using geochemically suitable material. Non-contact water will be conveyed around infrastructure as much as feasible to maintain local drainage patterns. Diversion of this clean water and snow will restrict the total volume of contact water at the site. The MLA does not require any ditches or ponds for water management purposes. Roads and pads will be designed to have runoff disperse as sheet flow to minimize channelized flow. Runoff from pads will discharge towards Bathurst Inlet along the same flow paths as the predevelopment topography. Site contact water that reaches the marine environment is predicted to meet the CCME water quality guidelines for the protection of marine aquatic life. The approximate discharge location and flow direction are presented in Figure 3.3-1.

3.4.2 Soil Landfarms

At both the Goose Property and MLA, hydrocarbon contaminated soil, resulting from accidental release of fuel, will be placed in a lined containment area (landfarm). It will be bioremediated to guidelines for industrial land use as shown in Table 3.4-2. Soil that has been remediated to meet these criteria can then be disposed of in a WRSA or reused on site, if appropriate.

Table 3.4-2. Soil Remediation Criteria

Soil Texture	Fraction 1 (C6-C10)	Fraction 2 (>C10-C16)	Fraction 3 (>C16-C34)	Fraction 4 (>C34)
Fine-grained	320 (170[2])	260 (230[2])	2,500	6,600
Coarse grained	320 (240[2])	260	1,700	3,300

Notes: [1] Source: Government of Nunavut (2009).
[2] Where applicable, for protection against contaminated groundwater discharge to an adjacent surface waterbody or for protection of potable groundwater.

Water pooling within a landfarm will be monitored for quality and will be sent to the active tailings facility or released to designated terrestrial locations. The pooling water will be released to the receiving environment if it complies with discharge water criteria presented in Table 3.4-3. Otherwise, treatment will be provided.

Table 3.4-3. Proposed Landfarm Pooling Water Quality Discharge Criteria

Parameter	Grab Sample Maximum Concentration (mg/L)[1]
pH	Between 6.0 and 9.5
Total Suspended Solids	15
Oil and Grease	15 and no visible sheen
Total lead	0.01
Benzene	0.370
Toluene	0.002
Ethylbenzene	0.09

Notes: [1] Source: Nunavut Water Board Water License No: 2AM-MRY1325 (2013)

3.4.3 Oily Water, Ice, and Snow

Oily water, ice, and snow may be generated from the following activities:

- Snow clearing operations;
- Precipitation accumulating in lined soil remediation landfarms;
- Precipitation accumulating in lined bulk fuel storage facilities; and,
- Accidental releases of fuel or other substances.

Potentially contaminated water, ice, and snow will be collected in a lined pond for treatment. Treated oily water will not be discharged directly to a waterbody. Treated oily water will be discharged to land in the summer at a minimum setback of 31 m from waterbodies provided that the water meets the criteria specified in Table 3.4-4.

Table 3.4-4. Oily Water Discharge Criteria

Parameter	Grab Sample Maximum Concentration (mg/L)
pH	Between 6.0 and 9.5
TSS	35
Oil and Grease	no sheen
Total lead	0.20
Benzene	0.370
Toluene	0.002
Ethylbenzene	0.090
Ammonia	4
Arsenic	0.5
Copper	0.30
Nickel	0.50
Zinc	0.50

Notes:
[1] *Source: Nunavut Water Board Water License No: 2AM-MRY1325 (2013)*

3.4.4 Quarries and Borrow Areas

Rock quarries and sand/gravel borrow areas will be developed at each of the Project sites to facilitate construction. The Borrow Pits and Quarry Management Plan outlines operating quarry procedures that include environmental protection measures and monitoring plans. Runoff from quarries and borrow area excavations will be managed in accordance with the environmental protection measures outlined in Section 6.6.

Runoff from the quarries and borrow pits can be elevated in suspended solids as well as possibly hydrocarbons from minor spills during refueling of equipment, and residual concentrations of ammonia from the use of ammonia nitrate fuel oil (ANFO) explosives. Runoff will be collected within the work area and will only be discharged to land if meeting the water quality criteria in Table 3.4-5. Blasting residues were modelled for the FEIS including ammonia, nitrite, and nitrate. ANFO water quality estimates are detailed for all Project phases in the Water and Load Balance Report (Appendix V2-7H).

Table 3.4-5. Quarry Runoff Criteria

Parameter	Grab Sample Maximum Concentration[1] (mg/L)
Total Arsenic	0.50
Total Copper	0.30
Total Lead	0.20
Total Nickel	0.50
Total Zinc	0.50
Total Suspended Solids	50.0
Ammonia (NH3-N)	4.0
Oil and Grease	No visible sheen
pH	Between 6.0 and 9.5

Notes:
[1] Source: Adapted from Schedule 4 of the MMER

3.4.5 Landfills

Landfills will be constructed and operated at the Goose Property. The landfills will be used for the disposal of non-combustible inert waste, and as such, are expected to generate minimal leachate.

The Goose Property landfills will be located within the waste rock storage areas (WRSAs), shown in Figures 3.2-1, 3.2-2, and 3.2-3. Any potential seepage from the Goose landfills will be collected along with mine contact water via the water management system of collection ponds and berms and will therefore be subject to meeting the same mine contact water quality requirements. Inert non-combustible waste from the MLA will be temporarily stored at the site until the waste can either be transferred to the Goose Property or backhauled by sealift for final disposal.

3.5 WATER MANAGEMENT – CONSTRUCTION ACTIVITIES

3.5.1 Culverts

There are five culvert locations predicted for the Project, all situated on the Goose Property (Figure 3.5-1). Two types of culverts are considered for the site roads and airstrip:

- Non fish-bearing crossings; and
- Fish-bearing crossings.

The non-fish-bearing crossings will consist of corrugated steel pipe and are currently designed with a diameter of either 1.2 m or 2.5 m, depending on the required flow. The fish-bearing crossings will be sized to keep maximum water velocities below 1.5 m/s such that they do not present a velocity barrier to migrating Arctic Grayling. In addition, the culverts will be embedded to a depth of 0.4 m and filled with streambed material to promote fish passage and habitat suitability.

3.5.2 Water Intakes

Water intake structures will be constructed in Goose and Big Lakes to supply domestic, industrial, and process make-up water. The selected locations for these intakes are deep and close to shore. These structures are expected to consist of an insulated PVC pipe installed into the lake on a rockfill base to keep the pipe from the lake bottom. Rock armour will be placed over the pipeline to provide ice scour protection. Insulated HDPE pipelines will convey all freshwater from the intakes to dedicated

pumphouses for the Goose Process Plant and Goose Camp. A potable water treatment plant will be constructed at the end of the domestic supply pipeline.

Construction of these intakes will involve in-water works. To limit disruption to aquatic resources, the following practices will be implemented:

- Only clean non-potentially acid generating (NPAG) armour rock that is free of sediment will be placed in the water during construction to minimize turbidity in the water during construction of the intake;
- Work will be isolated using silt curtains;
- Work will be carried out during calm periods to minimize any turbidity effects due to the re-suspension of sediment; and
- TSS and turbidity levels will be monitored throughout construction.

No in-water blasting is currently planned for the construction of the water intakes. Water intakes will be equipped with screens to prevent the entrainment or impingement of fish in accordance with current DFO requirements. Additional design details will be provided in future updates to this plan.

3.5.3 Lake Dewatering

Llama Lake will be dewatered to access the mining resource underneath the basin. It will be staged dewatered from 1.1 Mm^3 to 0.45 Mm^3 to allow for the lake footprint to be used as a reservoir for contact water generated during the Construction phase.

Umwelt Lake will be completely dewatered to allow for construction of the Saline Water Pond infrastructure.

In advance of dewatering, a "fish-out program" per the Aquatic Effects Management Plan will be completed. The fish-out program would follow the DFO's *General Fish-Out Protocol for Lakes and Impoundments in the Northwest Territories and Nunavut* (Tyson *et al.*, 2011). Lake dewatering can commence once the catch-per-unit-effort (CPUE)/recapture phase of the Fish-out Program, described in the Aquatic Effects Monitoring Plan, has been completed (typically between August and September).

The fish-out program will aim to be completed outside of periods where there is high migratory bird use of the lake (i.e., nesting, brood rearing and migration periods) to avoid the incidental take of migratory birds through entanglement in any gill nets. Mitigation measures for minimizing mortalities of diving birds may include increasing the visibility of gill nets, use of visual or auditory deterrents to prevent birds from landing on the lake during active gill-netting, monitoring migratory bird usage of the lake and determining high use feeding areas prior to setting gill nets and avoiding these areas, and reporting of by-catch to adjust mitigation measures.

Llama Lake will be dewatered into Goose Lake during the open water season of Year -3 to allow for Umwelt Pit development to begin in Year -2, as Llama Reservoir will be used to store contact water collected during Umwelt Pit mining. Prior to dewatering and open pit development, Llama Lake diversion berms will be constructed to divert upstream runoff from entering Llama Lake. Umwelt is also dewatered to Goose Lake. In both cases, it is assumed that 50% of the water from both lakes can be dewatered directly to Goose Lake, while the remaining 50% will require treatment for TSS prior to discharge to Goose Lake. Any treatment sludge generated will be disposed of in Umwelt WRSA. Once lake dewatering is complete, lake bottom sediments within the pit boundaries will be excavated and placed into Umwelt WRSA.

Llama Reservoir
Llama U/G Laydown Area
Llama Lake and Umwelt Lake Initial Dewatering Pipeline and Pump System (Year -3)
Construct Saline Water Pond (Year 1, Q1)
Primary Pond
Umwelt WRSA
Umwelt Pit
Umwelt U/G Laydown Area
Umwelt WRSA Pond
Goose Creek Culvert
Ore Stockpile Pond
Goose Plant Site
Water Treatment Plant
Echo Culvert
Gander Pond Culvert
Gander Pond
Goose Culvert
Rascal Stream East
Goose Airstrip
Main Tailings Dam (Year 1, Q4)
South Tailings Dam (Year 1, Q4)
Rascal Lake
Fox Lake
Big Lake
Giraffe Lake
Goose Lake
Propeller Lake

LEGEND

- Contact Water Event Pond
- Culvert Location
- Centerline of Creek
- Major Contour
- Minor Contour
- Road Infrastructure
- Freshwater Intake Line
- Contact Water Diversion Berm (Unlined)
- Contact Water Diversion Berm (Lined)
- Non-Contact Water Diversion Berm (Unlined)
- Pumped Contact Water Pipeline
- Pumped Saline Water Pipeline
- Pumped Dewatering Pipeline
- Pumped Clean Water Pipeline
- Treated Sewage Line
- Waste Rock Storage Area
- Goose ROM Stockpile
- Water Treatment Plant

NOTES

1. Contours shown at 2m intervals.

REFERENCE

NAD83 UTM Zone 13.
NTS Mapsheet: 076

0m 300 600 900 1200

srk consulting

SRK JOB NO.: 1CS020.008
FILE NAME: 1CS020.008 - Goose_Phase 1.dwg

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BACK RIVER PROJECT

SITE WIDE WATER MANAGEMENT REPORT

PHASE 1
Construction
Year -3 to Year -1

DATE: 2015/09/18
APPROVED: EMR
FIGURE: 3.5-1

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3.5.4 Diversion and Containment Berms

The following three types of berms will be constructed to support construction:

- Unlined non-contact water diversion berms;
- Lined contact water containment berms; and
- Unlined contact water diversion berms.

All diversion berms will be constructed directly onto the tundra surface with non-potentially acid generating (NPAG) run-of-mine (ROM) or run-of-quarry (ROQ) material that contains sufficient fines to contain and convey water. All containment berms will be constructed with ROM or ROQ material and will contain a geosynthetic clay liner (GCL) that will be tied into the active permafrost layer if the operational head is less than 4 m, and into permafrost if the operational head is greater than 4 m. Table 3.5-1 summarizes the berm construction activities.

Table 3.5-1. Berm Construction Activities during the Construction Phase

Structure	Lining Details	Notes
Llama Lake Diversion Berms (Southwest, West, East, and South)	Unlined	Divert upstream runoff from entering Llama Lake
Umwelt WRSA Containment Dam	Lined	Contains contact water in Umwelt WRSA
Umwelt WRSA Diversion Berm	Unlined	Diverts runoff from Umwelt WRSA into Umwelt WRSA Pond
Primary Pond Haul Road Containment Dam	Lined	Contains contact water in the Primary Pond to the east, alignment along haul road
North Llama WRSA Containment Dam	Lined	North section of dam constructed before west section to contain small section of Llama Lake that will store contact water
Ore Stockpile Pond Diversion Berm	Unlined	Along western edge of Ore Stockpile
Ore Stockpile Pond Containment Dam	Lined	Along northern and eastern edges of Ore Stockpile Pond

As described in the Geotechnical Design Parameters Report (Appendix V2-7C), permafrost soils are sensitive to damage if they are altered in any way. Therefore, to minimize damage, excavation into these soils should be avoided as much as practical. These designs are presented in the Site-Wide Water Management Report (Appendix V2-7I). If diversion structures result in water flowing and/or ponding over previously dry areas, it is possible that this new heat source may result in permafrost degradation. If the underlying soils are ice rich, the subsequent differential settlement resulting from ice melting may be significant. This may result in increased localized ponding that might affect the natural drainage. These potential occurrences will be monitored, and if degradation is observed, then clean overburden soil or NPAG material will be imported to manage and stabilize the settlement.

3.5.5 Open Pits

The open pits will accumulate water from direct precipitation. In addition, the Llama Pit overlaps with the talik zone of Llama Lake and as such, groundwater inflows are expected at the mine. Water will be collected using in-pit sumps and pumped to various water management facilities as follows:

- Umwelt runoff and Llama pit inflows and runoff will be pumped to the Primary Pond; and
- Goose and Echo pit runoff will be pumped to the Echo WRSA Pond.

Only Umwelt Pit will be mined during the Construction Phase, with ore being stockpiled until milling begins in Year 1.

3.5.6 Underground Mining

Underground mining is planned for the four deposits on the Goose Property: Llama, Umwelt, Goose Main, and Echo. Underground mine development will start at Llama in Year -1, at Umwelt in Year 1, at Goose Main in Year 4, and at Echo in Year 5.

Underground development is currently planned to extend below the basal permafrost at three underground mines (Umwelt, Llama, and Goose Main), and as such, groundwater inflows are expected during development. Echo underground is located completely within permafrost and as such no groundwater inflows are expected.

Groundwater inflows will be pumped into the Saline Water Pond (SWP) as surface for storage during the Operations Phase. Water in the SWP will be separated from all other contact water during the mine life and will be pumped back into mined-out underground workings and the bottom of Llama pit, to create a meromictic lake, upon Closure. Additional information on expected groundwater inflow quality and quantity can be found in the Hydrogeological Characterization Report (Appendix V2-7A).

3.5.7 Waste Rock Storage Areas

Waste rock and overburden will be co-disposed in WRSAs located close to the open pits. Runoff and seepage from the WRSAs will be collected in perimeter berms and directed towards collection ponds. Separate berms will be used to direct non-contact surface water away from the WRSAs, to minimize the amount of contact water that needs to be managed.

During the Construction Phase, the Umwelt WRSA is the only active waste rock facility. Runoff from the Umwelt WRSA will be directed to either the Primary Pond or Umwelt WRSA pond. Any water in the Umwelt WRSA pond is pumped to the Primary Pond, which is then pumped to the Llama Reservoir.

As described in the design criteria outlined in the Site-Wide Water Management Report, all collection ponds will be sized with sufficient freeboard contingency to provide both operational flexibility and accommodate large flows. Further refinements to the design will be completed during detailed engineering and will be captured in an updated version of this plan prior to construction.

3.5.8 Ore Stockpile Facility

The ore stockpile will be built up in Year -2 and Year -1 from mining of Umwelt Open Pit, before the Goose Process Plant is operating. Runoff and seepage will be directed towards the Ore Stockpile Pond via the Ore Stockpile Pond Diversion berm. This pond will be surrounded by a containment dam. Water from the Ore Stockpile Pond is pumped to the Primary Pond, which is ultimately pumped to the Llama Reservoir during the Construction phase.

3.5.9 Saline Water Pond

Umwelt Lake will be dewatered to construct the Saline Water Pond. The pond's perimeter berms will be configured as depicted in Figure 3.5-1. The pond will be completed before receiving connate water inflows pumped from the Llama underground development, which begins in Year -1.

3.5.10 Water Treatment

During the Construction Phase, flows from dewatering efforts in Llama and Umwelt lakes will be treated for TSS, and contact water stored in Llama Reservoir will be treated for both TSS and arsenic. Inventory from dewatering efforts will be treated and discharged to Goose Lake during the open water season only. After partial dewatering of Llama Lake, the contact water stored in Llama Reservoir will be treated during the open water season. Table 3.5-2 summarizes the Construction Phase water treatment schedule.

Table 3.5-2. Water Treatment during Construction Phase

Source	Discharge Location	Period Start	Period End	Flow Rate (m^3/d)	Parameter	Comment	Final Treated Volume (m^3)
Llama Lake	Goose Lake	Yr-3, Q3 (7/1/2016)	Yr-3, Q3 (10/1/16)	5,000	TSS	Initial dewatering, open water season	460,000
Umwelt Lake	Goose Lake	Yr-1, Q3 (7/1/2016)	Yr-1, Q3 (10/1/16)	1,390	TSS	Dewatering, open water season	128,000
Llama Lake	Goose Lake	Yr-2, Q3 (7/1/2016)	Yr-1, Q3 (10/1/16)	15,000	TSS, Arsenic	Final dewatering, contact water treatment, open water season	2,760,000

3.5.11 Stream Diversions

The majority of Project infrastructure has been located to avoid fish bearing water and, wherever possible, to avoid encroaching on freshwater fish habitat. Additional mitigation to avoid adverse effects on fish is required for streams that may experience reduced discharge resulting in the potential for increased fish and egg stranding. In these cases, all potential fish use (migration, spawning, rearing, and egg incubation) will be prevented by creating fish barriers at migratory pathways into channels prior to ice melt. This includes barriers constructed at the following locations:

- Umwelt Outflow at the limit of the southern flowing downstream end where the stream connects to eastern flows toward Goose Lake;
- Goose Inflow East (GIE) and Goose Inflow South (GIS) at the downstream limit where each stream enters Goose Lake; and
- Rascal Stream East (RSE): upstream of the airstrip culverts.

Blocking fish access to the GIE, GIS, and RSE streams may involve the construction of a permeable or semi-permeable gravel berm dug into the streambed. Once flows are re-established in GIE, GIS, and RSE in the Closure Period, barriers may be removed to allow fish passage into the systems. Blocking fish access to Umwelt Outflow may involve creating a permanent impassable fall or cascade barrier. This may be done to prevent fish access to upstream water management areas if required during Post-Closure.

RSE flows from Rascal Lake through the future airstrip extension, and towards the proposed Goose Main Open Pit. A culvert crossing will facilitate drainage through the Goose Airstrip and a second culvert crossing will be installed for a downstream haul road near the RSE discharge into Goose Lake.

To allow for mining of Goose Main Pit, a channel diversion (Goose Diversion) is proposed to route non-contact water around the open pit and into Goose Lake; plan and profile designs of the Goose Diversion can be seen in drawing A-20 of Appendix V2-7I. Construction will be completed during winter,

while the lake and outlets are completely frozen to eliminate any need for cofferdams. No instream blasting is currently planned during these works. This diversion work has been identified as a candidate for fisheries offsetting, and is further quantified in the Fisheries Offsetting Plan (Volume 10, Chapter 21).

3.6 WATER MANAGEMENT – MINE OPERATIONS

3.6.1 Mine Contact Water Discharge Criteria

Mine contact water is water that must be managed after contacting site workings, ore or mine wastes. This includes discharges from the TSF (none are planned during Operations), runoff from ore and waste rock storage areas, and water that has been pumped from open pits during mine operations. At the Goose Property, mine contact water will be treated to levels specified in the MMER or site specific water quality objectives prior to release at the final discharge point.

Sabina will meet Water Quality Objectives (WQOs) for entry into receiving waters (Goose Lake). The WQOs consist of the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME, 2013) and site-specific WQOs developed in line with the CCME (2007) framework, or other scientifically defensible means. Site specific WQOs have been developed for both arsenic and copper, as per Table 3.6-1.

Table 3.6-1. Water Quality Targets for Arsenic and Copper

Parameter	MMER (mg/L)	CCME (mg/L)	Site-Specific WQO (mg/L)
Total Arsenic	0.5	0.005	0.01
Total Copper	0.3	0.002	0.0042

3.6.2 Site Water Balance

A monthly operational water balance was developed for the Project using the GoldSim© software package and is detailed in the Water and Load Balance Report (Appendix V2-7H). The intent of the modelling was to optimize the water management strategy and tailings deposition schedule, and to evaluate water treatment needs during Operations and Closure to meet water quality guidelines. The model is based on mass balance principles, available hydrology inputs, mining and production schedules, developed water management plans, and best available water chemistry and source load inputs. The modelling timeline included two years of pre-production (Year -2), 10 years of Operations at a milling rate of 6,000 tpd, 13 years of Closure and Post-Closure, and 22 ensuing years for a total run length of 47 years (from Year -2 to Year 45).

The variability in runoff conditions was addressed in the analyses by using a stochastic version of the water balance model that incorporates Monte Carlo type simulation techniques. The year-to-year variability of monthly runoff was quantified by multiplying the annual runoff depth by the average monthly runoff distribution according to the typical hydrograph, a runoff factor based on the surface type, and the catchment area. The model was run in this manner with a randomly generated runoff depth for each year. A total of 100 model runs were completed using this approach. At the end of 100 model runs, all results were compiled and probability distributions of the results were generated. 5^{th}, 50^{th}, and 95^{th} percentiles were generated and reported. The 95^{th} percentile values correspond to abnormally wet conditions, and represent the values that are likely to be exceeded only 5% of the time. Conversely, the 5^{th} percentile results correspond to abnormally dry conditions and represent the values that are likely to be exceeded 95% of the time. The median (50^{th} percentile) presents the mid-point of climatic conditions.

The model is sensitive to input parameters, including the timing of Process Plant start-up, runoff coefficients, groundwater inflows, bulk density of the tailings, and seasonal ice development. Water balance schematics for the three Goose Property Operations Stages are presented as Figures 3.6-1, 3.6-2, and 3.6-3. Additional details can be found in Appendix V2-7H of Volume 2.

3.6.3 Diversion and Containment Berms

Additional water management structures will be constructed as the Project develops into Operations. All diversion and containment berms will be constructed applying the same design criteria as previously described. Table 3.6-2 outlines the berm construction and breaching activities during Operations. No breaching or construction activities are expected during Stage 3 of Operations while Goose Main TF is the active tailings facility.

Table 3.6-2. Berm Construction and Breaching during Operations

Stage - Active Tailings Facility	Action	Structure	Notes
1 – TSF	Construct	West Llama WRSA Containment Dam	Lined. Northern part of berm already constructed.
1 – TSF	Construct	Llama WRSA Diversion Berm	Unlined
2 – Umwelt TF	Breach	North Llama Non-Contact Water Diversion Berm	Once mining in Llama Open Pit is complete
2 – Umwelt TF	Construct	Echo WRSA Containment Berm	Lined
2 – Umwelt TF	Construct	Echo WRSA Diversion Berm	Unlined
2 – Umwelt TF	Construct	Echo Non-Contact Water Diversion	Unlined
2 – Umwelt TF	Construct	Goose Non-Contact Water Diversion	Unlined
2 – Umwelt TF	Construct	TSF WRSA Diversion Berm	Unlined

3.6.4 Open Pits

During Operations, accumulated precipitation into all four open pits will be collected using in-pit sumps and pumped to water management ponds as described above.

The Primary Pond is eventually pumped into Umwelt TF once mining in Umwelt is complete and tailings deposition begins there. The water and load balance model accounts for the possible salinity of the Llama pit inflows into the Primary Pond and ultimately Umwelt TF. The Echo Diversion Pond, Echo WRSA Pond, Primary Pond, and Ore Stockpile Pond are eventually breached. The Echo Pit will be allowed to fill with non-contact water from the south, and will eventually discharge into the Echo stream and Goose Lake.

3.6.5 Underground Facilities

Average groundwater inflows into the underground mines during the Operations Phase have been estimated for Umwelt (379 m^3/d), Llama (283 m^3/d), and Goose Main (50 m^3/d) underground mines. Inflows to the same mines have been estimated to be as high as 596 m^3/d, 350 m^3/d, and 85 m^3/d, respectively. TDS concentrations from the underground mine inflows are expected to be between 15,000 mg/L and 30,000 mg/L, particularly at the Umwelt and Goose Main deposits (SRK 2015c).

Groundwater accumulating in all underground mines will be pumped to the Saline Water Pond during the operational life of the mine. At Closure, water from the Saline Water Pond will be pumped back into the underground mines and to the bottom of Llama pit to create a meromictic lake.

3.6.6 Waste Rock Storage Areas

During the Operation Phase (Phase 2), water accumulating in the WRSA collection ponds at the Goose Property will be pumped to the active tailings facility (Figures 3.2-1 to 3.2-3).

At Stage 1 of Operations, the TSF is the active tailings facility and mining occurs at Umwelt and Llama open pits, and Llama and Umwelt underground facilities. As such, both Llama and Umwelt WRSAs are active waste rock facilities during this stage. Contact water from both the Llama and Umwelt WRSAs is pumped to the Primary Pond, which is ultimately pumped to the TSF.

During Stage 2 of Operations, Umwelt TF is the active tailings facility and mining occurs at Llama Pit, Goose Main Pit, and Echo Pit along with the four underground facilities. As such, all four WRSAs (Llama, Umwelt, Echo, and TSF) are active during this stage. Contact water from both the Llama and Umwelt WRSA Ponds continues to be pumped to the Primary Pond, which is pumped to Umwelt TF. Water collected by the TSF WRSA Diversion Berm from seepage through the dam is pumped back into the TSF WRSA Pond. Water from the TSF WRSA Pond will be pumped to the Echo WRSA Pond, which will then be pumped to Umwelt TF.

During Stage 3 of Operations, Goose Main TF is the active tailings facility and mining occurs in Umwelt, Goose Main, and Echo underground facilities only. All four WRSAs will be progressively closed during this stage, and permafrost aggradation will happen in parallel. Contact water from all WRSA ponds will be pumped to Goose Main TF, including inventory from the Primary Pond.

3.6.7 Ore Stockpile Facility

During Operations (Phase 2), runoff water from the Ore Stockpile Pond will be pumped to the active tailings management facility and managed as appropriate.

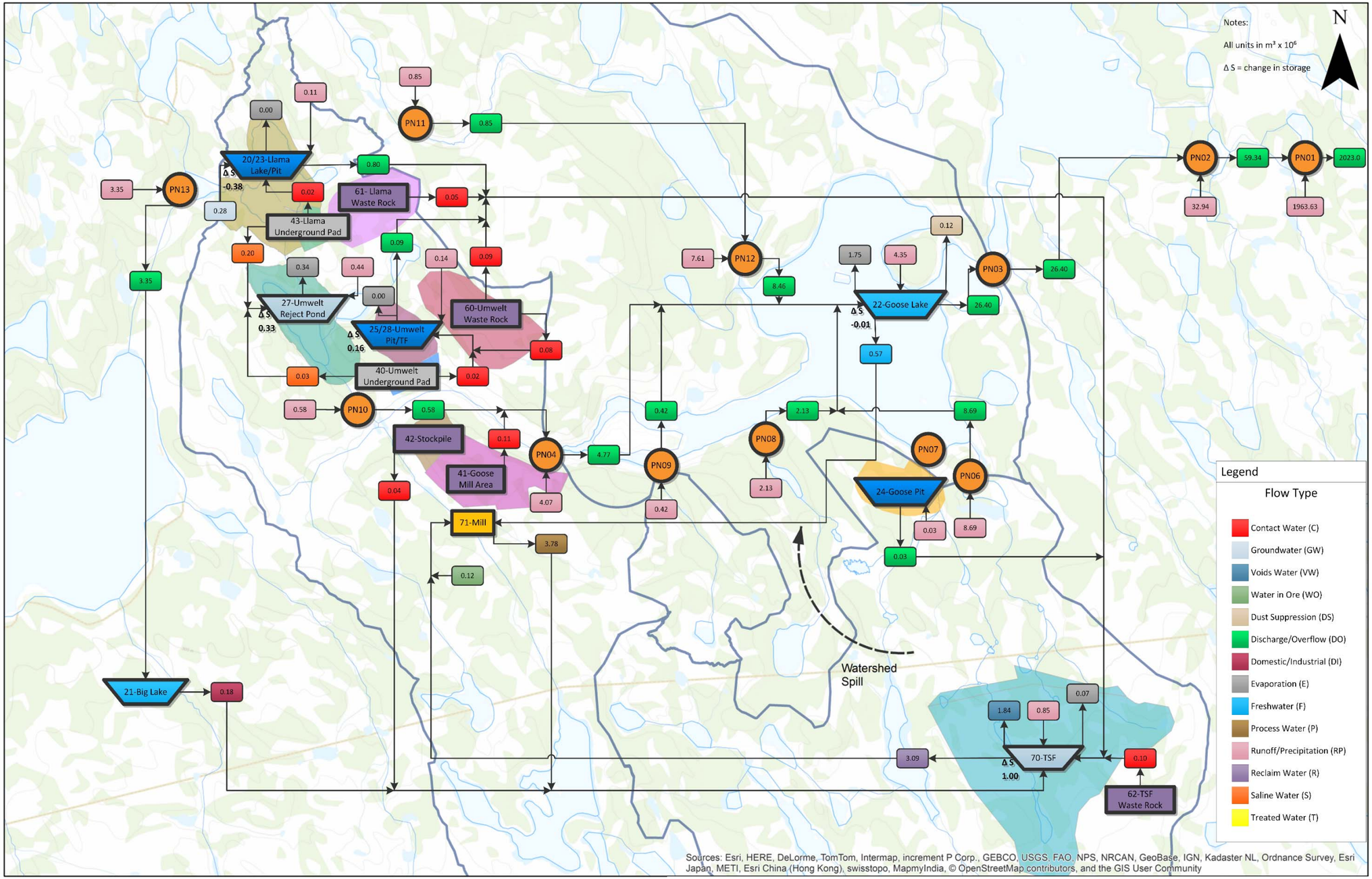
3.6.8 Tailings Management Facilities

The Tailings Storage Facility (TSF) will store both tailings solids and supernatant water for the first two years of Operations. As development continues, the mined-out open pits of Umwelt and Goose Main will be used to store tailings and supernatant water. These facilities are named the Umwelt Tailings Facility (Umwelt TF) and Goose Main Tailings Facility (Goose Main TF). The three tailings repositories will be the used as storage for all Goose Property contact water derived from the pits, WRSAs, and ore stockpiles. While each tailings management facility is active, it will also serve as the main source of reclaim water for the Process Plant, which will average 4,900 m^3/d.

A seepage analysis of the TSF liner predicts that minor seepage through the embankment of the TSF is expected. The TSF WRSA Diversion Berm, constructed downstream of the TSF, will collect surface runoff and sub-surface seepage through the active layer, which will be intercepted and pumped back into the TSF.

3.6.9 Saline Water Pond

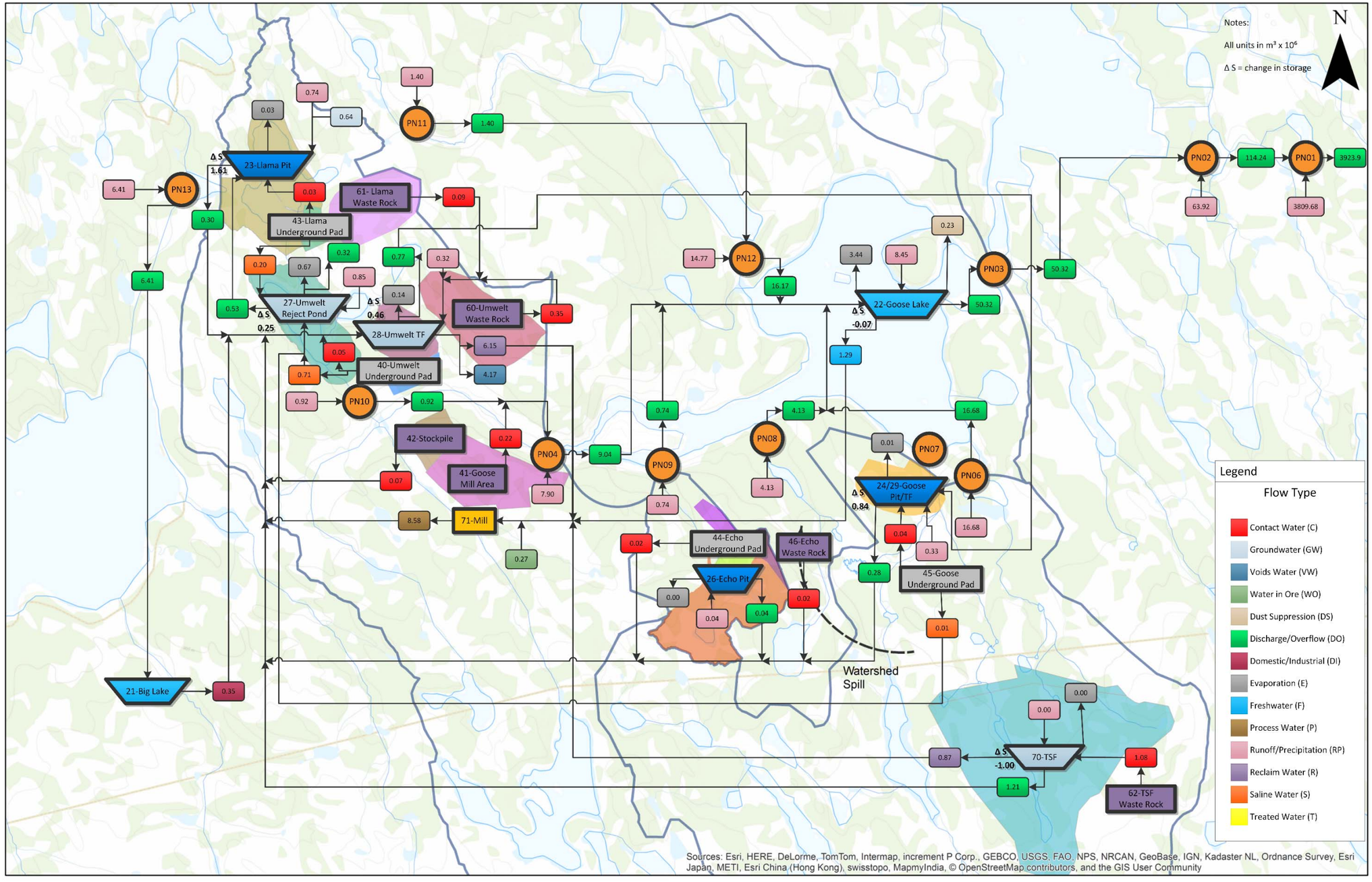
Saline water from the Llama, Umwelt, and Goose Main underground mines will be collected and pumped to the Saline Water Pond.



Phase 2 Stage 1: Yr-1,Q4 to Yr2,Q3

Note:
Volumes shown in flow type box, illustrate total volumes during the phase.
Change in storage for reservoirs (i.e. Goose Lake) are illustrated adjacent to the respective shape.

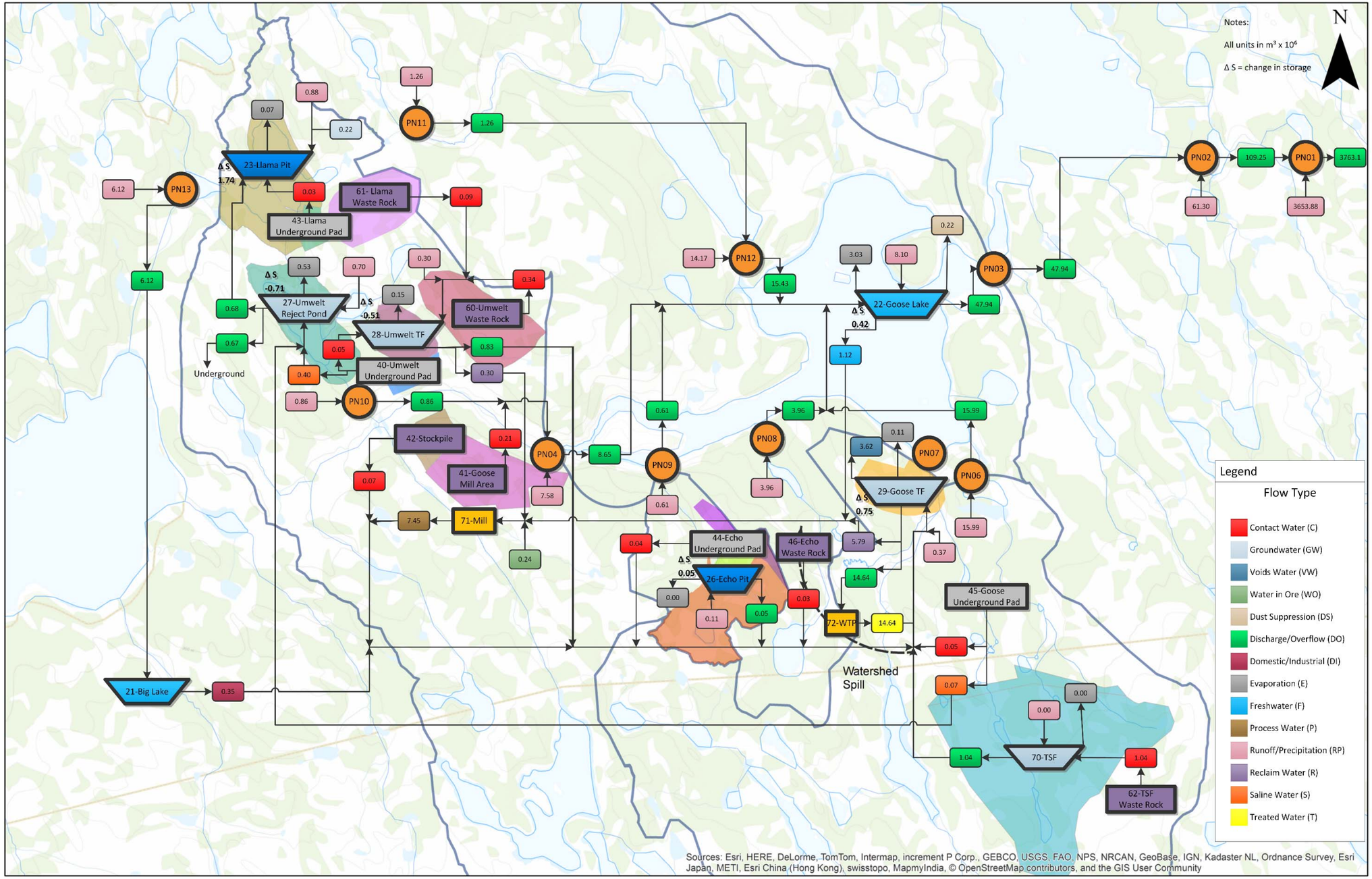
srk consulting	Sabina GOLD & SILVER CORP.	Water and Load Balance Report
		Phase 2 Stage 1 –TSF Operation
Job No: 1CS020.008 Filename: Appendix B Figures.pptx	Back River Project	Date: September 2015 | Approved: SPB | Figure: **3.6-1**



Phase 2 Stage 2: Yr2,Q4 to Yr6,Q3

Note:
Volumes shown in flow type box, illustrate total volumes during the phase.
Change in storage for reservoirs (i.e. Goose Lake) are illustrated adjacent to the respective shape.

srk consulting	Sabina GOLD & SILVER CORP.	Water and Load Balance Report
		Phase 2 Stage 2 – Umwelt TF Operation
Job No: 1CS020.008 Filename: Appendix B Figures.pptx	Back River Project	Date: September 2015 | Approved: SPB | Figure: **3.6-2**



Phase 2 Stage 3: Yr6,Q4 to Yr10,Q2

Note:
Volumes shown in flow type box, illustrate total volumes during the phase.
Change in storage for reservoirs (i.e. Goose Lake) are illustrated adjacent to the respective shape.

srk consulting	Sabina GOLD & SILVER CORP.	Water and Load Balance Report
		Phase 2 Stage 3 – Goose Main TF Operation
Job No: 1CS020.008 Filename: Appendix B Figures.pptx	Back River Project	Date: September 2015 | Approved: SPB | Figure: **3.6-3**

3.6.10 Water Treatment

Water will be treated from Goose Main TF for TSS, arsenic, and copper during Stage 3 of Operations. Inventory will be recirculated through the water treatment plant from Goose Main TF, which will continue to operate through the Closure Phase. An estimated 8,500 m^3/d will be treated annually from Year 7 to the Year 10, for an estimated treated volume of 5.4 Mm^3. No discharge to receiving waters will take place during this period.

3.6.11 Explosives Manufacture and Storage

Pre-packaged explosives delivered by air will be used early in construction until an AN Facility is constructed at the Goose Property. Ammonium nitrate for ANFO production will be delivered to the mine site in shipping containers. The storage of pre-packaged explosives and ammonium nitrate is expected to represent a low potential to impact water resources.

An explosives truck wash facility will be constructed and operated at the AN Facility. Wash water from this facility may be high in ammonia, suspended solids and/or metals. This wash water will be transported to a water management pond for treatment or discharge as appropriate. Alternatively, this truck wash water will be treated at the AN Facility in an evaporator.

3.7 WATER MANAGEMENT – MINE CLOSURE

Water management concepts during the closure period are presented in Figures 3.7-1 and 3.7-2. The total duration of Closure and Post-Closure is 13 years. Water management during this period relates to ongoing camp operation, passive filling of open pits, runoff control from WRSAs, and recirculation treatment within the Goose Main TF. The Plan will continue to be implemented until the contact water meets site-specific discharge limits and receiving water quality objectives. At this point, passive discharge to the environment will be possible. Closure activities are thoroughly discussed in the Mine Closure and Reclamation Plan.

3.7.1 Culvert Closure

Culverts will be removed from all-weather roads and the natural drainage restored. Roads will otherwise remain intact to ensure preservation of permafrost and facilitate long-term site access for monitoring and inspection.

3.7.2 Berm Closure

During the closure period, the diversion and containment berms will be breached in an effort to restore natural drainage and provide water to the open pits for filling. Table 3.7-1 presents a breaching schedule for the diversion and containment structures at the Goose Property.

3.7.3 Open Pit Closure

The open pits will be passively filled by breaching various water management structures, thereby allowing both contact and non-contact water to fill the pits. Pit water will meet applicable discharge criteria and then be allowed to overtop into nearby watercourses.

Llama Pit, which was already partially flooded by the operation of Llama Reservoir, will be further flooded as all Llama diversion berms will be breached. Runoff from the Llama WRSA will also be routed to Llama Reservoir. The Llama Reservoir will overtop under average hydrologic conditions in Year 13 and discharge towards the reclaimed Umwelt catchment.

Table 3.7-1. Diversion and Containment Berm Breach Schedule during Closure Period

Project Phase	Structure	Notes
3 - Closure	Saline Water Pond Containment Dams and Berms	After dewatering of Saline Water Pond into the underground has been completed
3 - Closure	Echo Non-Contact Water Diversion Berm	Pond floods into Echo Pit
3 - Closure	Echo WRSA Containment Dam and Diversion Berm	WRSA Pond floods into Echo Pit
3 - Closure	Primary Pond Containment Dam	Primary Pond floods to Umwelt TF
3 - Closure	Ore Stockpile Pond Containment Dam and Diversion Berms	Pond floods to Umwelt TF
3 - Closure	Llama Non-Contact Water Diversion Berms	Allows Llama Reservoir to fill
3 – Closure	Llama WRSA Containment Dam (West)	Drains Llama WRSA Pond into Llama Reservoir
3 - Closure	Goose Non-Contact Water Diversion Berm	Allows Goose Main TF to flood after treatment is completed
4 – Post-Closure	Llama WRSA Diversion Berm and WRSA Pond Containment Dam (North)	WRSA will be fully capped and frozen, no need to divert water anymore
4 – Post-Closure	Umwelt WRSA Diversion Berm and WRSA Pond Containment Dam	WRSA will be fully capped and frozen, no need to divert water anymore
4 – Post-Closure	Main TSF Dam and TSF WRSA Diversion Berm	TSF WRSA Pond will be breached towards Goose Main TF and onwards to Goose Lake
4 – Post-Closure	Goose Main Pit Diversion Berm	Restores natural drainage and allows Goose Main TF to fill

Umwelt Pit will be allowed to fill with catchment water, as well as water from the breached Primary Pond and Ore Stockpile Pond. Water from the Umwelt WRSA will also be routed to Umwelt Pit. Umwelt Pit will be breached at the north end and will overtop in Year 14 under average hydrologic conditions.

Echo Pit will be allowed to fill with catchment water from the south, as well as water from the breached Echo WRSA Pond. Echo Pit is expected to overtop in Year 14 under average hydrologic conditions, and will eventually discharge into Echo Stream, which then flows into Goose Lake.

Recirculation treatment in Goose Main Pit will continue during the open water season until Year 18, at which point the pit will be filled. Water from the TSF WRSA Pond will continue to be pumped into Goose Main TF throughout this period as well. The pit will be breached at the north end into Goose Lake once WQOs have been met.

Pit lake water quality monitoring will be conducted to ensure it meets discharge criteria prior to pit overtopping and passive discharge. In the unlikely event that the water in any of the pit lakes is not suitable for discharge, the pit lake would be batch-treated to address any remaining water quality impairments. Five years of post-closure water quality monitoring will continue for each open pit to ensure that WQOs are met.

3.7.4 Underground Facility Closure

During mine operations, saline groundwater entering the underground workings will be pumped to the Saline Water Pond at surface. At closure, the Saline Water Pond will be dewatered back into Llama, Umwelt, and Goose Main underground mines. Vent raises and underground portals will be capped with either concrete or waste rock. Waste Rock Storage Area Closure

Giraffe Lake
Propeller Lake
Goose Lake
Big Lake
Fox Lake
Rascal Lake
Gander Pond
Closed Llama WRSA
Llama Pit (Flooded)
Primary Pond Breached to Umwelt Pit
Closed Umwelt WRSA
Decommission dams around Saline Water Pond
Umwelt TF (Flooded)
Goose Creek Culvert
Gander Pond Culvert
Goose TF (Flooded Year 18)
Goose Culvert
Rascal Stream East
Airstrip
Echo Culvert
Breach Echo WRSA Pond
Water Treatment Plant (See Note 2)
Echo Pit (Flooded)
Echo Diversion Pond (Breached to Echo Pit In Year 11)
TSF WRSA Pond
Closed TSF WRSA
7270000 N
7269500 N
7269000 N
7268500 N
7268000 N
7267500 N
7267000 N
7266500 N
425500 E
426000 E
426500 E
427000 E
427500 E
428000 E
428500 E
429000 E
429500 E
430000 E
430500 E
431000 E
431500 E
432000 E
432500 E
433000 E
433500 E
434000 E
434500 E
435000 E
435500 E
436000 E
436500 E

LEGEND

- Contact Water Event Pond
- Culvert Location
- Centerline of Creek
- Major Contour
- Minor Contour
- Road Infrastructure
- Non-contact Diversion Berm (Unlined)
- Contact Water Diversion Berm (Lined)
- Non-contact Diversion Berm (Unlined)
- Breached Berms
- Pumped Contact Water Pipeline
- Water Treatment Pipeline
- Breach Location
- Covered Waste Rock Stockpile Area
- Inactive TF
- Water Treatment Plant
- Decommissioned Pad
- Pit Lake (Closed)

NOTES

1. Contours shown at 2m intervals.
2. Treated water from Goose TF is pumped back in parallel pipeline.

REFERENCE

NAD83 UTM Zone 13.
NTS Mapsheet: 076

0m 300 600 900 1200

srk consulting

SRK JOB NO.: 1CS020.008
FILE NAME: 1CS020.008 - Goose_Closure.dwg

Sabina GOLD & SILVER CORP.

BACK RIVER PROJECT

SITE WIDE WATER MANAGEMENT REPORT

PHASE 3
Closure
Year 10 to Year 18

DATE:	APPROVED:	FIGURE:
2015/09/18	EMR	3.7-1

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Closed Llama WRSA
Closed Umwelt WRSA
Giraffe Lake
Propeller Lake
Goose Lake
Big Lake
Gander Pond
Rascal Stream East
Airstrip
TSF WRSA Breach Location in Year 18 (See Note 2)
Rascal Lake
Fox Lake
Closed TSF WRSA

LEGEND

- Centerline of Creek
- Major Contour
- Minor Contour
- Proposed Road Infrastructure
- Breached Berm
- Breach Location
- Covered Waste Rock Stockpile Area
- Decommissioned Pad
- Inactive TF
- Pit Lake (Closed)

NOTES

1. Contours shown at 2m intervals.
2. TSF WRSA pond breached to Goose TF.

REFERENCE

NAD83 UTM Zone 13.
NTS Mapsheet: 076

0m 300 600 900 1200

srk consulting

SRK JOB NO.: 1CS020.008
FILE NAME: 1CS020.008 - Goose_Post-Closure.dwg

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BACK RIVER PROJECT

SITE WIDE WATER MANAGEMENT REPORT

PHASE 4
Post-Closure
Year 18+

DATE:	APPROVED:	FIGURE:
2015/09/18	EMR	3.7-2

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During Operations, potentially acid generating (PAG) waste rock storage areas will be progressively covered with a 5 m cap of NPAG waste rock to promote the aggradation of permafrost in the WRSAs so that the PAG rock remains frozen. Final sloping and minor NPAG covering activities will occur during the Closure Phase.

Runoff from the WRSAs will be collected in the Operations Phase. The collection ponds will be monitored and ultimately pumped to the active tailings facility. Permafrost aggradation into the WRSAs will also be monitored. Once the runoff consistently meets the site-specific contact water discharge criteria, the collection ponds will be breached and removed and the final post-closure discharge will be established.

Five years of post-closure water quality monitoring from the WRSAs will take place to ensure WQOs are being met.

3.7.5 Ore Stockpile Facility Closure

Milling of all remaining stockpiled material will be completed in Year 10. The Ore Stockpile Pond Containment Dam is breached at the beginning of the closure period so that the pond flows towards Umwelt TF. No remaining seepage or runoff from the area is expected. Five years of post-closure water quality monitoring will be conducted in the area to ensure runoff meets WQOs.

3.7.6 Tailings Management Facility Closure

No tailings deposition and nor milling will occur during the closure period. Umwelt TF will be flooded during the closure period as proximal water management berms are breached and it is allowed to passively fill. Confirmatory water quality monitoring will take place before the pit is breached in order to make sure WQOs have been met.

Seepage collected by the TSF WRSA Diversion Berm will continue to be pumped back into the TSF WRSA Pond. Water collected from the TSF WRSA Pond will continue to be pumped to the Goose Main TF. This process will continue until Year 18 when Goose Main TF is full. At this point, both the TSF dam and the TSF WRSA Diversion Berm will be breached, allowing any remaining runoff to flow towards Goose Main TF.

Recirculation treatment during the open water season at a rate of 8,500 m^3/d will continue from Goose Main TF until it overtops in Year 18, under average hydrologic conditions, and water quality monitoring has confirmed that the WQOs have been met. The Goose Main Pit Diversion Berm and the Goose Main Pit rim will then be breached to allow water to flow into Goose Lake. The closure period may be extended if WQO's are not satisfied, thus necessitating further treatment.

Five years of post-closure water quality monitoring will be conducted at the former tailings facilities to ensure WQOs are being met.

3.7.7 Saline Water Pond Closure

The Saline Water Pond will be dewatered into Llama, Umwelt, and Goose Main underground mines. Once it is dewatered, sediments will be tested and if the chloride content is too high, it may be removed and placed in an appropriate location. The SWP diversion berms and dams will then be breached allowing Umwelt Lake to re-establish. No further water management activities at the Saline Water Pond will take place during closure. Water quality monitoring will happen during the closure and five year post-closure periods to ensure WQOs are being met.

3.7.8 Water Treatment Closure

As mentioned above, 8,500 m^3/d of recirculation treatment for TSS, arsenic, and copper will continue throughout closure at the Goose Main TF during the open water season. Based on the load balance model, water quality within Goose Main TF is expected to meet or exceed WQOs by Year 18, the time at which Goose Main TF is also expected to flood. Once this has been confirmed by water quality sampling, all pumping and piping infrastructure as well as water treatment plant itself will be dismantled and landfilled. Sludge produced from water treatment during the closure period will also be landfilled.

4. Water Management – Care and Maintenance

Temporary closure (also termed Care and Maintenance) is defined as the cessation of mining and processing operations for a finite period of time with the intention of resuming operations upon resolution of the cause of cessation (MVLWB/AANDC 2013). Care and Maintenance activities will depend on the phase at which cessation of operations takes place.

Monitoring will take place and continue as outlined in Section 7 at whatever phase cessation occurs. Key surface water infrastructure will be maintained through Care and Maintenance to ensure proper operation. Depending on the stage at which temporary closure occurs, the water level in the active tailings facility at the time may l need to be monitored as there will be a net buildup of water due to the fact that no reclaim water will be used for processing. Should temporary closure occur for a long period of time (i.e. one or more years), it may be necessary to begin pumping from the active tailings facility and treating the excess water for discharge.

The level of effort involved in maintaining the site in a state of temporary closure will depend on the Project stage. For more details, refer to the Mine Closure and Reclamation Plan (Volume 10, Chapter 29).

5. Applicable Legislation and Guidelines

The Site Water Monitoring and Management Plan is a requirement of the EIS Guidelines issued to Sabina by NIRB and it forms part of the DEIS.

The Site Water Monitoring and Management Plan has been designed to comply with the following regulations:

- Nunavut Waters and Nunavut Surface Rights Tribunal Act (2002);
- *Northwest Territories Waters Regulations*, under the *Northwest Territories Waters Act (SOR/93-303)* (expected to be replaced in the near future by a Nunavut Waters Act and regulations);
- *Fisheries Act* (1985), including the MMER (SOR/2002-22);
- *Nunavut Environmental Protection Act* (1988); and
- *Nunavut Land Claim Agreement Act* (1993c).

Water use and waste disposal in Nunavut is regulated by the NWB through the water licensing process. The Project will be subject to a Type A Water Licence.

6. Roles and Responsibilities

Environmental management at the Project is the responsibility of all site personnel, including employees and contractors. This philosophy will be communicated to all that go to the Project site.

A Health, Safety, and Environment (HSE) team will be established to lead environmental management at the site. Community and government relations will also be the responsibility of the HSE team. Corporately, these aspects of the Project will be led by a Vice President, Environment & Sustainability, who reports to the Chief Executive Officer and the Board of Directors.

At the Project sites, the General Manager will be responsible for environmental management, supported by an HSE team and reporting to the Vice President, Environment & Sustainability. An HSE Manager will be responsible for the day-to-day environmental management activities. These will evolve with the development of the corporate and Project-specific organization philosophies.

7. Environmental Protection Measures

7.1 GENERAL OBJECTIVES

The purpose of environmental protection measures for site water management is to eliminate or reduce the Project effects on water quality.

The main objectives of Sabina's water management strategies are to:

- Minimize the amount of water that contacts mine ore and wastes, which ultimately reduces the volume of water requiring management;
- Appropriately manage all contact water and discharges to protect local aquatic resources; and,
- Implement water conservation and recycling to maximize water reuse and minimize the use of natural waters.

Protection measures may include the planning and design of engineered structures, the application of control technologies, the implementation of best management practices, and specific requirements from regulatory authorizations. Monitoring of the protection measures and adaptive management are also an integral part of effective environmental protection measures.

7.2 WATER USAGE AND CONSERVATION MEASURES

7.2.1 General Measures

The following protection measures will be applied to water usage:

- Freshwater intakes will be designed to limit erosion and sedimentation, protect against freezing, and accommodate peak flows;

- Controlled construction of the engineered intakes will ensure minimal changes in turbidity and resuspension of sediment;
- All material used in construction will be clean, free of sediment, and geochemically stable; and,
- All intakes will be screened in accordance with the *Freshwater Intake End-of-Pipe Fish Screen Guideline* (DFO, 1995). The water withdrawal rate will be controlled such that fish do not become impinged on screens.

Water will be recycled to the maximum extent possible. The most significant water recycling activities will be within the tailings management facilities. The TSF and the Umwelt TF and Goose Main TF will store both tailings solids and supernatant water. The supernatant water will include contact water from the open pits and WRSAs. Water will be recycled and form the main source of reclaim water for the Process Plant.

7.2.2 Water Use Conservation Measures

Long-term water usage has been closely evaluated as part of the FEIS. The focus has been on identifying maximum water use, while protecting fish and fish habitat. Short-term use will be required for various Project activities (i.e., winter ice road construction, dust suppression, etc.). Potential short-term water sources will be evaluated in advance to determine if they will be adequate for the activity in accordance with the DFO (2010) winter water withdrawal guidelines:

- Total water withdrawal from a single waterbody will not exceed 10% of the available water volume; and,
- Only waterbodies with maximum depths that are ≥1.5 m than their corresponding maximum expected ice thickness should be considered for water withdrawal.

7.3 SEDIMENT AND EROSION CONTROL MEASURES

Surface water will be managed within the Project footprint such that sediment-laden runoff is minimized, intercepted, and/or treated prior to entering downstream receiving waters or mine process facilities. Effective sediment control depends on the isolation of easily-eroded, disturbed ground surfaces.

Measures will be implemented to reduce the quantity of runoff where the mobilization of sediments cannot be eliminated. Sediment-laden water will be captured and routed to sediment basins.

Sediment and erosion management and control during initial and ongoing construction may involve establishing contact water collection ditches/berms, constructing sediment ponds, limiting land disturbance to a practical minimum, reducing water velocities across the ground through surface texturing and re-contouring, and progressively rehabilitating and stabilizing disturbed land surfaces to minimize erosion.

Exposed landscape surfaces will be protected by the installation of covering material such as riprap, aggregate, or rolled erosion control products. Runoff flow may be controlled by a combination of measures, including:

- Texturing/grading of slopes to slow runoff and reduce effective slope length;
- Synthetic permeable barriers and/or fibre rolls to reduce runoff velocities and retain sediments; and,

- Check dams, gabions, and energy dissipation structures to reduce flow velocities in channels.

Sediment levels in runoff will be minimized by intercepting sediment before it reaches the freshwater environment. In addition to measures aimed at controlling runoff flow, the quantity of transported material in runoff may be controlled by measures including:

- Preserving riparian zones which trap sediment and to reduce flow velocities;
- Installing synthetic permeable barriers, fibre rolls, and/or silt fences as required;
- Installing check dams, gabions, and sediment basins to reduce flow velocities and encourage sediment deposition;
- Maintaining and repairing any machinery prior to use that has the potential to result in a fluid release or leak; and
- Locating fuel transfer and maintenance activities greater than 31 m from a watercourse or waterbody, except for approved activities near water.

7.4 MINE WATER RUNOFF MANAGEMENT

A number of environmental protection measures will be implemented to manage mine water runoff, including:

- Collection of all mine water runoff through use of diversions, collection ditches/berms and pipelines;
- Recycling of mine contact water to the extent possible at the Goose Property (Section 6.2);
- Treatment of mine contact water prior to discharge to the environment during Construction, Operations, and Closure;
- Land discharge of mine contact water where possible, rather than direct discharge to surface waters; and
- Passive discharge of mine contact water during the Post-Closure Phase, provided MMER discharge criteria and WQOs will be met.

At the Goose Property, these measures will be achieved by collecting all mine contact water from open pits, ore stockpiles, WRSAs and the tailings management facility. Water will be recycled from the TSF and TFs for use in the milling process. At Closure, water from Goose Main TF will be circulated through the treatment plant until water quality has improved to discharge criteria. As previously mentioned, passive discharge of untreated mine contact water will occur during Post-Closure only if discharge criteria and receiving water quality objectives are met. In the unlikely event that mine water runoff from pit lakes and WRSAs do not meet discharge criteria, water treatment will be provided by directing runoff from these areas to a central location and treating from there.

Diversion structures will be required around the Goose Main open pit to divert non-contact water away from mining areas. This strategy will reduce the total amount of contact water generated by the Project. Mine water runoff management has been optimized based on the plans assessed in the FEIS. The management strategies will continue to evolve and will be finalized during detailed design.

7.5 GENERAL SITE RUNOFF

Collected water or runoff that meets the criteria specified in Table 3.3-1 will be discharged to land, and where possible at a minimum setback of 31 m from a waterbody, provided the water meets the

criteria. To protect the freshwater environment during construction and decommissioning activities, the Project will minimize runoff and the transport of material into freshwater by the following planning and design measures:

- WRSAs will be confined to the local watersheds where the deposits are located to limit potential effects on water quality in local drainage areas;
- Infrastructure will be located, whenever feasible, on competent bedrock or appropriate base material that will limit permeability and the transport of potentially lower quality water into the active layer and ultimately to the freshwater environment;
- Footprint areas of Project components will be minimized, such as locating infrastructure nearer to the central location of Project sites around the deposits; and
- The landscape will be reclaimed as soon as possible to minimize erosion potential.

At select water crossings, pumping or siphoning may be employed to facilitate the transfer of water from one side of the structure to the other side. Pumping may be required at crossings where culverts were not installed, culverts were improperly installed, or culverts were installed with insufficient capacity. Pumping can also serve as a temporary solution during freshet or prior to a culvert installation.

7.6 BORROW AREA AND QUARRY DEVELOPMENT

Plans to develop aggregate sources as well as the identified environmental protection measures and monitoring plans are described in the Borrow Pits and Quarry Management Plan. The following summarizes the environmental protection measures identified to minimize impacts to water during borrow area and quarry planning and development:

- Maintain a setback distance of 31 m from creeks and streams;
- Preserve vegetative buffers to limit impacts on water quality;
- Use berms and ditching to direct runoff away from the excavation;
- Slope rock quarry floors so that water is diverted to a sump within the quarry or adjacent to the quarry boundaries where it can be monitored prior to release;
- Sample accumulated water within water collection areas for TSS, oil and grease, and ammonia-nitrogen;
- Apply sediment and erosion control measures such as those described in Section 6.3;
- Use dust skirts on conveyors and apply dust suppression measures as identified in the Air Quality Monitoring and Management Plan (Volume 10, Chapter 17);
- Monitor for ground ice during excavation of borrow areas;
- Monitor and address any subsequent settlement to maintain positive drainage and avoid the ponding of water (which can further exacerbate thawing of ground ice); and
- Routinely inspect the effectiveness of water management structures.

These environmental protection measures are described further in the Borrow Areas and Quarry Management Plan. Individual quarry development plans and standard operating procedures will be prepared by the contractor before extraction activities commence.

7.7 DUST CONTROL

Dust from stockpiles and WRSAs is not expected to be substantial; however, dust will be monitored and managed to the extent reasonable. Crushing and screening operations will be conducted with equipment designed to mitigate ore dust dispersion. In the unlikely event that an unacceptable amount of dust is generated from end-dumping or front-loading during stockpiling and transferring operations, additional dust mitigation measures will be applied as identified in the Air Quality Monitoring and Management Plan.

7.8 ONGOING ACID ROCK DRAINAGE / METAL LEACHING (ARD/ML) TESTING

This plan will be periodically updated as new geochemical information if available. The Mine Waste Rock Management Plan will be updated during Water Licencing to incorporate criteria and procedures for the segregation of PAG and NPAG waste rock.

Goose Property Waste Rock

Goose Property mine workings and waste rock represent a moderate ARD/ML potential. Low to moderate bulk Neutralizing Potential (NP) contents could result in acidic drainage after a lag time of 14 to 20 years. Interaction with the deposit material and air/water could result in result in runoff/drainage exhibiting concentrations of arsenic and copper greater than MMER limits. This plan has been designed in order to minimize exposure time of the mine workings and waste rock to air/water and, wherever possible, to ensure the exposure time is less than the expected lag time.

Tailings Geochemistry

The bulk tailings that will be stored in the TSF will have a moderate to high ARD/ML potential. During Operations, if tailings material that forms the TSF beaches is not buried under fresh material before the lag time is exceeded then ARD will develop. This plan has significantly informed the tailings deposition plan in order to minimize the development of ARD. The water and load balance model has taken the tailings deposition schedule into account in the water quality prediction of the TSF runoff.

7.9 CONSIDERATION OF CLIMATE CHANGE

Water management strategy designs have considered climate change in all water management infrastructure design. Based on the assessment on climate change completed for the Project (Appendix V4-3B), the variability in precipitation from baseline conditions during the life of the mine is expected to be less than 10%. As a result, rainfall depths adopted in the design of all water management infrastructure have been increased by 10% over baseline conditions (SRK 2015f).

8. Monitoring Program

There will be a Site Surveillance Network Monitoring Program that will be outlined in the future Type A Water Licence. This Program will consist of all of the site compliance monitoring required for managing/moving and releasing water from all potential containment areas. Fish and Fish Habitat could be directly influenced by water levels and quantities. This will be monitored as part of the Aquatic Effects Monitoring Program and the Fish Offsetting Monitoring Program.

8.1 CONSTRUCTION PHASE

These monitoring activities are proposed during the Construction Phase:

- Visual inspections to confirm that the mitigation measures identified in this document and other relevant management plans (i.e., the Environmental Protection Plan, Borrow Pits and Quarry Management Plan) are implemented satisfactorily;
- Visual inspections to monitor the effectiveness of sediment and erosion control and runoff collection measures on a regular basis (daily or weekly as appropriate);
- Monitor treated sewage effluent discharges on a weekly basis for key indicators (i.e., TSS and ammonia) and monthly sampling using laboratory analysis for the parameters listed in Table 3.3-1;
- Periodically sample runoff at active construction fronts for the parameters listed in Table 3.4-1;
- Monitoring of runoff from quarries and borrow pits in relation to the quarry runoff criteria identified in Table 3.4-4;
- Monitoring of runoff from Umwelt WRSA and the Ore Stockpile Pond for compliance with MMER limits;
- Recording daily and monthly water consumption; and,
- Monitoring of waste and water management aspects including remediated soil, oily water and landfill seepage as outlined in the Surveillance Network Program (SNP) outlined in the Type A Water Licence.
- Monitoring of water quantity and quality will occur during all dewatering activities. Volume of water transferred will be measured on a continuous basis using appropriate flow meters.
- Field turbidity and TSS will be monitored daily. As data becomes available, a TSS and turbidity curve will be generated to manage dewatering activities. Water transferred during dewatering activities will meet a TSS or turbidity threshold equivalent to the MMER limit for TSS. The trigger level to suspend dewatering activities will be 90% of the MMER limit to avoid releasing water above the threshold. Clean lake water will be transferred and monitored until the trigger level is reached. When the TSS trigger level is reached, lake water will be treated for TSS through the water treatment plant before discharge into Goose Lake.
- If released volumes of water change stream base flows or water levels by greater than 10% of baseline, then water transfer rates will be adjusted as required.
- During construction, the emphasis of monitoring will be on the implementation and success of mitigation at construction areas. Toward the end of construction, Operation Phase monitoring activities will be implemented and monitoring will shift to include the relevant aspects of Operation Phase monitoring (Section 7.2). Operation phase activities beginning before the end of the construction phase will include the installation of Operation Phase water management facilities, milling, pre-stripping and mining of open pits and underground facilities, and the development of waste rock stockpiles.

8.2 OPERATIONS PHASE

In addition to the above efforts during construction (Section 7.1), the following is proposed for monitoring during the Operation Phase:

- Recording daily and monthly water consumption;
- Regular visual monitoring of Operation Phase water management facilities;
- Visual inspections and monitoring of construction areas as described in Section 7.1;

- Daily monitoring of the tailings discharge and the supernatant water level within the decant tower;
- Monitoring of effluents prior to discharge in relation to the criteria identified for various effluents within the tables of Section 3;
- Underground mine inflows will be sampled to verify water quantity predictions and verify storage requirements;
- Monitoring of brine discharge water to Bathurst Inlet to ensure that the salinity of the water remains within natural variability or CCME guidelines in sensitive marine areas.
- Monitoring of mine contact water discharges as prescribed by a study design developed under the MMER; and
- Implementation of the future AEMP to monitor effects to downstream aquatic environments.

During Operations, the emphasis will be on inspecting and monitoring construction fronts as aspects of construction will be ongoing throughout the mine life. The Operation Phase monitoring program will also incorporate the monitoring of mining activities and water management systems associated with the active tailings facilities, pits, WRSA collection ponds, and the Saline Water Pond.

8.3 CLOSURE

The following is proposed for monitoring during closure:

- Regular inspections to confirm that closure activities are being undertaken as identified in the final approved Mine Closure and Reclamation Plan;
- Construction-type monitoring is undertaken during decommissioning activities as described in Section 7.1;
- TSF/TF water quality monitoring until WQOs are met;
- Water quality being discharged from pits and the WRSAs all meet water quality objectives; and
- Water quality in Goose Main TF is improving with treatment such that the planned discharge schedule may go ahead.

Due to the relatively long Closure Phase, there will be sufficient opportunities to conduct post-closure monitoring of the closed-out Project features. The WRSAs, Llama Pit, Umwelt Pit, and Echo Pit will be closed out by Project Year 14, allowing for a number of years of post-closure monitoring during the Passive Closure Stage. Closure monitoring at receiving waters will be measured against water quality objectives.

8.4 POST-CLOSURE

Post-closure monitoring is expected to be required for five years after completion of closure activities and the completion of treatment from Goose Main TF. This consistent with mine reclamation at other northern sites and is believed to be a reasonable monitoring period given the amount of verification monitoring that can performed during the Operations and Closure Phase. Post-closure monitoring is expected to include:

- Water quality sampling at mine contact water discharge locations in accordance with water quality objectives; and

- Final Environmental Effects Monitoring studies in accordance with the water quality objectives needed to obtain status as a recognized closed mine from Environment Canada.

9. Mitigation and Adaptive Management

A key element of monitoring as outlined in Section 7 is to verify that mitigation measures are being implemented and are achieving the intended outcome. Adaptive management will be employed where mitigation is not achieving the intended result. Alternative mitigation measures will be identified and implemented, and will be reflected in updates to this plan and related management plans.

Indications of the need for adaptive management measures may include:

- If results from the Surveillance Network monitoring program (which will be outlined in the future Type A Water Licence) show non-compliance; and
- If results from the Aquatic Effects Monitoring Program, which will monitor the receiving environment around the mine infrastructure and activities, or the Fish Offsetting Monitoring Program, show adverse effects to fish or fish habitat due to water quantity issues.

10. Checking and Corrective Action

10.1 GENERAL APPROACH

Internal reporting structures will be developed so that monitoring results are reviewed to identify instances of non-compliance with this plan so that feedback is provided to the contractor or within Sabina and corrective action is undertaken in a timely manner. Items of non-compliance with applicable permits, licences, and authorizations will be reported to the respective agency as outlined in those authorizations.

Specific construction activities will require rapid checking of monitoring results and the implementation of corrective action. This includes the monitoring of TSS and turbidity data during in-water works. Field measurements of TSS and turbidity may be undertaken daily and corrective action such as work stoppage will be undertaken immediately, if appropriate.

10.2 CHECKING AND CORRECTIVE ACTION SPECIFIC TO DEWATERING ACTIVITIES

Checking and corrective action will occur during dewatering through the evaluation of continuous flow data and daily TSS and turbidity data. Results of the monitoring program will be reviewed by the Environmental Team, and water quantity and quality trends will be updated on a time scale relevant to the dewatering activity. If the dewatering activity will take two weeks or less, then data will be updated daily. If dewatering will take longer, then a more appropriate time scale may be used (e.g. every 3 days or weekly). This program will allow early detection of changes in water quality and implementation of corrective actions, if required. If trigger levels or thresholds are approached or exceeded, dewatering activities will be suspended.

11. Environmental Reporting

External reporting of Sabina's monitoring results and performance against this management plan will be in accordance with the following permits, licences, approvals and authorizations (Table 11-1).

Table 11-1. Reporting Requirements

Regulatory Instrument	Responsible Agency	Information to be Reported	Frequency	Compliance Inspections
Project Certificate	NIRB	Terms and conditions relevant to water management	Annually	A NIRB Monitoring Officer will inspect the site against the Project Certificate annually
Type A Water Licence	NWB	Water licence reporting requirements, including those identified in this plan	Monthly (SNP only); Annually	A waters inspector will inspect the site
Authorization for HADD of fish habitat under the Fisheries Act	DFO	Specified in the authorization – focused on protection of fish habitat	Annually	A fisheries officer may inspect the site periodically to determine compliance with the
MMER	Environment Canada	Effluent quality and toxicology; sediment, benthics, fish population data	Monthly reporting of effluent quality and receiving water quality; annual reporting	
AEMP	NWB	To be determined – possibly inclusive of water and sediment quality and freshwater biota	As prescribed in the AEMP – likely annually	The AEMP will be submitted to the NWB and reviewed by other relevant agencies including DFO and Environment Canada

12. Plan Effectiveness

It is expected that this plan will require updating in advance of the Type A Water Licence application for the Project. This plan will be reviewed on an annual basis and will be updated as required to reflect adaptive management (changes to the mitigation measures identified) or if Project changes necessitate changes to the monitoring program.

13. Quality Assurance / Quality Control (QA/QC)

QA/QC principles will be applied throughout the field sample collection and laboratory analysis phases.

The following procedure will be used when water quality sampling:

- All water quality samples will be collected by qualified personnel using suitable sampling equipment;
- Samples will be preserved (where applicable) in appropriate containers, and transported and stored following accepted procedures;
- Chain-of-Custody forms will be used to track the samples;
- Duplicate samples will be collected from a subset (10 to 20%) of all samples collected to quantify environmental variability and analytical consistency;
- Travel, equipment, and field blanks will be collected to detect potential sources of contamination; and
- Qualified laboratories with the appropriate accreditation will be used for all laboratory analyses.

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8. Ore Storage Management Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Ore Storage Management Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 8	All	FEIS Updates	Removing George, and other general updates for FEIS
	3.2	Geochemical Characteristics	Section rewritten as summary. Refers to detailed geochem report App. V2-7D
	3.3	Ore production schedule	Schedules updated with FS data, stockpile plan changed to one central stockpile at Goose plant (LG, MG, HG)
	6.1	Runoff Management	Detail added to reflect updates to FEIS water mgmt.
	App. A.	Site Layouts	Updated layouts

BACK RIVER PROJECT
ORE STORAGE MANAGEMENT PLAN

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Appendix A. Project Site Layouts

Glossary and Abbreviations

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

CPUE	Catch per Unit Effort
MMER	Metal Mining Effluent Regulations
QA	Quality Assurance
QC	Quality Control
ROM	Run-of-Mine (i.e., blasted ore that has not yet been crushed)
TSF	Tailings Storage Facility
TSS	Total Suspended Solids
VEC	Valued Ecosystem Component

1. Introduction

The Ore Storage Management Plan outlines the Sabina Gold & Silver Corp. (Sabina) plan for managing stockpiled ore at the Back River Project (the Project). The scope of the plan covers operational procedures, the implementation of environmental protection measures, and monitoring the effectiveness of any mitigation strategies. The plan applies to the construction and operation phases of the Project during which ore will be produced and stored prior to processing. It is expected that all ore will have been processed by the end of the operation phase.

The Ore Storage Management Plan includes the following:

- Applicable legislation and guidelines.
- The roles and responsibilities of the environmental team.
- Environmental protection measures.
- A monitoring program regarding the management of ore, with reference to other biophysical management plans for monitoring of potentially affected environmental media.
- Mitigation strategies recommended to avoid or minimize the potentially adverse effects on air and water quality.
- Monitoring and corrective actions.
- Record keeping and environmental reporting.
- A framework for the evaluation of plan effectiveness.
- A quality assurance/quality control (QA/QC) program.

The Ore Storage Management Plan is a "living document". It will be regularly updated based on management reviews, incident investigations, regulatory changes, or other Project-related changes. The plan has most recently been updated for the Final Environmental Impact Statement (FEIS) based on Feasibility Study Project designs. The plan may be further updated based on engineering completed prior to the start of construction and will incorporate for-construction engineering drawings of stockpiles and associated water management infrastructure.

2. Scope and Objectives

The Ore Storage Management Plan is a discipline-specific biophysical management plan that forms part of Sabina's overall Environmental Management Plan (EMP) developed for the Back River Project. This management plan has been prepared in accordance with Section 9.4.5 of the EIS Guidelines that the Nunavut Impact Review Board (NIRB) issued to Sabina (NIRB, 2013).

The scope of this plan focused on the management (i.e., handling and storage) of ore. The main environmental concerns related to ore storage are associated with the effects of runoff on local water quality and the potential for dust to spread ore fines on the surrounding land and water. As such, the Valued Ecosystem Components (VECs) that will be monitored include air quality and water quality. To avoid overlap and inconsistencies with other biophysical management plans, Sabina has referenced

the Project-wide monitoring plans for air in the Air Quality and Monitoring Management Plan, and water in the Site Water Monitoring Management plans.

3. Planning and Implementation

3.1 PHYSICAL CHARACTERISTICS

The main lithologies at the Project include greywackes, banded iron formation (BIF), mudstones, and other minor units (i.e., dykes and other intrusions). The majority of the gold mineralization within the various pits is hosted within the BIF unit. Within the Goose deposit, the mineralization is also hosted within greywackes and mudstones. As such, it is expected that the ore will exhibit characteristics similar to the BIF. The bulk density of the stockpiled ore will likely be about 2.16 t/m^3. The blasted ore material could be up to 2 m in diameter depending on the equipment used.

A review of other Northern gold mines (primarily Agnico Eagle Meadowbank) shows similar densities and material size.

3.2 GEOCHEMICAL CHARACTERISTICS

SRK Consulting (Canada) Inc. (SRK) completed geochemical characterization studies to assess the metal leaching/acid rock drainage (ML/ARD) potential of ore and waste rock associated with the Back River Property (the Property). The characterization program included additional test work and further data interpretation intended to supplement previous work by Rescan Environmental Services Ltd. (Rescan 2014a).

Geochemical testing has shown that portions of the ore may have metal leaching and acid rock drainage potential. Water quality predictions suggest that the majority of stockpiled ore will be processed before ML/ARD occurs. See Volume 2, Appendix V2-7D: Geochemical Characterization Report for more information. As a precaution, water in contact with the ore stockpiles will be managed through the site water management system and collected and treated if required before discharge. Further details on water management can be found in the Site Water Monitoring and Management Plan.

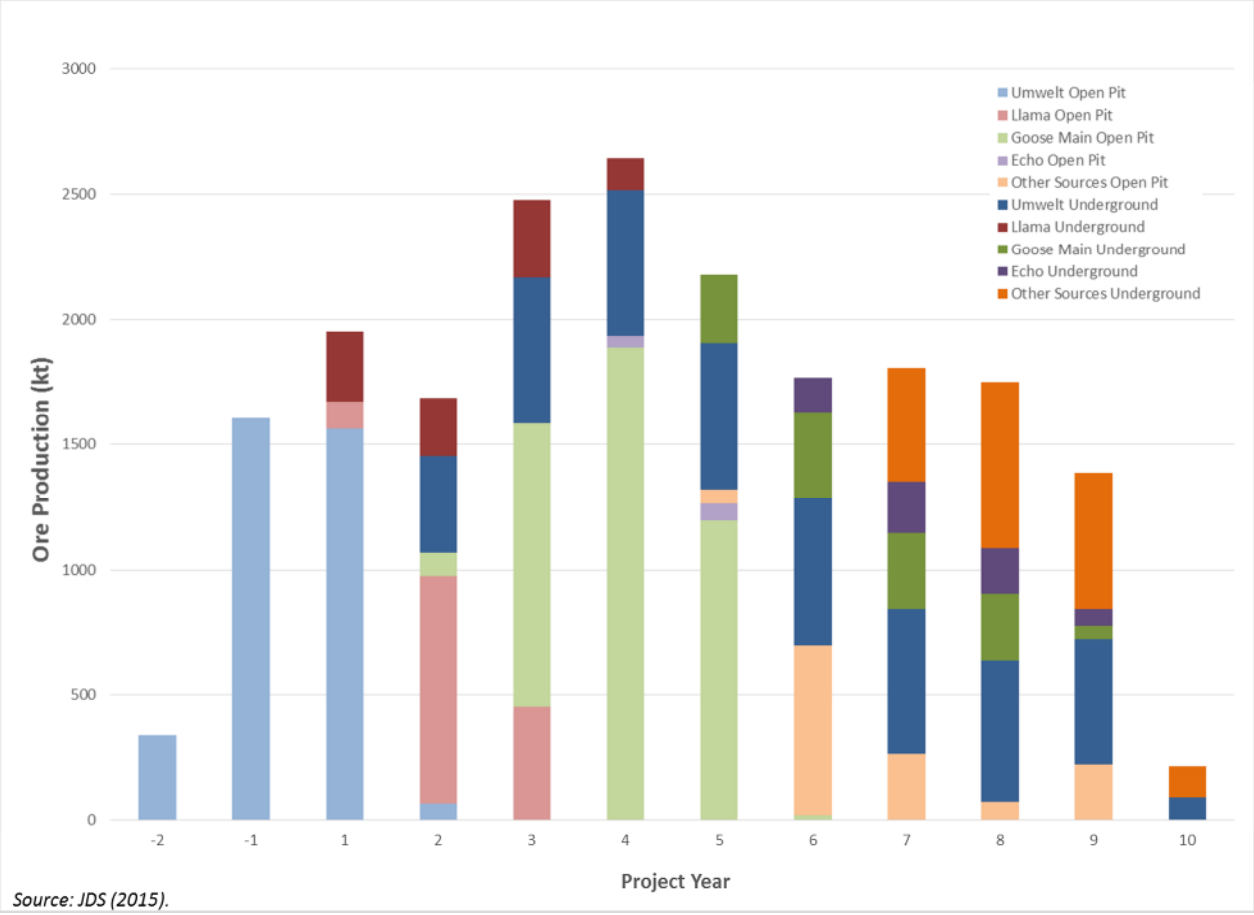
All gold deposits experience different geochemical conditions. Although some are similar in nature, none are identical. The associated ARD/ML and water management plans have considered the experience of other similar project is similar climatic conditions

In the current mine plan, ore stockpiles are drawn down completely during operations, therefore no stockpiles will remain at closure.

3.3 PRODUCTION OVERVIEW

An ore production schedule is provided in Figure 3.3-1 and summarized in Table 3.3-1. The schedule includes low-, mid-, and high-grade ore.

There will be one main ore stockpile area at the Goose Property located to the northwest of the process plant and temporary stockpiles on the laydown areas near underground portals (see the site layout for the Goose Property in Appendix A).The main stockpile area will contain three stockpiles: low-grade, mid-grade, and high-grade ore. All ore will be fed from these stockpiles to the crushing circuit. Crushed ore will be fed by conveyor onto the covered, fine ore stockpile, before being fed into the mill.



Source: JDS (2015).

Figure 3.3-1. Ore Production Schedule

Table 3.3-1. Ore Production Schedule (kt)

	Year											
Production Area	**-2**	**-1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Umwelt Open Pit	340	1,603	1,561	67								
Llama Open Pit			110	910	453							
Goose Main Open Pit				90	1,130	1,885	1,195	20.9				
Echo Open Pit						45	67					
Other Sources Open Pit							57	677.5	261	73	220	
Umwelt Underground				386	584	584	584	584	584	565	502	92
Llama Underground			282	231	310	130						
Goose Main Underground							276	346	302	264	55	
Echo Underground								137	204	185	66	
Other Sources Underground									453	659	542	121
Total OP/UG (kt)	340	1,603	1,953	1,684	2,476	2,644	2,179	1,765	1,804	1,746	1,386	212

Source: JDS (2015).

"Open pit mining at Goose Site will begin with Umwelt pit in Year -2 to provide waste rock for construction and enable the stockpiling of high-grade ore prior to the start of plant processing. Open

pit mining will then transition sequentially to the Llama, Goose Main and Echo pits. Open pit mining will be completed by Year 6 at Goose Site. Underground ore production will begin in Year 1 with the Llama mine and then transition to the Umwelt, Goose Main and Echo mines. [Underground mining at] Umwelt beginning in Year 2, will continue until Year 10" (JDS, 2015).

Run of Mine (ROM) stockpiles are used throughout the project life to optimize life-of-mine economics and mill feed. The size of the ore stockpiles over the mine life is shown on Figure 3.3-2 and in Table 3.3-2.

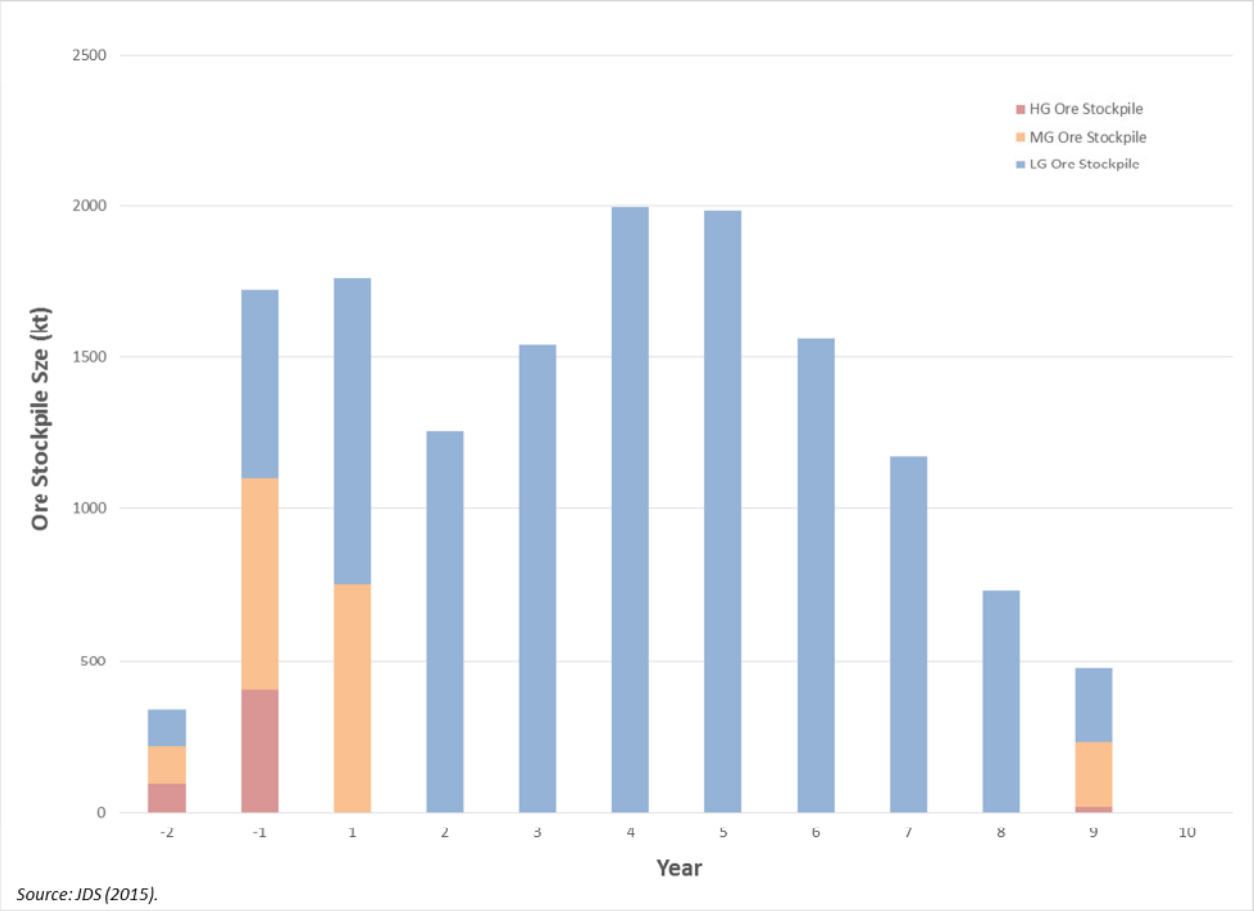


Figure 3.3-2. Ore Stockpile Sizes

The size of the high-grade ore stockpile next to the process plant will peak at approximately 404 kt in the year before production (i.e., Year -1). The size of the mid-grade stockpile will peak in Year 1 at 749 kt. The size of the low-grade ore stockpile will steadily increase in size from Year -2 and peak at approximately 2,000 kt in Years 4 and 5. From Year 5 onward, the low-grade ore is processed to supplement mine production until the stockpiles are consumed.

3.4 GOOSE PROPERTY ORE STOCKPILE METHODS AND PROCEDURES

The current mine production schedule indicates that 19,793 kt of ore will be produced from open pit and underground mines. Ore generated from mining activities will be end-dumped in surficial stockpiles and deposited in a similar manner as the waste rock. The current total ROM ore stockpile storage design requirement is approximately 2,000 kt. The size of the stockpile will be adjusted in accordance with mine plan and may be much smaller or larger than noted here.

Table 3.3-2. Ore Stockpile Sizes over the Life of Mine

Year	Ore Stockpile Size (kt)			
	High-grade	Mid-grade	Low-grade	Total in Goose Stockpile
-2	93	123	124	340
-1	404	700	620	1724
1	0	749	1012	1761
2	0	0	1255	1255
3	0	0	1541	1541
4	0	0	1995	1995
5	0	0	1984	1984
6	0	0	1559	1559
7	0	0	1173	1173
8	0	0	730	730
9	18	219	236	473
10	0	0	0	0

Source: JDS (2015).

The acid-generating potential of the ore is not expected to adversely impact surface water and soil quality as the stockpiles are temporary and will be consumed during processing. In the unlikely event that ore stockpiles are present at closure, the ore will be relocated to Waste Rock Storage Areas (WRSAs) and capped with the NPAG waste rock.

The ore at the Goose Property will be stockpiled with maximum side slopes of 2H:1V. Further design details (stockpile design, foundation requirements and runoff management etc.) will be provided in a future update of the plan following detailed engineering design. Other similar northern operations (i.e., Meadowbank) were considered in the ore grade handling aspects of the Project.

The stockpiled ROM ore will eventually be loaded into the hopper of the primary crusher. Crushed ore will be fed by conveyor onto the enclosed fine ore stockpile to be temporarily stored before being fed into the mill for processing.

The development of deposits at the George Property is not being proposed in the EIS.

3.5 ORE MANAGEMENT ALTERNATIVES

The proposed layout for the stockpile was selected based on proximity to facilities (i.e., high-, mid-, and low-grade stockpiles will be located near the plant site). The size of each stockpile was optimized against the design mine plan for quantities and grade of ore produced. However, the mine plan or cut-off grades associated with each stockpile may change. As a result the size and active life of stockpiles, may be change for economic, technical, or operational reasons.

A potential alternative would be to process low-grade and mid-grade ore as it is generated, rather than stockpiling the ore. This alternative would negatively impact the Project's economics without a clear environmental benefit.

Another alternative would be to create separate stockpiles near each mining area. However, a centralized stockpile is currently preferred as it reduces footprint, operational complexity, and is economically favourable.

4. Applicable Legislation and Guidelines

The Ore Storage Management Plan has been designed to comply with existing regulations and follow the available guidelines provided by the federal government and the government of Nunavut. The applicable regulations include:

- *Fisheries Act* (1985b), including the *Metal Mining Effluent Regulations* (SOR/2002-22).
- *Nunavut Environmental Protection Act* (1988).
- *Nunavut Land Claims Agreement Act* (1993).
- *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (2002).
- Northwest Territories Waters Regulations (SOR/93-303), under the *Northwest Territories Waters Act* (1992; expected to be replaced in the near future by a "*Nunavut Waters Act"* and regulations).

5. Roles and Responsibilities

The General Manager is ultimately responsible for the success of the plan and approves all relevant policies and documents, auditing, action planning and the verification process.

The HSE Manager along with his/her direct reports are responsible for the implementation of this plan including:

- Overall management of plan.
- Monitoring.
- Operational aspects.
- Internal reporting.
- External reporting.
- Ensuring compliance and adaptive management.

6. Environmental Protection Measures

6.1 RUNOFF MANAGEMENT

At the Goose Property, dedicated collection ponds will collect the runoff from the low-grade, mid-grade, and high-grade ore stockpiles. The contact water in the collection ponds will be pumped or trucked to the Tailings Storage Facility (TSF) or active tailings facility (TF). The water quality of the runoff is expected to be similar to that for the waste rock (see Section 3.2).

The runoff collection facilities constructed for the ore stockpiles will apply the same design criteria as has been developed for the WSRAs in terms of managing extreme flows. Additional detail on the waste rock is provided in the Mine Waste Management Plan, and water management is addressed in the Site Water Monitoring and Management Plan.

Since the ore storage stockpiles are temporary and the life of the mine is relatively short, the identification of measures to protect the ore storage infrastructure from the effects of climate change was not deemed necessary.

6.2 DUST CONTROL

Dust from the ROM ore stockpiles is not expected to be meaningful given the large size of the ore coming from the pit. Crushing and screening operations will be conducted in enclosed units to minimize dispersion of ore dust. The fine ore stockpile will be enclosed. Dust will be monitored at the site as described in the Air Quality Monitoring and Management Plan, and in the unlikely event that an unacceptable amount of dust is generated from end-dumping or front-loading during stockpiling and transferring operations, additional dust mitigation measures will be applied as identified in the Air Quality Monitoring and Management Plan.

7. Monitoring Program

Routine ore stockpile inspections will be conducted at regular intervals by the Environmental Superintendent or designate. These inspections will include:

- Measurement, recording and reporting of the number of truckloads and tonnage of ore hauled and stockpiled.
- Monitoring stockpile construction and operation visually to ensure compliance with permits, authorizations and commitments of monitoring plans.
- Evaluating the effectiveness of runoff collection measures.
- Surveying the extents of stockpiles to ensure the piles are within the areas set out in the permits and authorizations.
- Photographing the site conditions and observations as necessary.

Air and water quality monitoring and reporting will be conducted as described in the Air Quality and Site Water management plans, respectively.

8. Mitigation and Adaptive Management

The Ore Storage Management Plan may be updated if monitoring under the Air Quality and Site Water management plans identify the need for corrective action.

9. Checking and Corrective Action

The Environmental Superintendent or designate will conduct regular checks of the monitoring activities and any trends in the data collected. Corrective action will be taken if ore storage is not being conducted in accordance with this plan or any Standard Operating Procedures (SOPs) developed for ore management.

10. Record Keeping

Record keeping will be conducted by the Environmental Superintendent or designate. Field and laboratory data will be entered into suitable electronic databases.

11. Environmental Reporting

Environmental reporting will be conducted as identified in future permits, approvals and authorizations relevant to ore storage and management.

12. Plan Effectiveness

The Environmental Superintendent or designate will conduct regular evaluations of the monitoring activities. This plan may be updated if additional methods for monitoring are found to be more appropriate.

13. Quality Assurance / Quality Control

The QA/QC for the ore monitoring program will include the preparation of a SOP for each of the activities within the program (i.e., stockpiling and transporting of ore, etc.) and auditing operations against this plan and any relevant SOPs.

References

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

1988. *Environmental Protection Act*, C. E-7.

1992. *Northwest Territories Waters Act*, SC. C. 39.

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JDS Energy & Mining Inc. 2015. *Sabina Back River Project, Technical Report and Feasibility Study for the Back River Gold Property, Nunavut*. Prepared for Sabina Gold & Silver Corp..

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Northwest Territories Waters Regulations, SOR/93/303.

Nunavut Impact Review Board (NIRB). 2013. Guidelines for the Preparation of an Environmental Impact Statement for Sabina Gold & Silver Corp.'s Back River Project. NIRB File No. 12MN036).

Appendix A
Project Site Layouts

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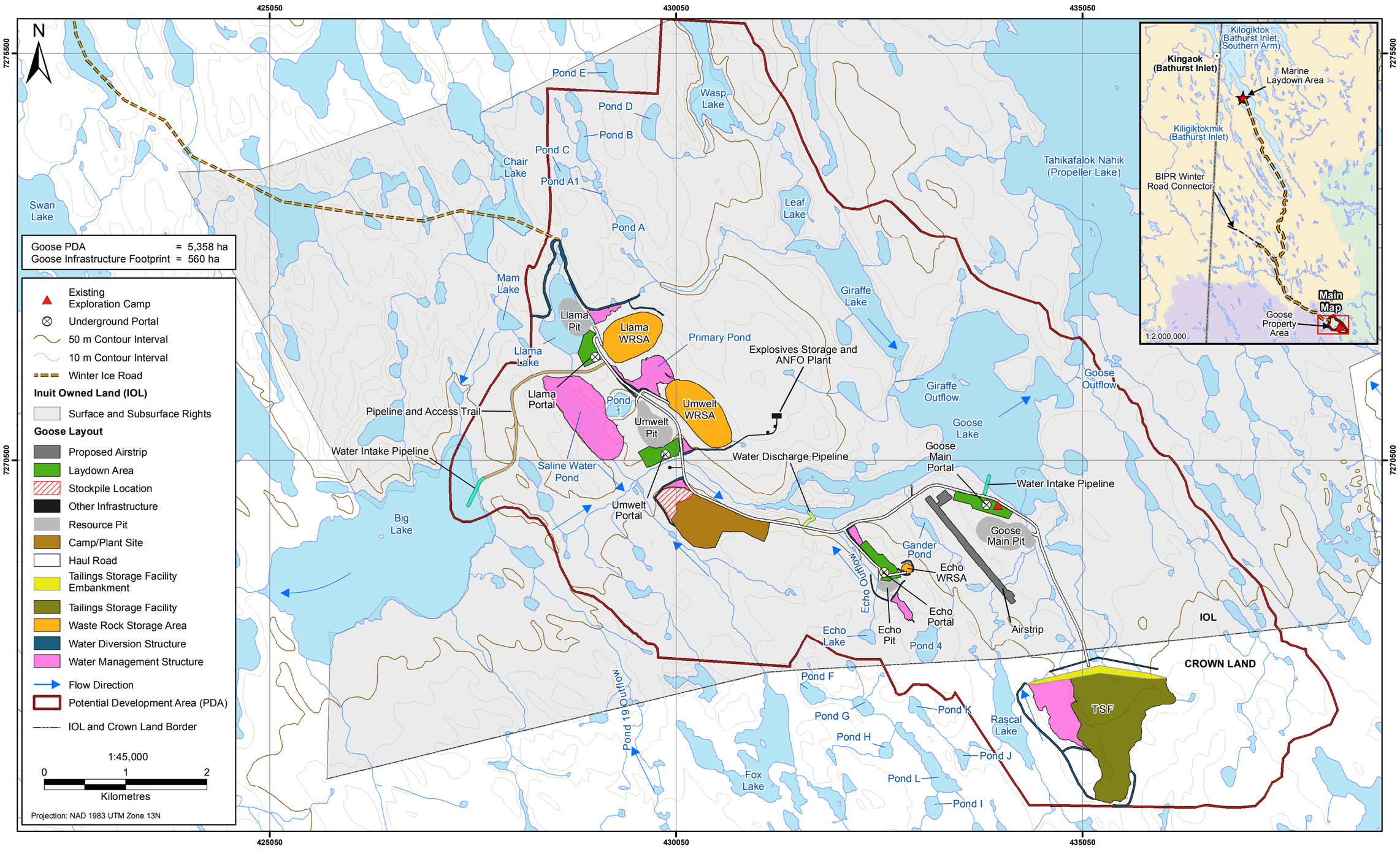

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Potential Development Area and Layout
Goose Property Area

GIS # BR_FEIS_NA_tab_MLASiteLayout_v1

October 21 2015

380750

381500

7395000

7394000

N

FUEL SHIP

FLOATING HOSE

WATER INTAKE PIPELINE

LIGHTERING BARGE

LIGHTER BARGE TERMINAL

WATER DISCHARGE PIPELINE

PIPE CROSSING

PORT OFFICE

LINED HAZARDOUS WASTE MGMT. AREA (5000m2)

LANDFARM (2500m2)

FREIGHT STORAGE AREA (11,000m2)

VEHICLE MAINTENANCE

FRESH/FIRE WATER STORAGE TANK

DESALINATION. POTABLE WATER

ERT

KITCHEN/ADMIN OFFICES

75 PERSON CAMP

INCINERATOR

HELIPAD

MOBILE EQUIPMENT PARKING WITH BULL RAIL

FREIGHT STORAGE AND CAMP AREA (70,500m2)

AN STORAGE AREA

FUEL STORAGE AND OFF-LOADING PAD
4 x 15,000 000L TANKS

Main Map

Marine Laydown Area

Kilogiktok (Bathurst Inlet, Southern Arm)

BIPR Winter Road Connector

Goose Property Area

1:1,810,000

Marine Laydown Area PDA = 653 ha
Marine Laydown Area Infrastructure Footprint = 26 ha

Winter Ice Road

Contours 1m

Inuit Owned Land

Surface Rights Only

Marine Laydown Infrastructure

Storage

MLA Infrastructure

MLA Infrastructure slope

Equipment parking

Potential Development Area (PDA)

1:7,500

0 200 400

Meters

Projection: NAD 1983 UTM Zone 13N

Kilogiktok (Bathurst Inlet, Southern Arm)

Marine Laydown Area

1:110,000

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Marine Laydown Area
Layout and Potential Development Area

9. Mine Waste Rock Management Plan

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BACK RIVER PROJECT
Mine Waste Rock Management Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 9	All	Topic Waste Rock & Tailings	Divided the combined DEIS report with WR and tailings managed in a single report to two separate reports. The Tailings Management Plan can be found in Vol 10, Ch 22.
	All	George	Removed waste rock associated with George to reflect the updated Project plan.
	All	Waste rock lift thickness	DEIS referenced 3 m WR lifts. FEIS has increased lift thickness to 10 m.
	All	Concurrent placement of PAG and NPAG waste rock in WRSAs.	DEIS has separate stockpiles for these two materials, and then double handling in closure to cover the PAG piles with NPAG.

BACK RIVER PROJECT
MINE WASTE ROCK MANAGEMENT PLAN

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Glossary and Abbreviations

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

AEP	annual exceedance probability
ARD	acid rock drainage
BIF	banded iron formation
CCME	Canadian Council of Ministers of the Environment
CDA	Canadian Dam Association
EDGM	earthquake design ground motion
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
FLB	field leach barrel
HDPE	high-density polyethylene
IDF	inflow design flood
MAC	Mining Association of Canada
MCRP	Mine Closure and Reclamation Plan
MDE	maximum design earthquake
ML	metal leaching
MMER	Metal Mining Effluent Regulations
Mt	million tonnes
NIRB	Nunavut Impact Review Board
NP	neutralizing potential
NPAG	non-potentially acid generating
NWB	Nunavut Water Board
OBE	operating basis earthquake
OMS	operation, maintenance, and surveillance
OVB	overburden material
PAG	potentially acid generating
PGA	peak ground acceleration
QA	quality assurance
QC	quality control

Sabina	Sabina Gold & Silver Corp.
SFE	shake flask extraction
SOP	standard operating procedure
TF	Tailings Facility
TSF	Tailings Storage Facility
TSM	Towards Sustainable Mining
uPAG	uncertain acid generating potential
VEC	Valued Ecosystem Component
WRSA	waste rock storage area

1. Introduction

This chapter describes the Mine Waste Rock Management Plan (the Plan) that Sabina Gold & Silver Corp. (Sabina) will follow in the development and operation of the Back River Project (the Project). This plan and other management plans are intended to describe the ways in which Sabina will address or mitigate issues identified in the Final Environmental Impact Statement (EIS). The Plan outlines the approach for managing waste rock produced at the Goose Property; no waste rock will be generated at the Marine Laydown Area (MLA) in southern Bathurst Inlet.

The Mine Waste Rock Management Plan is a discipline-specific management plan that forms part of Sabina's overall Environmental Management Plan (EMP) developed for the Project. This management plan has been prepared in accordance with Section 9.4.6 of the Environmental Impact Statement (EIS) Guidelines that the Nunavut Impact Review Board (NIRB) issued to Sabina (NIRB, 2013).

This plan for the Back River Property (the Property) includes the following:

- Applicable legislation and guidelines;
- The roles and responsibilities of the environmental team;
- Environmental protection measures;
- Contingency strategies;
- A monitoring program for water quality and quantity data during WRSA operations;
- Mitigation and adaptive management to avoid or minimize potential adverse effects on air and water quality;
- Checking and corrective actions;
- Record keeping and environmental reporting;
- A framework for the evaluation of plan effectiveness; and
- A quality assurance/quality control program to be applied to the monitoring program.

The information presented herein is current as of August 2015. This plan is a "living document", and will be updated based on engineering design, management reviews, incident investigations, regulatory changes, or other Project-specific protocols. The Plan will be included in Sabina's future Type A Water Licence Application and may be updated prior to submitting the application pending comments from review of the FEIS. The Plan may be updated again prior to construction if instructed to do so by the NWB during the licensing process. The Plan will be reviewed on a regular basis to incorporate any lessons learned, major changes to facility operation or maintenance, and environmental monitoring results.

2. Scope and Objectives

The scope of the Plan covers operational procedures, the implementation of environmental protection measures, and monitoring of the effectiveness of mitigation. The Plan applies to the Construction and Operations phases of the Project during which time waste rock will be produced, as well as the Closure and Post-Closure phases as waste rock will be permanently stored at the Property. The Plan is meant to

ensure that the Project is conducted as proposed, predicted adverse environmental effects are promptly mitigated, mitigation measures are successful, and relevant laws and regulations are met. Closure and reclamation of waste rock storage areas (WRSAs) is also addressed in detail in the Mine Closure and Reclamation Plan (MCRP).

The main environmental concerns related to waste rock storage are the potential for metal leaching and acid rock drainage (ML/ARD), and therefore potential effects of seepage and runoff on local water quality, as well as dust emissions on the surrounding land and water. Progressive reclamation is also considered as it presents an important opportunity to reduce environmental liabilities associated with mine closure while the mine is in operation.

The measures identified in this plan are intended to protect the following Valued Ecosystem Components (VECs):

- Air quality;
- Surface hydrology;
- Water quality;
- Sediment quality;
- Fish and aquatic habitat; and
- Fish (primarily Arctic Grayling and Lake Trout).

3. Planning and Implementation

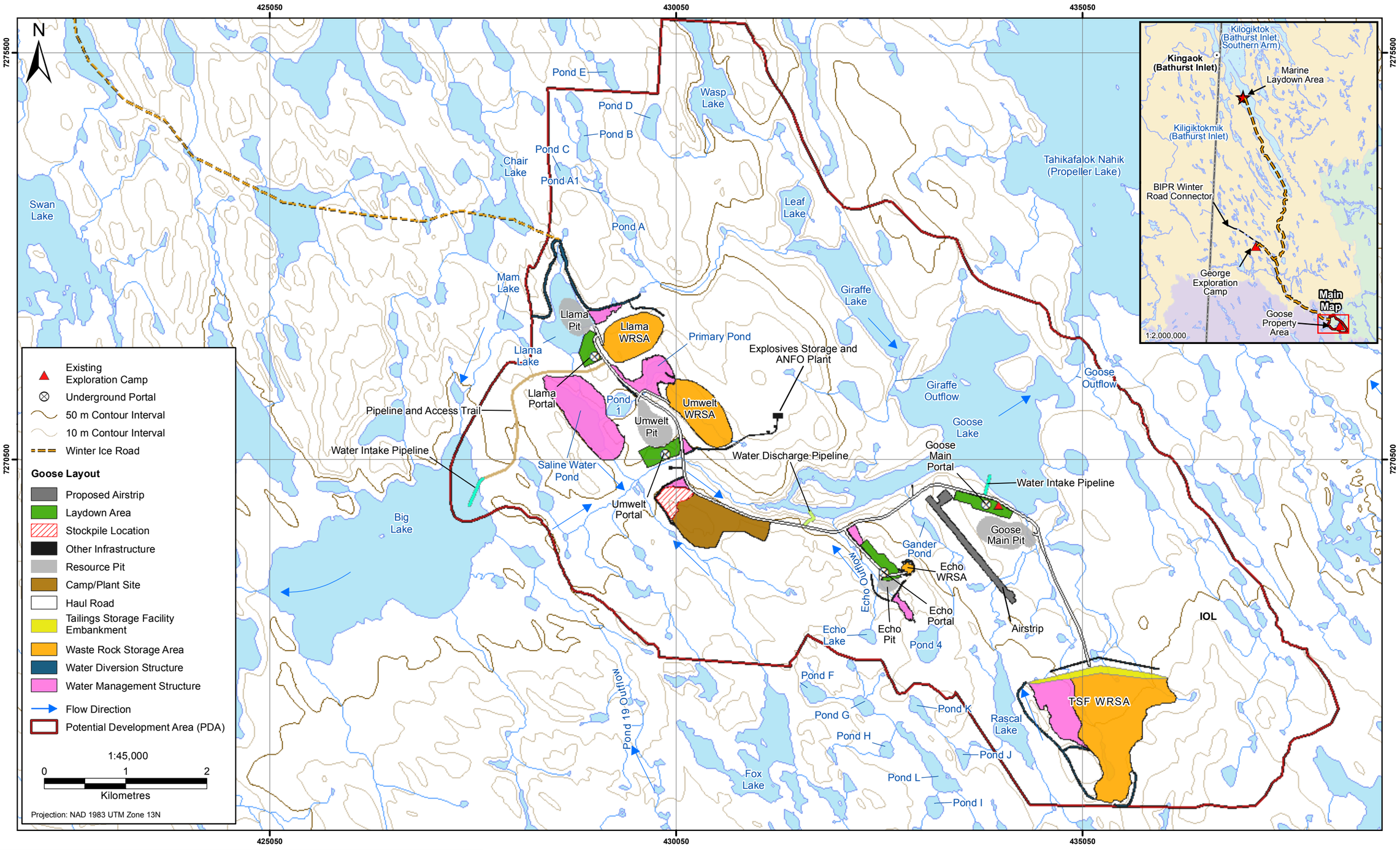
3.1 OVERVIEW

Waste rock and overburden will be produced during mining and will be stored in engineered WRSAs located close to each of the open pits (Figure 3.1-1). There will be four (4) WRSAs at the Goose Property as follows:

- **Umwelt WRSA:** Located to the east of the proposed Umwelt open pit and underground mines.
- **Llama WRSA:** Located to the east and south of the proposed Llama open pit and underground mines.
- **TSF WRSA:** Located to the south of the proposed Goose Main open pit, placed on top of the TSF once it is no longer in use. The majority of this material will be sourced from the Goose Main open pit mine.
- **Echo WRSA:** Located to the east and north of the proposed Echo open pit and underground mines.

A total of 64.3 Mt of overburden and waste rock will be generated consisting of the following:

- Overburden = 5.3 Mt.
- Non-potentially acid generating (NPAG) waste rock = 24.7 Mt (~42 %).
- Potentially acid generating (PAG) waste rock = 34.3 Mt (~58 %).



Sabina GOLD & SILVER CORP.

General Arrangement Plan

Figure 3.1-1

The WRSAs have been designed to encapsulate the PAG waste rock with a minimum 5-m thick NPAG waste rock cover on the top and sides of each pile. Depending on the physical characteristics of the overburden, it may be incorporated within the pile or used as cover material.

Results from the water quality assessment (Appendix V2-7H) indicate that during Construction and Operations, there is potential for elevated concentrations of sulphate, ammonia, nitrate, and arsenic in seepage and runoff that comes into contact with the WRSAs. Therefore, seepage and runoff will be managed according to the Site Water Monitoring and Management Plan (Volume 10, Chapter 7). Over time, it is expected that permafrost will aggrade into the PAG rock, which will greatly reduce the rates of oxidation and eliminate interaction with seepage. Results from the water quality assessment (Appendix V2-7H) indicate that at closure, the water in contact with the NPAG cover material will be acceptable for direct discharge.

The following sections provide details on the physical and geochemical characteristics of the waste rock, the waste rock production schedule, WRSA design, stability analyses and thermal modelling completed in support of the design, and alternatives that were considered in the design.

3.2 WASTE ROCK PHYSICAL CHARACTERISTICS

Physical characterization of run-of-mine (ROM) waste rock for the purpose of stability assessment has not been carried out. Such testing is however seldom done due to the practical limitations of suitable test methods for this type of material. As a result, it is standard practice to use literature values supported by engineering judgement. Table 3.2-1 summarizes the material properties adopted for ROM waste rock for the Project (Appendix V2-7C).

Table 3.2-1. Typical Run of Mine Waste Rock Physical Properties

Parameter		Value
Moist Unit Weight (kN/m^3)		20
Degree of Saturation (%)		30
Porosity, n		0.3
Volumetric Water Content		0.09
Frozen	Apparent Cohesion, c' (kPa)	0
	Friction Angle, ϕ (^{o})	38 to 40
Unfrozen	Apparent Cohesion, c' (kPa)	5
	Friction Angle, ϕ (^{o})	38 to 40

3.3 OVERBURDEN AND WASTE ROCK GEOCHEMICAL CHARACTERISTICS

Detailed geochemical characterization studies to assess the metal leaching/acid rock drainage (ML/ARD) potential of overburden, quarry rock, waste rock, tailings, and mine workings associated with the Back River Property was carried out. Detailed results of these geochemical studies can be found in Appendix V2-7D: Geochemical Characterization Report.

The results of the geochemical characterization program indicate that overburden has a negligible potential for ML/ARD. In contrast, an appreciable proportion of the waste rock is PAG or has an uncertain potential for ARD. PAG and uncertain waste rock is found in all of the stratigraphic units except for the gabbro dykes, but is more common in the LIF and to a lesser extent in the UIF units. The Umwelt, Llama, and Echo deposits have the highest proportion of PAG material, while the Goose

Main deposit has the lowest proportion. The kinetic tests indicate that metal leaching is greatly enhanced when acidic conditions are allowed to develop. Therefore, specific measures will be necessary to control ML/ARD potential in the PAG waste rock. For management purposes, Sabina has assumed that all rock that is PAG or rock which has an uncertain potential for ARD will be managed as PAG.

In-situ quantities of PAG and NPAG were determined based on the proportion of PAG and NPAG samples present in each of the modelled stratigraphic and intrusive units, and the quantities of waste rock present in each of these units. The in-situ quantities were then adjusted to reflect inefficiencies in the segregation process. The site-specific screening criteria for defining NPAG material is an NPR ratio of greater than 3, or total sulphur less than 0.15%. The resulting estimates of PAG/NPAG waste rock quantities are presented in Table 3.3-1. The production schedule showing the quantities of PAG/NPAG over the mine life is presented in Table 3.3-2. Note that the production schedule highlights that the majority of waste rock will be moved to WRSAs in the first half of Operations.

The distribution of PAG and NPAG waste rock is not closely linked to stratigraphy or to lithology. Therefore, identification and subsequent segregation of these materials will require a dedicated blast hole monitoring program similar to the procedures that are used to identify and segregate ore in the mining operation. The testing to support segregation will likely include a combination of sulphur analyses (using a Leco furnace), and NAG tests. Communications and tracking protocols will be required to ensure that the PAG and NPAG materials are placed in appropriate locations within the WRSAs. Verification monitoring will also be required to confirm that the segregation procedures are functioning as intended, and that the relative quantities of PAG/NPAG waste rock are within the expected ranges.

Preliminary calculations indicate that the delay in the onset of acidic conditions (lag times) in exposed waste rock would be on the order of 9 to 12 years under field conditions. Acidic conditions are expected to occur more rapidly in some of the waste rock but average pH conditions in seepage and runoff would be expected to remain buffered until WRSA freeze back conditions develop. The current water management plans include provision for treatment during the latter part of Operations and first few years of Closure to ensure that discharges meet the site specific water quality requirements. Additional details can be found in the Site Water Monitoring and Management Plan.

3.4 WASTE ROCK STORAGE AREA DESIGN

Waste rock storage areas will be constructed using the bottom-up approach. Haul trucks will end dump waste rock in horizontal layers (bubble dumps). A dozer will be used to level out these dumps, prior to starting a new lift. No dedicated waste rock compaction will be done; however, haul trucks will continuously traffic over previously placed areas providing wheel traffic compaction.

Waste rock will be placed in accordance with its ARD classification, with PAG waste rock placed in the central part of the WRSA, and NPAG placed along the margins. Upon completion, the entire outer surface of the WRSA will be clad in a minimum 5-m thick layer of NPAG rock. Over time, permafrost is expected to aggrade into the WRSAs, but an active layer will remain in the NPAG cover.

All WRSAs will have final overall side slopes of 3H:1V, with the exception of Echo WRSA which will have final overall side slopes of 2.4H:1V. Individual bench slopes can be angle of repose (approximately 1.5H:1V), with bench setbacks designed to allowed for an overall slope at the desired grade.

Table 3.3-1. Quantities and Proportions of Waste Rock by ARD Classification – Goose Deposits

Scenario	Pit	Quantity ('000s)			Distribution %*	
		PAG	NPAG	OVB	PAG	NPAG
In-situ Quantities	Umwelt	9,490	9,163	1,289	51%	49%
	Llama	7,479	7,490	1,037	50%	50%
	Main	3,663	20,693	2,755	15%	85%
	Echo	192	782	250	20%	80%
	Total	**20,823**	**38,127**	**5,331**	**35%**	**65%**
75% of NPAG recovered except 0% in LIF and 50% in Umwelt/Llama UIF	Umwelt	13,053	5,600	1,289	70%	30%
	Llama	10,548	4,421	1,037	70%	30%
	Main	10,101	14,255	2,755	41%	59%
	Echo	584	389	250	60%	40%
	Total	**34,286**	**24,665**	**5,331**	**58%**	**42%**

*Notes: * Distribution does not include overburden (OVB).*

Table 3.3-2. Waste Rock Disposal Schedule

	Location	Mine	Waste Type	Total ('000s)	Year of Operation											
					-2	-1	1	2	3	4	5	6	7	8	9	10
GOOSE	Construction, TSF, & Umwelt WRSA	Umwelt Open Pit	OVB	1,289	1,289	0	0	0	0	0	0	0	0	0	0	0
			NPAG	5,601	1,292	3,458	831	21	0	0	0	0	0	0	0	0
			PAG	13,052	2,796	8,110	2,126	20	0	0	0	0	0	0	0	0
	Llama WRSA	Llama Open Pit	OVB	1,037	0	0	1,037	0	0	0	0	0	0	0	0	0
			NPAG	4,422	0	0	2,019	2,175	228	0	0	0	0	0	0	0
			PAG	10,546	0	0	4,532	5,519	496	0	0	0	0	0	0	0
	TSF WRSA & Echo WRSA	Goose Main Open Pit	OVB	2,754	0	0	0	2,362	392	0	0	0	0	0	0	0
			NPAG	14,255	0	0	0	685	6,683	5,575	1,309	3	0	0	0	0
			PAG	10,101	0	0	0	466	4,232	3,933	1,461	8	0	0	0	0
		Echo Open Pit	OVB	250	0	0	0	0	0	250	0	0	0	0	0	0
			NPAG	389	0	0	0	0	0	286	103	0	0	0	0	0
			PAG	584	0	0	0	0	0	412	172	0	0	0	0	0

The final WRSA heights will range from 35 to 50 m above ground surface. The final WRSA footprints are currently planned for 38 ha (Umwelt WRSA), 35 ha (Llama WRSA), 56 ha (TSF WRSA), and 6 ha (Echo WRSA). These footprints would cover only a small portion (less than 3%) of the Goose PDA.

Water management around the WRSA will be completed in accordance with the Site Water Monitoring and Management Plan.

3.5 WASTE ROCK STORAGE AREA STABILITY ANALYSIS

Short and long term stability was conducted for the proposed WRSAs on the Property. The recommended minimum design values for Factors of Safety (FoS) for WRSAs as published by the British Columbia Guidelines for Mined Rock and Overburden Piles (BCMDC 1991) were adopted. To help inform the stability analysis, a Dump Stability Rating (DSR) for the WRSAs was also completed in accordance with these guidelines.

The slope stability analysis was carried out using commercial limit equilibrium method software using critical (i.e. maximum ultimate slope height) for each of the WRSAs. Two different analysis methods were applied in each case. For the stability analyses, the overburden material and the WRSAs were conservatively assumed to be unfrozen. The stability of the WRSAs was also analyzed with consideration of haul truck wheel loads applied near the crest.

From the stability analysis results it was observed that all analyses satisfy the required minimum factors of safety for all conditions. Additional details on the waste rock stability analysis can be found in Appendix V2-7E in Volume 2.

3.6 WASTE ROCK STORAGE AREA THERMAL MODELLING

Thermal modelling of WRSAs on the Property was completed as part of the FEIS by SRK Consulting (Canada) Inc. (Appendix V2-7E). Multiple scenarios based on a range of conditions were considered including material saturation, thermal properties, variable boundary conditions, material composition, as well as convection and conduction. All modeling was done taking climate change into consideration.

Freeze back of the WRSAs is considered to be validated if the temperature throughout the PAG waste rock remains below 0°C. Under these conditions, freeze back at the Property is estimated to be less than five (5) years with no allowance for convective cooling in the winter, and less than 2.5 years with allowance for convective cooling (i.e. for seasonal winter freezing during operation of the WRSAs).

The modelling was extended to year 2100 to account for projected influences of climate change. The modelling results indicate that the active layer thickness for the assumed base case is expected to be less than 5 m (i.e. remain in the NPAG cover) assuming convection facilitates cooling.

The results of this analysis will be confirmed and refined during Operations and Closure of the Project. As additional site-specific data is collected, this information will be used to further enhance or modify the closure of WRSAs, associated water treatment, and closure monitoring.

3.7 WASTE ROCK MANAGEMENT ALTERNATIVES

The proposed locations of the WRSAs were selected based on proximity to open pits and other facilities, suitability of ground conditions, as well as the ease with which runoff from the WRSAs can be collected to runoff collection ponds. Consideration was also given to identify important terrestrial habitat, special landscape features, rare vegetation, and archeology.

The waste rock management strategy for the Project is to ensure that in the long term, all PAG material is fully encapsulated within the permafrost so as to minimize the potential for contaminants of concern seeping into the receiving environment. To ensure the PAG remain frozen, it will be covered with a layer of NPAG sufficiently thick to host the active layer.

Alternative Waste Rock Management strategies that were considered for managing the PAG waste rock include subaqueous disposal, low permeability covers, co-disposal with tailings, and co-mixing with tailings.

Subaqueous Disposal

Subaqueous disposal can include disposal in an engineered structure, in a natural waterbody (i.e. lake), or in a mined-out open pit (or underground development). Construction of a permanent, water retaining, engineered structure was considered, but it was not the preferred long-term approach in light of other alternatives. Deposition in a large natural water body was also ruled out as the lakes around the Property are either generally shallow offering limited confinement, or are larger lakes that provide good aquatic habitat, and may require the lake to be delisted in accordance with Schedule II of the Metal Mining Effluent Regulations (MMER).

The underground mining methods employed on the Project require a portion of material as mine backfill. This backfill material will be composed primarily of waste rock from the underground mine, and where practical, will include some PAG waste rock from open pit developments. However, even if the volume that can be stored underground is maximized, the majority of the PAG material will remain on the surface. Consideration was given to storing PAG waste rock in mined-out open pits. At the Goose Property, the current mine scheduling, and the need to use the pits for tailings management and water management precludes this opportunity.

Low Permeability Covers

Consideration was also given to low permeability covers. Generally the use of low permeability soil covers would be the most cost effective; however, there are no suitable natural materials to construct the covers and as such, this would not be a feasible option. Therefore, the only viable low infiltration cover would be geosynthetic liners. The initial capital cost, and long-term replacement cost and viability of these liners make them an undesirable option.

Co-Disposal

Co-disposal of PAG waste rock with tailings in the mined-out open pits would be another viable waste rock management approach for the Project; however, as mentioned, current Project scheduling and the requirements for use of the mined-out open pits for tailings storage and water management precludes this option.

Co-Mixing

Co-mixing is a waste rock management strategy whereby NPAG tailings and PAG waste rock is physically mixed to generate a potentially physically and geochemically more stable product. The concept holds great promise; however there is no precedent for full-scale application at production rates planned for the Project. Until there is sufficient proof of concept, this option was considered too uncertain to be given further consideration.

4. Waste Rock Contingency Strategies

The mine design, including the WRSA design, has been carefully prepared taking into consideration the vast database of site characterization data gathered for the Project, coupled with rigorous engineering analysis. Where data was limited, conservative assumptions were consistently applied. There is therefore a high level of comfort that the plans are viable and realistic. It is however understood that mining activities are by nature associated with inherent uncertainty. As a result it is possible that, with respect to the WRSAs, any of the following scenarios listed in Table 4-1 might occur. The table also lists the possible contingency strategy associated with these scenarios.

Table 4-1. Waste Rock Management Contingency Strategies

Possible Scenario	Contingency Strategy
The total volume of waste rock might be smaller or greater than expected.	Provided the ratio of PAG to NPAG remains unchanged, this will have no material effect. A greater total volume of waste rock might mean a larger overall WRSA footprint, which might require a small increase on event pond sizing during Operations.
The ratio of PAG to NPAG waste rock might be different than expected.	If the amount of NPAG increases, there is no negative effect. If the amount of PAG increases leaving a shortfall of NPAG to cover the PAG, a portion of the PAG may have to be covered with a geosynthetic liner, or a portion may have to be disposed of in Goose Main or Llama open pit upon closure, or additional water treatment may be required.
The PAG material might oxidize faster than expected.	This may require increased operational and closure phase water treatment capacity. It will however not change the overall closure strategy.
Neutral metal leaching from the NPAG material may be greater than expected.	This may require the WRSAs to be covered with a geosynthetic liner, or relocation of waste rock into Goose Main or Llama open pit upon closure, and possibly additional water treatment.
Freeze back of the waste rock pile may take longer than expected.	Depending on the runoff water quality, this may require a longer closure period.
The active layer thickness of the WRSA, and therefore the required cover thickness, might be greater than expected.	If there is not sufficient NPAG to make up the difference, this may require that a portion of the PAG may have to be covered with a geosynthetic liner, additional NPAG may have to be locally sourced, or a portion of PAG may have to be relocated to Goose Main or Llama open pit upon closure, or additional water treatment may be required.

5. Applicable Legislation and Guidelines

The Mine Waste Rock Management Plan has been prepared to comply with existing regulations and follow the available guidelines provided by the federal government and the government of Nunavut. The applicable regulations include:

- *Fisheries Act* (1985), including the *Metal Mining Effluent Regulations* (SOR/2002-22).
- *Nunavut Environmental Protection Act* (1988).
- *Nunavut Land Claim Agreement Act* (1993).
- Nunavut Waters and Nunavut Surface Rights Tribunal Act, S.C. 2002, c 10 (Canada, 2002); Nunavut Waters Regulations (2013).

Water use and waste disposal in Nunavut is regulated by the Nunavut Water Board (NWB) through the water licensing process. The Project will be subject to a Type A Water Licence.

Other guidance documents considered in the development of the waste rock management plan include the Mine Site Reclamation Guidelines for the Northwest Territories (INAC 2007), and Guidelines for the Preparation of an Environmental Impact Statement for Sabina's Back River Project (NIRB 2013).

6. Roles and Responsibilities

The General Manager is ultimately responsible for the success of the Plan and approves all relevant policies and documents, auditing, action planning, and the verification process.

The Mine Manager, along with their direct reports, is responsible for the implementation of this plan including:

- Overall management of plan;
- Operational aspects; and
- Internal reporting.

The Environmental Superintendent, along with their direct reports, is responsible for the implementation of this plan including:

- Monitoring;
- External reporting; and
- Ensuring compliance and adaptive management.

Future revisions to this plan will further define the site management structure, organizational chart, and a listing of designated personnel responsible for aspects of this plan as the organizational structure is developed. It is expected that successful implementation of this plan will require dedicated support by grade control geologists, mine planners, and the environmental department.

7. Environmental Protection Measures

7.1 WASTE ROCK IDENTIFICATION, SEGREGATION, AND PLACEMENT

Implementation of the selected waste rock management strategy will require a dedicated blast hole monitoring program to identify PAG and NPAG material, and to direct it to the appropriate location within each of the WRSAs. The procedures used to identify and segregate PAG and NPAG waste rock are similar to the procedures that are used to identify and segregate ore in the mining operation. Key aspects will include sampling and testing to identify and delineate zones of PAG and NPAG material in advance of blasting, and communications and tracking protocols to ensure that the PAG and NPAG materials are placed in appropriate locations within the WRSAs.

It is expected that the testing required to support segregation will likely include a combination of sulphur analyses (using a Leco furnace), and NAG tests. The proposed criteria for defining NPAG waste rock will be a total sulphur content below 0.15% S, and/or NAG test pH >5.

7.2 MANAGEMENT OF SEEPAGE AND RUNOFF FROM WASTE ROCK STORAGE AREAS

Seepage and runoff from the WRSAs will be collected in perimeter ditches/berms and directed to collection ponds. During Operations, runoff from the WRSAs at the Goose Property will be pumped to the TSF or active TF and treated prior to discharge. Runoff and seepage management from the WRSAs is detailed further in the Site Water Monitoring and Management Plan.

Collection ponds will continue to operate and collect runoff from the WRSAs into the Closure phase, until the collected runoff meets discharge criteria and are expected to meet applicable receiving waters criteria. During the Active Closure stage and while the collection ponds remain operational, collected runoff at the Goose Property will be directed to the appropriate TF. Once runoff can be demonstrated to meet applicable limits, the ponds will be decommissioned in accordance with the Mine Closure and Reclamation Plan (MCRP).

The collection ponds constructed for the WRSAs will apply appropriate design criteria in terms of managing extreme flows. Detail on WRSA water management is addressed in the Site Water Monitoring and Management Plan.

7.3 DUST CONTROL

Dust from the WRSAs is not expected to make a significant impact; however, dust will be monitored and managed to the best extent possible. Because of the size of the waste rock generated from the pits, the WRSAs are not expected to generate a meaningful amount of dust. In the unlikely event that an unacceptable amount of dust is generated from end-dumping or front-loading during stockpiling operations, additional dust mitigation measures will be applied as identified in the Air Quality Monitoring and Management Plan.

7.4 AVOIDANCE OF NAVIGABLE WATERS

The siting of the WRSAs are not located in any waters and therefore do not have the potential to affect navigation.

8. Monitoring Program

Routine inspections will be conducted at WRSAs and will include:

- Measurement, recording, and reporting of the number of truckloads and tonnage of waste rock hauled and stockpiled in accordance with the waste rock disposal schedule (Table 3.3-2), including confirmation that PAG and NPAG waste rock are being disposed of in the appropriate WRSAs.
- Monitoring WRSA construction and operation visually to ensure compliance with design, this management plan, permits, authorizations, and commitments.
- Sampling and testing to verify that the geochemical characteristics of waste rock within the NPAG areas of the WRSAs are within expected ranges.

- Installing ground temperature monitoring instrumentation (thermistors) to ensure that PAG waste rock is encapsulated in permafrost.
- Evaluating the effectiveness of runoff collection measures.

Runoff water quality monitoring will be conducted as described in the Site Water Monitoring and Management Plan and additional testing frequency details will be provided in the Type A Water License Application.

9. Mitigation and Adaptive Management

Additional mitigation or adaptive management may be required as an outcome of monitoring activities described in Section 7. This may include changes to WRSA development as a result of operational, engineering, and environmental monitoring.

10. Checking and Corrective Action

The General Manager or designate will conduct checks of the monitoring activities and any trends in the data collected. Corrective action will be undertaken if mine waste management is not being conducted in accordance with this plan or any SOPs developed for stockpiling of waste rock.

11. Record Keeping

Record keeping will be conducted by the site environmental compliance supervisor. Field and laboratory data will be entered into suitable electronic databases and checked for quality control.

12. Environmental Reporting

Environmental reporting will be conducted as identified in future permits, approvals, and authorizations relevant to mine waste management. The Type A Water Licence is expected to be the primary regulatory instrument governing mine waste management for the Project.

13. Plan Effectiveness

The General Manager and Environmental Specialist will conduct an evaluation of the Plan and its effectiveness on an annual basis. This plan may be updated as required if additional methods for construction, operation, maintenance, and monitoring are found to be more appropriate.

14. Quality Assurance / Quality Control

Quality Assurance / Quality Control (QA/QC) for the waste rock monitoring program will include the preparation of Standard Operating Procedures (SOPs) developed for mine waste management operations, and auditing operations against this plan and any relevant SOPs.

References

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

Rescan Environmental Services Ltd. (Rescan). 2013. *Back River Project: Geochemical Characterization and Metal Leaching / Acid Rock Drainage Potential Report*. Prepared for Sabina Gold & Silver Corp. PROJ#0194096-0040-0007, Rev. A.1, dated October 2013.

10. Waste Management Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Waste Management Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 10	7, 7.6	MLA sewage	Direct incineration of (human) sewage
	7.3.1	Landfill locations	At one or more WRSAs

BACK RIVER PROJECT
WASTE MANAGEMENT PLAN

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Appendix B. Site Layouts Showing Locations of Waste Management Facilities

Glossary and Abbreviations

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

AANDC	Aboriginal Affairs and Northern Development Canada
CCME	Canadian Council of Ministers of the Environment
CEPA	*Canadian Environmental Protection Act*
DEIS	Draft Environmental Impact Statement
EC	Environment Canada
FEIS	Final Environmental Impact Statement
GN	Government of Nunavut
HMMP	Hazardous Materials Management Plan
HR	Human Resources
IMP	Incineration Management Plan
KIA	Kitikmeot Inuit Association
MLA	Marine Laydown Area
NIRB	Nunavut Impact Review Board
NT/NWT	Northwest Territories
SOP	Standard Operating Procedures
TDG	Transportation of Dangerous Goods
QA	Quality Assurance
QC	Quality Control
WHMIS	Workplace Hazardous Materials Information System
WRSA	Waste Rock Storage Area

1. Introduction

This chapter describes the Waste Management Plan (WMP) that Sabina Gold & Silver Corp. (Sabina) will follow in the development and operation of the project. The WMP and other management plans are intended to describe the ways in which Sabina will address or mitigate issues identified in the Final Environmental Impact Statement (EIS). This Plan outlines the approach for managing non-hazardous wastes, recyclables, and treated sewage at the Back River Project (the Project) including the Goose Property and the MLA.

The WMP has been prepared in accordance with Section 9.4.7 of the EIS Guidelines issued by the Nunavut Impact Review Board (NIRB) to Sabina (NIRB 2013). This Plan was prepared in conformance with current Federal and Territorial statutory requirements.

The information presented herein is current as of September 2015. The WMP is a living document and will be updated based on engineering design, management reviews, incident investigations, regulatory changes, or other Project-specific protocols. The Plan will be included in Sabina's future Type A Water Licence Application and may be updated prior to submitting the application pending comments from review of the FEIS. The plan may be updated again prior to construction if instructed to do so by the NWB during the licensing process. The plan will be reviewed on a regular basis to incorporate any lessons learned, major changes to facility operation or maintenance, and environmental monitoring results. Any updates to the Plan will be filed with the Annual Report submitted under the Type A Water Licence.

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 overall objective of Sabina's WMP is to minimize potential effects from the Project on the environment from its waste management activities. This includes the development of systems and procedures for the proper handling and disposal of wastes, and to comply with all applicable legislation, regulations, authorizations, permits, and licences for the duration of the Project.

Objectives of the plan will be achieved by using proven strategies and applying the best fit technological developments to ensure that materials are used efficiently when brought to the Project sites and then disposed of in an environmentally acceptable manner. The scope of the WMP includes non-hazardous waste, recyclables, and treated sewage, at the MLA and Goose property. Separate waste management strategies will be prepared for the various mineral wastes (waste rock and tailings) as well as any hazardous waste products which may be produced through different components of the Project.

To avoid overlap and inconsistencies with other biophysical management plans, Sabina has referenced, where appropriate, the following management plans:

- Risk Management and Emergency Response Plan.
- Environmental Management and Protection Plan.
- Incineration Management Plan.

- Hazardous Materials Management Plan.
- Tailings and Waste Rock Management Plan
- Fuel Management Plan.
- Occupational Health and Safety Plan.

3. Planning and Implementation

Planning for the WMP started with the development of the DEIS, which identified existing (baseline) conditions, assessed potential impacts of the Project, developed conceptual mitigation strategies and developed specific mitigation measures to execute these strategies. Conceptual strategies and plans will continue to be elaborated and executed throughout the construction, operation, and closure phases of mining. Environmental management and social aspects will be tracked, reviewed, and updated through ongoing maintenance of the plan. These updates will incorporate relevant feedback from the public, obtained during public consultation.

Significance criteria have been developed that assist in identifying priority aspects, establish management criteria and activity-specific mitigation measures. For social issues and effects, a key factor for determining significance is ongoing feedback from public consultation. These efforts will be used to communicate progress, and involve the public where necessary, on environmental performance.

Monitoring will be the principal mechanism to provide feedback to continually gauge the effectiveness of environmental performance. Operational control is facilitated through the contractor job-specific standard operating procedures (SOPs) work instructions, on-the-job instruction, tailgate meetings where required, contract requirements, and service agreements. The effectiveness of physical operational control will be reviewed according to preventative maintenance and review procedures and schedules.

4. Applicable Legislation and Guidelines

4.1 APPLICABLE LEGISLATION

Specific legislation, regulations and guidelines related to waste management in Canada, and specifically within Nunavut, are summarized in Table 4.1-1. Waste management in Nunavut is regulated under:

- Nunavut's *Public Health Act* (1988);
- *Nunavut Environmental Protection Act* (1988);
- *Canadian Environmental Protection Act* (1999) ; and
- *Federal Transportation of Dangerous Goods Act*, 1992 (TDG; 1992).

Sabina will also be bound by the terms and conditions of its land use permits to be issued by Aboriginal Affairs and Northern Development Canada (AANDC) for Crown Lands and the Kitikmeot Inuit Association (KIA) for Inuit Owned Land, and its Type A Water Licence to be issued by the Nunavut Water Board (NWB).

Table 4.1-1. Applicable Legislation to Wastes Management in Nunavut

Acts	Regulations	Guidelines
Federal		
Canadian Environmental Protection Act (CEPA; 1999)	Schedule 1: List of Toxic Substances Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2002-301)	Environment Canada (EC) Technical Document for Batch Waste Incineration (EC 2010) Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil (CCME 2001).
Transportation of Dangerous Goods Act, 1992 (1992) and Regulations	Regulations Amending the Transportation of Dangerous Goods Regulation (SOR/2012-245)	
Territorial Lands Act (1985)	Territorial Land Use Regulations (CRC, c.1524) Northwest Territories and Nunavut Mining Regulations (CRC, c.1516)	Implications of Global Warming and the Precautionary Principle in Northern Mine Design and Closure (BGC 2003)
Hazardous Products Act (1985)	Controlled Products Regulations	Workplace Hazardous Materials Information System (WHMIS)
Territorial – Nunavut		
Nunavut *Environmental Protection Act* (1988)		Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities (GN 2011a) Environmental Guidelines for the Burning and Incineration of Solid Waste (GN 2012) Environmental Guidelines for Waste Asbestos (GN 2011b), Ozone Depleting Substances (GN 2011c)
Nunavut *Public Health Act* (1988)		
Territorial – Northwest Territories		
Northwest Territories *Environmental Protection Act* (1988)	Used Oil and Waste Fuel Management Regulations (NWT Reg. 064-2003).	Mine Site Reclamation Guidelines for the Northwest Territories (AANDC 2013)

4.2 APPLICABLE GUIDELINES

In addition to the mandatory requirements, a number of waste management guidelines have been considered in the preparation of this management plan, and/or will be considered in the design and operation of Project waste management facilities:

- The Mackenzie Valley Land and Water Board's (2011) guidelines for developing a waste management plan.
- Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the NWT (Ferguson Simek Clark, 2003)
- Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories (Government of the Northwest Territories Department of Municipal and Community Affairs, 1996)
- Mine closure guidelines developed by the Department of Aboriginal Affairs and Northern Development Canada (AANDC, 2013) were followed regarding specific landfill design and mitigation for potential impacts pertaining to waste.

The first guideline applies to the development of this Waste Management Plan, and the following two guidelines apply to the future development of operation and maintenance manuals for the sewage treatment and waste disposal facilities. The final guideline above focuses on closure measures for the landfill.

4.3 WASTE MANAGEMENT STRATEGIES

Responsible waste management begins by keeping all waste materials that can be economically recycled out of the waste stream destined for landfill or incineration. Sabina is committed to undertaking waste collection, storage, transport and disposal in a safe, efficient and environmentally compliant manner, by actively encouraging and implementing the four Rs of waste management: waste reduction, reuse, recycling, and recovery, as illustrated in Figure 4.3-1.

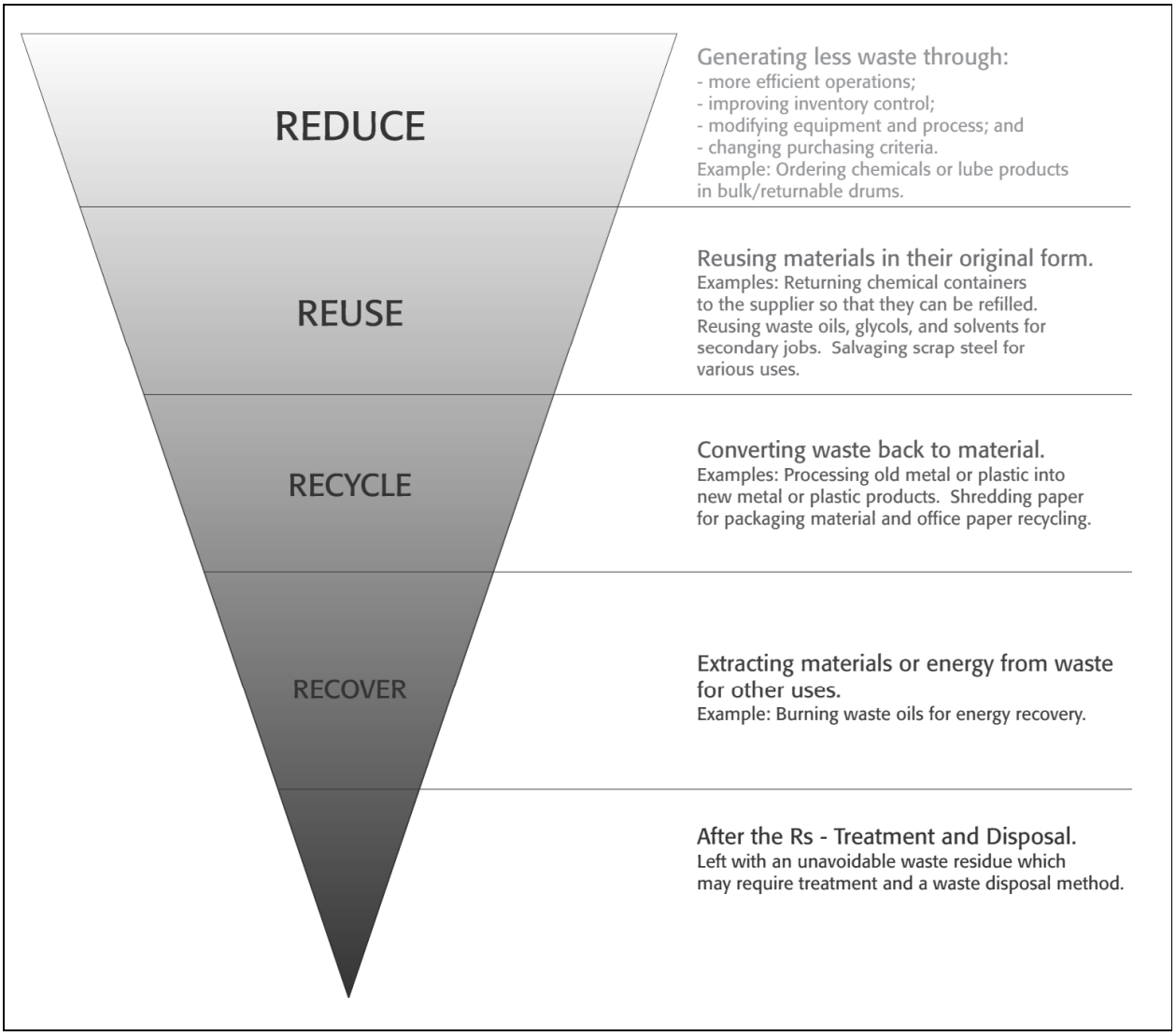

Figure 4.3-1. Basic Principles of Waste Management

The basic principles of waste management hierarchy presented in Figure 4.3-1 are consistent with the waste management hierarchy adopted (from the Mackenzie Valley Land and Water Board, 2011).

Sabina embraces source reduction as a key means of minimizing the quantities of wastes to be generated. Reducing the amount of waste produced is an environmentally responsible business principle. Team Leaders will be empowered to ensure that each area of operations uses materials in an efficient manner and to take the necessary steps to address these waste management principles.

Operating procedures at the mine will be developed to maximize the volume of materials that can be recycled or reused. The basic implementation of this strategy includes eliminating the use of disposable material in everyday use, encouraging the use of personal drink containers, stainless steel cutlery and reusable lunch boxes.

The waste reduction principles described above will be achieved by implementing the following strategies:

- **Proactive Procurement Policy**: Any tender documents will notify prospective bidders of the environmental sensitivity of the applicable Project site and solicit the use of the most environmentally suitable materials, equipment and products.
- **Pollution Prevention**: Pollution prevention methods to eliminate the generation of wastes will continuously be evaluated and where feasible, appropriate improved methods will be implemented. This will be achieved by applying the reduction, substitution, segregation, reuse, recycling and recovery approaches discussed as follows.
- **Strategic Material Substitution**: At the purchasing stage, the possibility of material substitution with less polluting products will be assessed - in particular for materials that are hazardous to handle, generate hazardous waste, or create environmental problems.
- **Strategic Chemical Substitution**: A policy of using chemicals that are cost effective, and accomplish the same results as the original chemicals employed, without or with less hazardous wastes generation in the process, will be adopted.
- **Waste Segregation**: Segregation of all waste streams by type or category will avoid potentially undesirable combined effects and will facilitate the reuse, recycling, recovery and/or disposal of the various wastes. All waste categories will be evaluated and the principals of the following four Rs applied:
  - **Reduction Initiatives**: Reducing the raw material consumption is the first step to reduce waste generation. To practice this principle, all processes and material used will be evaluated on the basis of possible reduction in raw material usage.
  - **Reuse Initiatives**: Reuse of the material in other applications and /or by other parties is routinely examined by using the waste materials exchange.
  - **Recycling Initiatives**: Recycling is the next option considered for the successful management of the waste streams.
  - **Recovery Initiatives**: Recovery of usable material or energy as a by-product is a part of the four Rs of the waste minimization process. For example, redistributing waste heat from generators to heat buildings is a process of recovery of energy from waste.
- **Disposal**: Disposal is the final option when the four Rs are no longer applicable or practical.

5. Roles and Responsibilities

The General Manager is ultimately responsible for the success of this plan and approves all relevant policies and documents, auditing, action planning and the verification process.

The HSE Manager along with his/her direct reports are responsible for the implementation of this plan including overall management of the plan and internal reporting.

The Environmental Superintendent along with his/her direct reports are responsible for auditing Project performance to ensure compliance and adaptive management.

All other Project personnel involved with waste management activities will be responsible for the effective implementation of this plan including: completion of required training, and maintaining compliance with training requirements as set out by this plan or by Sabina's SOPs and best management practices. All employees are to work in compliance with Health and Safety Laws and Regulations.

6. Waste Types and Waste Management Approach

6.1 WASTE TYPES

A material is considered to be a waste when it can no longer be used for its originally intended purpose. The types of waste anticipated to be generated by the main components of the Project can be classified into the following general categories:

- Combustible non-hazardous waste;
- Non-combustible non-hazardous waste;
- Recyclable waste;
- Treated sewage;
- Hazardous waste; and
- Other waste.

6.1.1 Combustible, Non-hazardous Waste

Typical combustible non-hazardous wastes include discarded materials in a solid, liquid, or semi-solid form that can be safely incinerated. Such wastes do not pose a risk to human or environmental health. The types of waste generated within this category include:

- Domestic food wastes;
- Cardboard and paper;
- (Unpainted) lumber scraps;
- Domestic refuse; and
- Damaged bulk containers.

Appendix A identifies the typical combustible non-hazardous waste types, sources, potential effects, management hierarchy, and management strategies.

6.1.2 Non-combustible, Non-hazardous Waste

Typical non-combustible non-hazardous wastes include discarded materials in a solid, liquid, or semi-solid form that cannot be burned or recycled. Such wastes do not pose a risk to human or environmental health. The types of waste generated within this category include waste concrete and other construction wastes such as steel, wire, roofing and asphalt.

6.1.3 Recyclable Waste

Recyclable materials comprise discarded items that can be made into new products. The typical types of waste generated within this category include:

- Beverage containers (plastic, aluminum, glass, tetra packs);
- Tires;
- Electronics and electrical wastes; and
- Dry cell batteries for domestic use (e.g., AAA to D cells, 6 and 9 volt batteries).

Refer to Appendix A - Waste Management Tables which identifies the recyclable waste types, sources, potential effects, management hierarchy, and management strategies.

6.1.4 Treated Sewage Waste

Domestic sewage and greywater will be produced by toilets, showers, laundry facilities, janitorial services and vehicle washing bays. The volume of wastewater generated will be approximately 275 L of wastewater per person per day, based on experience with other northern mining projects.

Appendix A identifies the sewage and grey water waste types, sources, potential effects, management hierarchy, and management strategies.

6.1.5 Hazardous Waste

Hazardous materials are covered by the *Transportation of Dangerous Goods Act* (1992) under Classes 2 through 6, and 8 through 9, that are no longer used for their original purpose and are intended for storage, treatment, recycling, or disposal. Hazardous material waste management is discussed in detail in Sabina's Hazardous Materials Management Plan (HMMP).

Lead acid batteries greater than 1 kg and rechargeable batteries are considered a contaminant as per the Environmental Guideline for Waste Batteries under the *Environmental Protection Act* (1988) of Nunavut. Waste batteries will be safely stored until they can be transported to a commercial recycler or registered hazardous materials receiver.

6.1.6 Other Wastes

In addition to the wastes identified in the preceding sections, Sabina has identified additional waste products to be managed. The other waste categories include:

- Medical waste: Waste generated in the first aid or health room will require special handling. Waste products will be put in single use medical waste containers. The management of biomedical waste is described further in the HMMP.

- Used oil and waste fuels: Used oil and waste fuels will be directed to incinerators or waste oil burners as appropriate. The management of used oil and waste fuels is described further in the HMMP.
- Incinerator ash: Subject to Toxicity Characteristic Leaching Procedure (TCLP) testing to confirm ash removed from the incinerator is classified as non-hazardous waste, the ash will be landfilled, as per Sabina's Incineration Management Plan. If shown to be hazardous, the incinerator ash will be handled as a hazardous waste and will be disposed of off-site in accordance with the HMMP.

6.2 TOTAL VOLUME OF WASTE

The total volume of waste generated at a given time during the life of the Project will be dependent on the phase of the Project, and activities and number of personnel at that time. The specific volume of material directed to the landfill, incinerator and recycling/reuse waste stream will be controlled through SOPs for waste management.

The greatest volume of waste production will occur during the construction phase due to the greater number of on-site personnel and the additional construction waste material produced. During this period, waste directed to the landfill will be predominantly composed of construction waste, including concrete, steel, wire, roofing and asphalt. An estimate of the total volume of waste expected to be generated by the Project during the construction, operation and active closure phases is presented in Volume 2.

6.3 TRAINING

As part of orientation, all on-site personnel, including Sabina Personnel and contractors, will receive basic environmental and waste management training, including:

- Reducing water use;
- Managing food wastes to minimize wildlife attraction;
- Reducing waste; and
- Separating waste (recyclables, dry-cell batteries, food waste, and hazardous waste).

The Sabina Environmental Policy will be communicated to all on site personnel during orientation and it will be emphasized that it is everyone's responsibility to properly dispose of waste, including the sorting of waste that can be reused and recycled.

Operation and maintenance manuals will be developed for the sewage treatment plant and waste disposal facilities, in accordance with the applicable guidelines identified in Section 4.2. Project personnel responsible for the handling of wastes will be fully trained in safe work and sorting procedures, and the identification of misdirected waste. Personnel working with waste materials will undertake formal training to ensure compliance with applicable legislation and Sabina's SOPs.

All personnel involved in the handling of hazardous wastes will receive Workplace Hazardous Materials Information System (WHMIS), Personal Safety and Protection and Emergency Response training. Where applicable, personnel will receive Transportation of Dangerous Goods (TDG) training.

Site specific training will be provided by Sabina and renewed as required according to SOPs and legislative requirements. Contractors may be requested to provide copies of safety certificates, including First Aid, WHMIS, and TDG.

Sabina will manage and update training logs to ensure that all on site staff are in compliance, and have been suitably trained for their respective tasks.

7. Waste Management Infrastructure

Wastes remaining after application of the waste minimization techniques will be managed in a practical and environmentally responsible manner utilizing methods appropriate for each waste type generated. The following methods will be applied at the site:

- Waste sorting at all generation points;
- Incineration of non-hazardous combustible wastes;
- Open burning in a regulated burn pit of untreated wood and cardboard;
- Landfilling of inert non-combustible wastes;
- Temporary storage and off-site shipping of hazardous and recyclable waste materials; and
- On-site treatment for contaminated soil and oily water from hydrocarbon spills in landfarms.

The waste management infrastructure at the MLA will include:

- Incinerating human waste (sewage);
- An incinerator for the disposal of acceptable combustible wastes;
- A lined landfarm for the treatment of contaminated soils and snow; and
- A lined hazardous waste storage area.

The waste management infrastructure at the Goose Property will include:

- A sewage treatment plant (STP).
- An incinerator for the disposal of acceptable combustible wastes.
- A lined landfarm for the treatment of contaminated soils and snow located in one or more WRSAs.
- A waste sorting facility.
- A landfill for disposal of non-hazardous solid wastes located in one or more WRSAs.
- A lined hazardous materials storage area.

The proposed location of these facilities is shown on site layouts included in Appendix B.

The Project will not use any municipal facilities or services for waste management, with the exception of hazardous waste material as outlined below, and detailed in the HMMP.

During the initial construction phase, Goose Property exploration camp facilities will be used and/or waste will be temporarily stored in containers or totes while operation phase waste management facilities are constructed (i.e., waste sorting facility, incinerator, landfill, hazardous material storage, landfarms, sewage treatment plant). The Operation Phase waste management facilities will be commissioned as early as possible during the Construction Phase. During Active Closure, there will be a

migration back to exploration phase type waste management facilities once the main mine facilities are decommissioned. Toward the end of Active Closure, a small closure landfill and camp incinerator will remain, and a landfarm will likely be in use as part of final closure activities. These facilities will be used through the Passive Closure Phase as well. Sewage and greywater will be managed with incinerating toilets and wetland discharge, respectively.

No waste management facilities currently exist at the MLA and rudimentary facilities will be established early in the construction phase as described above. These facilities will be used through the Construction and Operation Phases until near the end of the Active Closure Phase.

During all Project phases, efforts will be made to maximize the use of backhaul (air cargo or winter ice road) to remove hazardous wastes and recyclables to minimize on-site inventories.

7.1 INCINERATORS

Incinerators selected for the Project will incorporate technologies capable of satisfying the criteria set forth in *Environment Canada's Technical Document for Batch Waste Incineration* (EC 2010). Details of incinerator operation, maintenance, and agency requirements associated with incinerator emissions are outlined in the Incineration Management Plan (IMP). The IMP was developed in conjunction with the WMP and discusses environmental protection and monitoring programs developed in consideration of the overall waste segregation program.

The incinerators (at the Goose Property and at the MLA) will generate bottom ash that will require disposal under this Waste Management Plan (Section 6.1.6). The ash will be subject to representative Toxicity Characteristic Leaching Procedure (TCLP) testing to confirm ash removed from the incinerator is classified as non-hazardous waste, and then landfilled provided the ash is deemed non-hazardous. If shown to be hazardous, the incinerator ash will be handled as a hazardous waste and will be disposed of off-site in accordance with the HMMP.

7.2 DESIGNATED OPEN BURNING AREA

An open burning area will be established to burn cardboard packaging and non-treated wood waste such as pallets. Open burning procedures will be detailed in a future version of this plan, consistent with authorized open burning practices currently employed at the Goose exploration camp.

7.3 LANDFILL

A landfill will be required during construction, operations and closure of the Project for the disposal of non-hazardous, solid industrial wastes that cannot be reused, recycled or recovered (or incinerated) as per the waste management hierarchy (Section 4.3). The landfills will be operated as industrial dry waste landfills and not as municipal solid waste landfills. Inert waste material intended for disposal in the landfills includes plastics, wood, fiberglass insulation, roofing, asphalt, concrete, ceramics, small rubber items, clothing, glass, small appliances (batteries removed), ash, bricks, and waste asbestos (according to GN guidelines), and vehicles (liquids, grease and electronics removed).

7.3.1 Landfill Location

A landfill site will be developed at the Goose Property to serve the Construction and Operation Phases of the Project. The landfill will be located within one of the WRSA sites (which are yet to be determined). The WRSA will have water management monitoring criteria applied to it so will manage any seepage factor as part of the overall water management plan. The site will be developed starting in Year -2.

Throughout the project life, additional industrial dry waste landfills may be established. The other WRSAs are logical candidate locations since there is road access, adequate cover material available, and since the runoff from these facilities will already be managed and monitored. Non-hazardous waste generated at the MLA that is not suitable for incineration will be stored in containers that will be transported to the landfill at the Goose Property during each winter ice road season or backhauled off-site.

7.3.2 Landfill Design Considerations

A landfill design report will be submitted to the NWB for approval before construction, as required by the water licence.

Solid waste landfills are found in every municipality in Nunavut, as well as every current mining operation in the north (i.e., Meadowbank, Mary River, EKATI, Diavik, Snap Lake). Sabina has researched such northern landfill operations and proposes to adopt the landfill design approach used successfully at EKATI Diamond Mine, NWT, where permafrost has been used to minimize water leaching into the subsoil. The site is located in a region of continuous permafrost. As such, permafrost is expected to develop through the waste. Unfrozen waste will be present during operation in the summer months.

It is anticipated that the landfill sites will be developed using the area fill method as detailed in Kent et al. (2003). The area fill method is the preferred design method where permafrost and geological rock conditions inhibit the development of trenches. The design employed at EKATI allows for the landfill to become fully aggraded into the permafrost over time.

Each of the Project landfill sites will be capped and progressively closed as final elevations are achieved. Final elevations will be field fit so that the stability of the landfilled wastes will be maintained. Rounded tops will be established on completed portions of the landfills to minimize water accumulation and percolation through the landfilled wastes.

The quality of leachate from the landfill sites will be controlled by the rigorous controls placed on the materials to be landfilled. Leachate will be sampled and monitored in conformance with Water Licence requirements.

The total waste volume generated over the life of the mine will dictate the ultimate dimensions of each landfill. Designs will allow flexibility to accommodate layout extension or contraction within the confines of each respective WRSA.

7.3.3 Landfill Operation

Landfill operation will be performed under the guidelines referenced in Section 4.2. The landfill will be operated by trained personnel who will carry out regular inspections and monitoring of the facility. An operation and maintenance manual approved under the water licence will direct landfill operations. This manual will include:

- Location of the landfill and proximity to receiving waters
- A general description of how the landfill is to be operated and maintained
- A proposed schedule for when specific operating and maintenance activities are to be conducted (i.e., seasonal surface water sampling, routine visual inspection, berm inspections, etc.)
- A list of who is responsible for completing each item scheduled
- A description of the cover material to be used as well as the source of the material and how it will be placed

- Runoff and drainage control within and around the landfill, including erosion and sediment control and proposed restoration measures for erosion which occurs
- Treatment measures for contaminated drainage (although this is not seen as an issue)
- Prevention of windblown debris (although this is not seen as an issue)
- Method and frequency of site maintenance.

The manual will assist landfill site operators in establishing a proper waste management system and to ensure that the system operates efficiently and in compliance with the permits. Documentation requirements will also be identified within the Landfill operation manual to suit inspection agencies (see section 8 below).

7.3.4 Landfill Closure

The landfill used during the construction and operation phases, as well as any additional landfills identified for use during Active Closure of the mine, will be closed in accordance with the Mine Closure and Reclamation Plan.

7.4 TEMPORARY WASTE STORAGE FACILITIES

7.4.1 Non-hazardous Waste Storage

Combustible wastes will be temporarily stored in dedicated bins within the waste incineration building or in proximity to the incinerators until they are ready to be incinerated.

Recyclable non-hazardous, non-combustible waste will be stored in dedicated waste storage facilities located at each of the project sites. Specific waste storage locations have been conceptually identified at this time. Material will be safely stored until it is transported to an appropriate recycling or disposal facility. Each site will have both indoor and outdoor storage, and waste will be segregated according to its susceptibility to exposure to the elements.

Indoor storage for beverage containers will be used to avoid attracting wildlife. The majority of other items will be stored in the laydown yard outdoors, or in shipping containers where appropriate. This includes recyclables such as tires, electronics and electrical materials, and scrap metal.

7.4.2 Hazardous Waste Storage

All hazardous materials will be packaged for shipment to licensed waste management facilities located off-site for subsequent treatment, recycling and/or disposal. Hazardous waste will be stored inside or within lined containment facilities at the Goose Property and MLA to minimize potential leaching to the environment. The management and handling of hazardous waste is further detailed in the HMMP.

7.5 LANDFARM MANAGEMENT PLAN

Hydrocarbon contaminated soil, snow, and ice will be treated within dedicated landfarms to be located at both the Goose Property and MLA. The landfarm is a bioremediation treatment that uses naturally occurring microorganisms to metabolize and breakdown petroleum hydrocarbons in soils. The Goose landfarm will be located at the Echo WRSA. The MLA landfarm will be located at the construction laydown area and will consist of one cell for landfarming and a second cell for hazardous materials storage.

A Landfarm Operation, Maintenance and Monitoring Plan will be prepared and submitted to the NWB for approval within 60-days of construction, in accordance with standard conditions of Type A Water Licences. Below is an overview of Sabina's approach to landfarm design, operation and closure:

7.5.1 Landfarm Design Considerations

- The facilities will be bermed and lined with an HDPE liner. Berm height is assumed to range from 1.3 m to 2.1 m above the existing ground surface. Geotextile fabric will be placed on either side of the liner, with sand bedding also placed above and below the liner to protect it from tears.
- Two or more cells will be constructed, so that contaminated soils can be managed separate from contaminated ice and water.
- The facilities will be sloped with a 1 to 2% grade to collect contact water in sumps designed to hold half the expected snowmelt volume.
- The landfarms will be sized to accommodate a target volume of soil, assuming a treatment depth of 0.3 m. Provisionally, this will be 2,000 m^3 at the Goose Property and 1,000 m^3 at the MLA.
- The design will be finalized to accommodate the actual construction site topography, borrow material properties, and landfarm sizing requirements.

7.5.2 Landfarm Operation

- Staff operating the landfarm will have valid WHMIS and TDG training, and will be trained to operate the landfarm.
- Procedures will be developed in regard to the use of safety equipment, emergency response procedures, soil tilling, record keeping, soil and water sampling, and groundwater monitoring.
- Warning signs will be posted in appropriate languages prohibiting the dumping of soil materials without the permission of the General Manager, and warning personnel of the dangers and risks posed by the facility.
- Rock fragments exceeding 100 mm in diameter will not be accepted in the landfarm.
- The effectiveness of landfarming depends upon: soil characteristics (grain size, soil texture, bulk density, moisture content and permeability); type of hydrocarbon; and climatic conditions.
- After excavation and transport of contaminated soil to the landfarm area, the soil will be dumped and spread by a front-end loader or bulldozer. The soil will be tilled as it is spread, continuing until all the soil has been deposited to ensure that the material has been well aerated. Soils will be placed in a layer of 0.3 m and should not exceed 0.45 m in any condition. Material placement should maintain a minimum 2 m offset from the inside berm toe.
- At the start of the season, the soils should be evaluated for optimal nutrient, moisture and pH conditions. The soil should be loose and moist. Excessively dry soils will be irrigated prior to tilling, targeting an optimal water holding capacity of 40% to 85%.
- Irrigation water may be contact water from the sump, or subject to NWB approval, treated wastewater and/or sludge that contains nutrients that will assist bioremediation. If reclaimed wastewater is used, contact water discharge parameters may need to include biological oxygen demand (BOD) and faecal coliforms in addition to standard water licence discharge requirements.
- Contact water levels will be monitored and a freeboard of 0.5 m maintained. Any hydrocarbon sheen on sump water will be removed using absorbents.

- Excess contact water will be sampled and tested and discharged only if within landfarm effluent discharge parameters identified in the Site Water Monitoring and Management Plan and Type A Water Licence. Land and water inspectors will be notified, as required by land use and water licences, prior to discharge. Contact water not meeting discharge criteria will be directed to an oil-water separator for further treatment.
- Tilling will be conducted on a regular basis (ideally weekly) to aerate the soils and enhance microbial degradation.
- Soil will be considered remediated and removed from the landfarm when sampling demonstrates that soils meet Nunavut's Environmental Guideline for Site Remediation (Government of Nunavut, 2010).
- Soils that did not respond to bioremediation treatment may be disposed of off-site, or with prior approval, the materials could be used as fill within the on-site engineered landfill.
- Procedures will be developed for sampling soil and contact water, including quality assurance and quality control (QA/QC) procedures. QA/QC procedures will follow the applicable AANDC guidelines (INAC, 1996).
- The anticipated operational period of the landfarm is expected to be from June through September.
- During winter months, soil can be stockpiled to minimize contact with freshet water.

7.5.3 Landfarm Closure

The landfarm will be closed in accordance with Sabina's Mine Closure and Reclamation Plan. This is expected to include testing of residual soils being treated as well as sand bedding above and below the liner, and disposal of the liner and remaining soils in one of the approved landfills.

7.6 SEWAGE TREATMENT AND SLUDGE DISPOSAL FACILITIES

Sewage at the Goose Property will be treated using a biological reactor. Various lift stations will pump sewage from buildings on-site to the sewage treatment plant. A vacuum truck will collect and transport sewage wastes that are generated in remote locations. The sewage treatment plant will be designed to accommodate the maximum number of personnel on site during peak periods. Based on a 700-person camp at the Goose Property during construction, the sewage treatment plant would have a capacity of 192.5 m^3/day (700 people at 275 L/day). Treated effluent discharge locations and receiving waters are identified in the Site Water Monitoring and Management Plan.

Sewage sludge generated by the sewage treatment plant will be directed to the incinerator. The incinerator proposed for use at the Goose Property is designed to incinerate sewage sludge, and incinerator emissions will be monitored as described in the Incineration Management Plan.

Because of the smaller camp capacity and seasonal presence at the MLA, incinerating toilets will be used or collected sewage will be incinerated. Ash from incineration will be contained in drums and will be either backhauled to the Goose Property for disposal in the landfill, or will be backhauled by sealift to a licensed disposal facility off-site.

The sewage treatment facilities will be operated by trained personnel who will carry out regular inspection and monitoring of the facility. An operation and maintenance manual approved under the water licence will direct operation and maintenance of these facilities.

8. Record Keeping

Waste material logs will be completed to track the volume, material type and material source for all materials that are passed through the waste segregation and waste management process. The segregation of waste and transportation to each of the waste management facilities on site will be tracked and recorded. Material tracking logs will be stored digitally and available for review by on-site personnel and inspectors on an as-needed basis.

Details of record keeping for the incinerator, including the updating of a maintenance log and collection of incinerator operational data is provided in detail in the IMP. The testing and disposal of incinerator ash will be recorded and made available to the inspectors upon request.

9. Environmental Protection Measures and Monitoring Program

Sabina has an ongoing commitment to implementing environmental protection measures for all components of its operations. As previously indicated in Section 4.3, Sabina is committed to undertaking waste collection, storage, transportation and disposal in a safe, efficient and environmentally compliant manner, by actively encouraging and implementing the four Rs of waste management: waste reduction, reuse, recycling and recovery.

In addition, Sabina is also committed to implementing appropriate waste and runoff monitoring programs to satisfy regulatory requirements and achieve environmental protection. Waste and runoff monitoring requirements will be prescribed in the Type A Water Licence for the Project and will likely include the following:

- Visual inspections
- Inventory of quantity and type of materials directed to each of the waste management facilities (discussed in Section 7)
- Record of the weight and location of waste disposed of in the landfill
- Collection of samples and analysis of runoff quality (surface runoff or shallow groundwater seepage, as appropriate) downstream of the landfill
- Leachate quality testing of incinerator ash to determine if suitable for landfilling or requiring disposal at an off-site licensed hazardous waste disposal facility
- Inspections of the landfarm, records of soil and water management activities, and laboratory testing of soils and contact water
- Testing of treated sewage effluent quality from the sewage treatment plant

10. Environmental Reporting

It is expected that execution of this Waste Management Plan (subject to ongoing updates) will be a condition of Sabina's Type A Water Licence for the Back River Project. As such, the water licence will prescribe the required record keeping and reporting with respect to waste disposal. Such environmental reporting is expected to include:

- Filing of updates to the Waste Management Plan to the NWB
- Submission of design and as-built reports for waste management facilities
- Monthly and annual reporting of waste management activities and monitoring results, as prescribed in the water licence.

11. Plan Review and Effectiveness

The WMP will be included in Sabina's future Type A Water Licence Application, and may be updated prior to application submission pending comments from review of the FEIS. The plan may be updated again prior to construction if instructed to do so by the NWB during the licensing process. The plan will be reviewed on a regular basis to incorporate any lessons learned, major changes to facility operation or maintenance, and environmental monitoring results. Any updates to the WMP will be filed with the Annual Report submitted under the Type A Water Licence.

All employees will be informed of relevant updates and the updated WMP will be located in a designated area at each site.

Sabina will retain all raw data records and annual reporting for at least two (2) years in digital format. The updated WMP, raw data and annual reporting will be made available by Sabina at all times for review by the lands and waters inspectors, the NWB, and Environment Canada.

12. Closure Plan

Each of the landfill sites will be designed to minimize the area of surface disturbance, stabilize disturbed land surfaces against erosion, and return the land to a post-mining use that is consistent with past traditional pursuits and wildlife habitat.

Final closure of the landfill sites will be undertaken once they are no longer needed, which is dictated by site conditions (not anticipated) or when the mine closes as part of mine closure activities. Final closure will consist of covering the landfill sites with waste rock (that is not anticipated to generate acid rock drainage or metal leaching) to facilitate aggradation and encapsulation in permafrost. Details pertaining to mine closure, including closing of the landfill sites, are provided in Sabina's Mine Closure and Reclamation Plan.

13. QA / QC

Sabina will implement a series of Quality Assurance (QA) and Quality Control (QC) plans and programs at all levels of the waste management and landfill operation. QC procedures implemented as part of the WMP will be variable and program-specific. QA/QC procedures will be implemented immediately and updated as necessary based on findings of the year-end reporting.

Internal audits and inspections will be conducted as required by permit and other regulatory requirements on all components related to the WMP. Qualified personnel will perform regular inspections of the storage areas, landfarms and landfills to ensure that waste segregation and inventory are being documented correctly.

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Appendix A

Waste Types, Sources, and Management Structures

Sabina
GOLD & SILVER CORP.

Table A1. Waste Types, Sources, and Management Structure

Type	Source	Potential Environmental Effects	Waste Management Hierarchy	Waste Management Strategies
Combustible Non-hazardous Waste				
Kitchen and Food Waste	Food scraps Kitchen grease Wrappings contaminated with food Bagged lunches	Improper storage, handling and disposal can lead to the attraction and subsequent habituation of carnivores and scavengers Potential for litter	Train kitchen staff on waste reduction Use bulk food containers whenever possible	Designated wildlife-proof food waste containers will be located at all remote sites and underground lunchrooms Collected daily Stored inside the waste storage facility prior to incineration / landfilling Regular incineration
Corrugated Cardboard	Packaging of supplies/ materials	Potential for litter	Order products in bulk to minimize packaging Monitor and reduce, where possible, the amount of packaging shipped to the sites Reuse corrugated cardboard on-site to package materials being sent off-site	Stored inside the storage facility prior to incineration Regular collection and incineration
Domestic Refuse	Refuse from offices and camp rooms (e.g., paper, plastic wrapping, fabrics, etc.)	Improper storage, handling and disposal can lead to the attraction and subsequent habituation of carnivores and scavengers Potential for litter	Domestic waste will be reduced through employee education programs, including proper separation of waste Double-sided printing and photocopying will be encouraged	Educate employees about separating recycling and hazardous items from personal waste items Use clear garbage bags so that cleaning staff can monitor waste sorting habits Periodically assess domestic refuse to ensure that waste streams are being separated Regular collection and incineration / landfilling
Damaged Sacks (Super Sacks)	Used for the transportation of bulk materials and explosives	Potential for litter	Sacks will be used to ship explosives from the manufacturer to site, and undamaged sacks will be returned to the manufacturer for reuse. Only damaged sacks will be disposed.	Damaged sacks will be incinerated.

Table A1. Waste Types, Sources, and Management Structure

Type	Source	Potential Environmental Effects	Waste Management Hierarchy	Waste Management Strategies
Recyclable Wastes				
Beverage Containers (plastic, aluminum, glass, tetra packs)	Camp staff drinking bottled beverages	Improper storage, handling and disposal can lead to the attraction and subsequent habituation of carnivores and scavengers Potential for litter	The camp will not provide individually packaged beverages (e.g., cans of pop or juice, bottled water, etc.), rather the camp will promote the use of bulk beverages, available from a beverage dispenser	Basic waste management training, including recycling training, and waste reduction for all personnel on-site Designated recycling bins for beverage containers Used beverage containers will be stored in wildlife-proof containers Stored in the waste storage facility prior to shipping off-site
Electronics and Electrical Materials	Electrical devices that cannot be repaired and cannot be recycled	May contain mercury, lead, arsenic, cadmium, brominated flame retardants (BFRs), and polyvinyl chloride (PVC) that could enter ecosystem	Electrical devices will be repaired when possible	Sabina's environment staff will determine the risk of electronic devices and classify them as recyclables, hazardous or non-hazardous waste and investigate the possibility of recycling the electronics and/or appropriate methods for waste disposal
Dry cell batteries (AAA to D cell, 6 and 9 volt, and watch batteries)	Personal electronics (e.g., flashlights)	New domestic dry cell batteries do not contain mercury. Older batteries may contain small amounts of lead, cadmium, and mercury. Other battery compounds like silver, zinc, and nickel may also be present.		There will be designated collection bins for dry cell batteries in the employee facilities at each of the three project sites Dry cell batteries will be shipped off-site for recycling / disposal as appropriate.

Table A1. Waste Types, Sources, and Management Structure

Type	Source	Potential Environmental Effects	Waste Management Hierarchy	Waste Management Strategies
Sewage and Greywater				
Sewage effluent and greywater	Human waste Janitorial services Vehicle washing bay Kitchen sinks and dishwashers Showers Laundry	Increased concentration of nutrients and toxic contaminants Aquatic oxygen depletion and reduced water clarity Risks to human health from consumption of contaminated water Taste and odour problems in water Reduced aesthetic of water and shores and impaired recreational use Increase in ambient water temperature Changes in ecosystem species composition, abundance, and diversity Increased submerged weed growth Sedimentation (Environment Canada, as cited in CCME 2006).	Sabina and its contractors will reduce the amount of greywater produced by using water-efficient fixtures and appliances Sabina will educate employees and contractors about the importance of water conservation The bioreactor system recycles sludge as part of its system which reduces the amount of sludge created	Greywater and sewage effluent will be treated by biological reactor sewage treatment plant at the Goose Property. Greywater at the MLA will be passed through an oil-water separator and then land discharged away from waterbodies in accordance with land use regulations.
Sewage Sludge	Periodically sludge needs to be removed from the bioreactor sewage treatment system (Goose Property) or Pacto incinerating toilets (MLA).	This nutrient-rich product can act as a fertilizer if exposed to land or water May cause odours that can attract wildlife	No opportunity to limit the input of sewage waste on-site. Encourage staff to reduce greywater through education programs Water-efficient appliances will be used Use low phosphorus detergents The bioreactor system reuses sludge to reduce the output of sludge	Waste transported directly from the bioreactor system to the incineration building for same-day incineration.

Appendix B

Site Layouts Showing Locations of Waste Management Facilities

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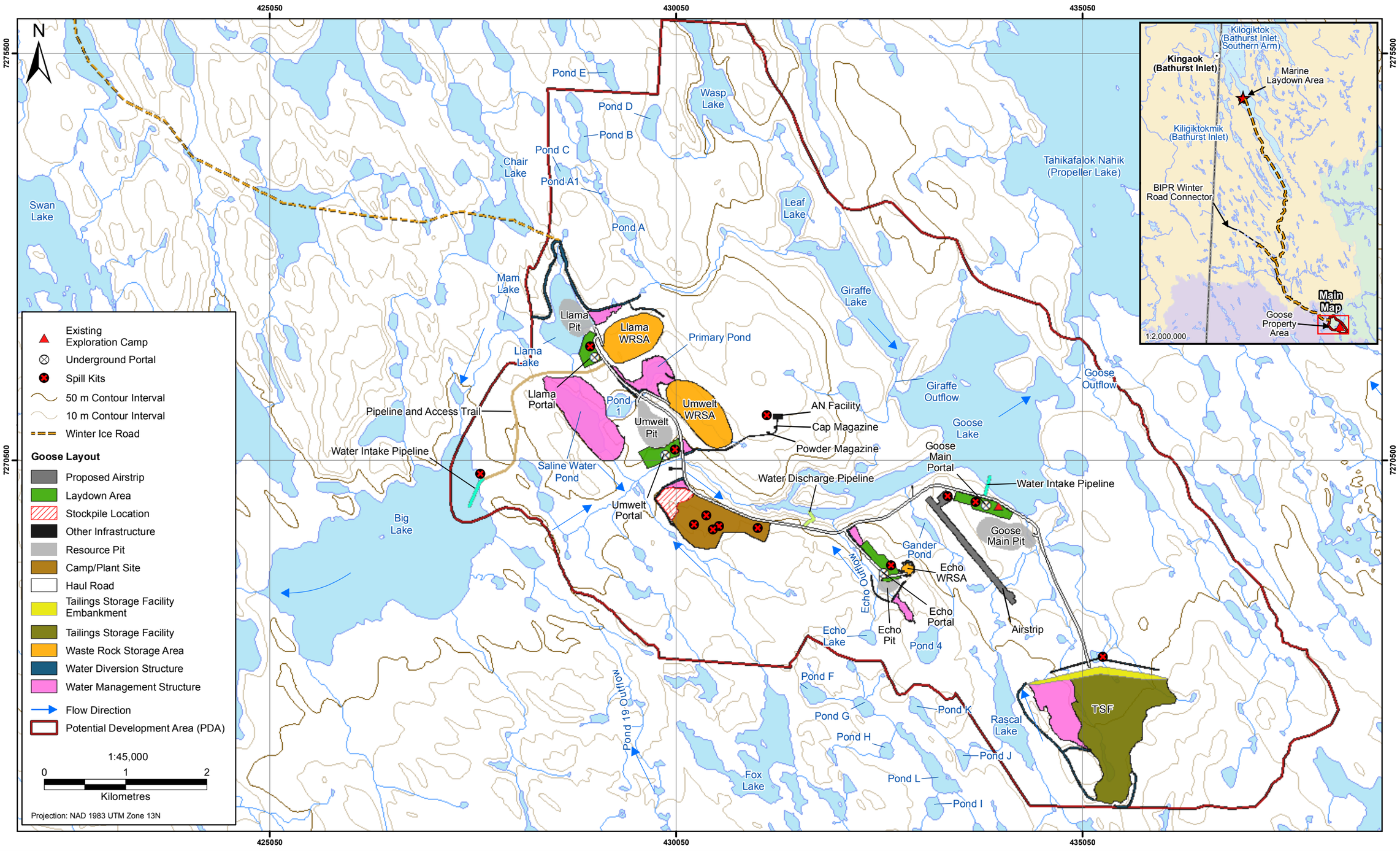
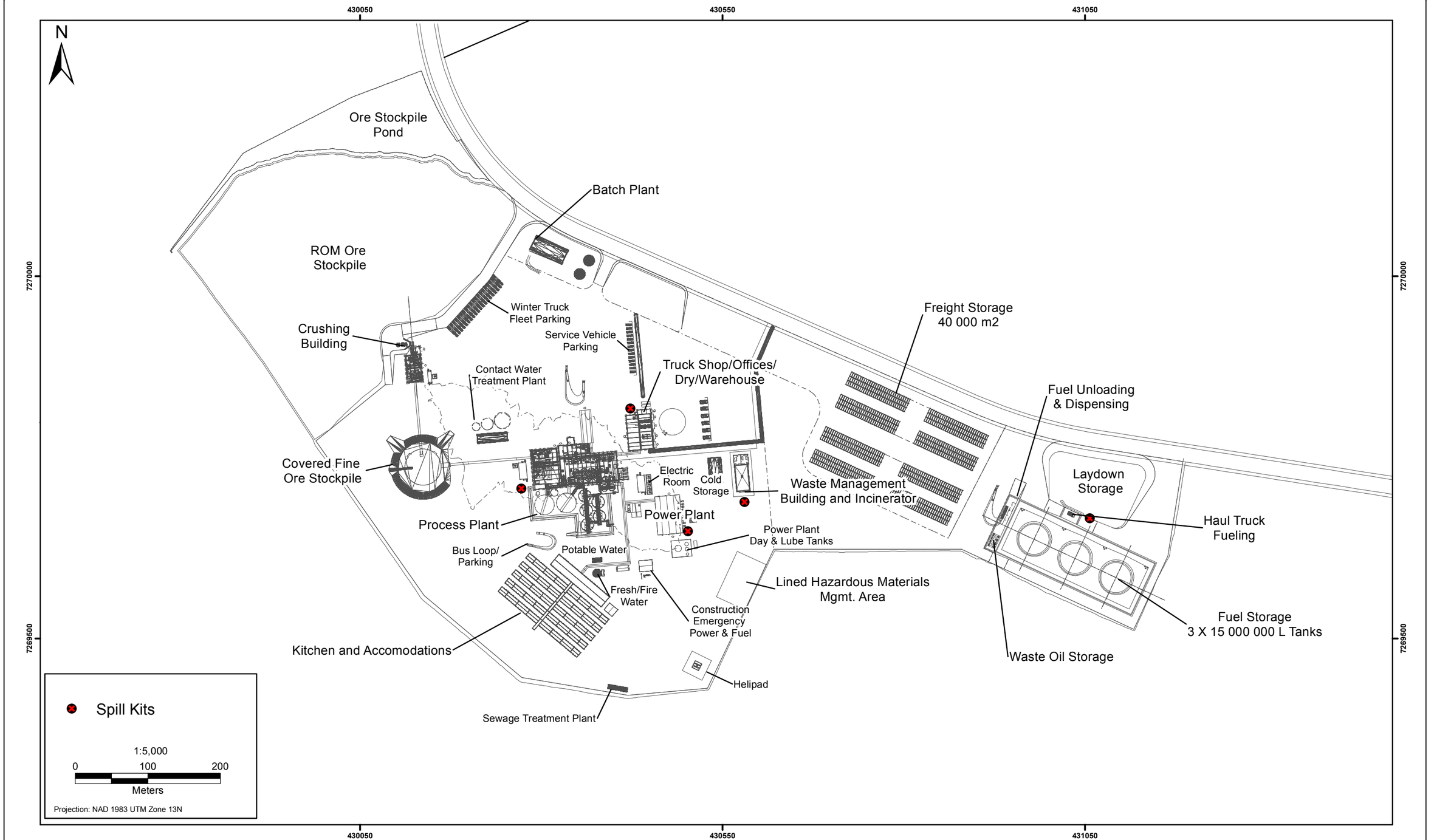


Sabina GOLD & SILVER CORP.

Goose Property General Arrangement

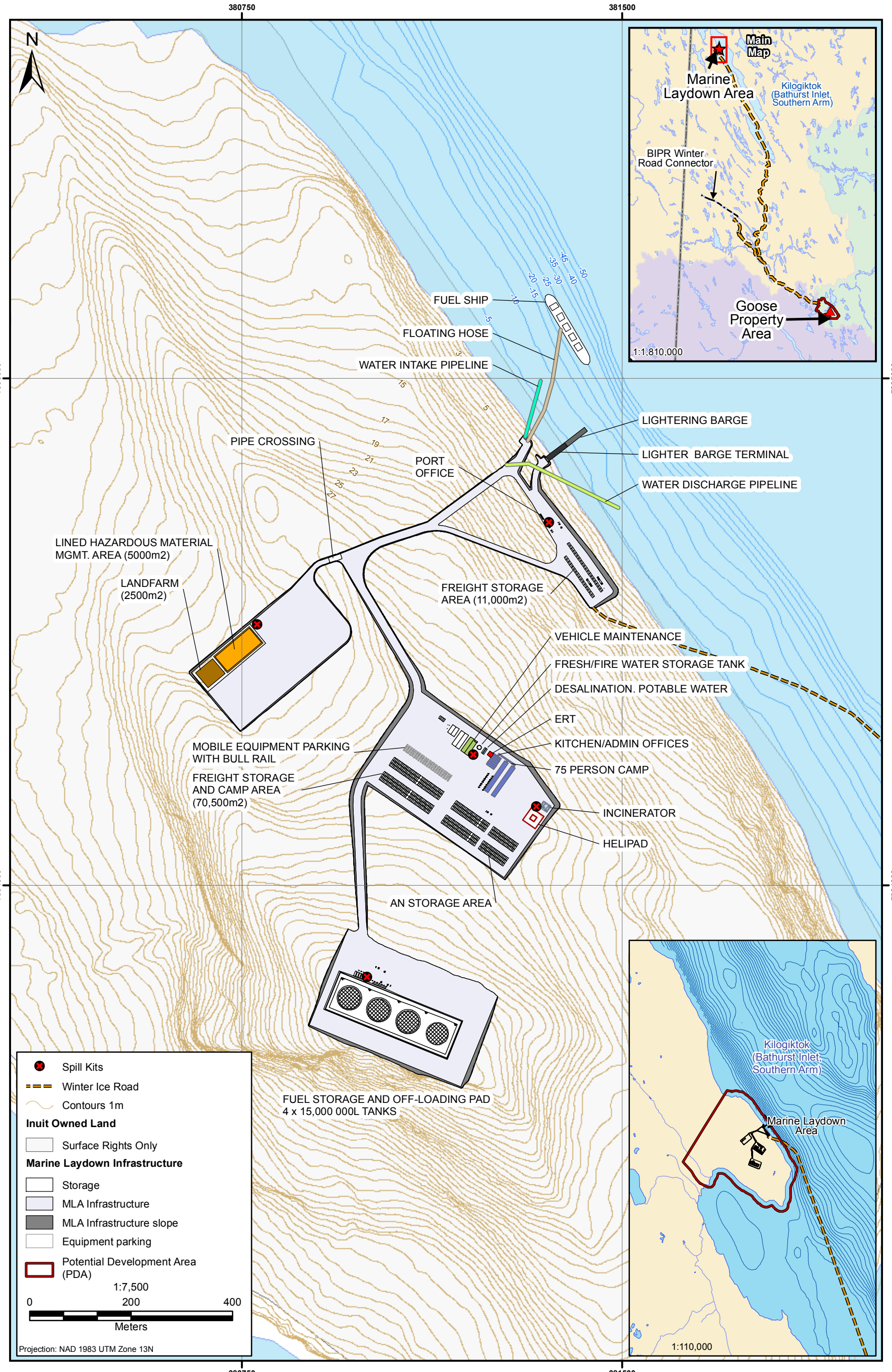


Sabina GOLD & SILVER CORP.

Goose Site Plan General Arrangement

GIS # BAC-50-034_S

October 26 2015



Sabina GOLD & SILVER CORP.

Marine Laydown Area General Arrangement

11. Incineration Management Plan

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BACK RIVER PROJECT
Incineration Management Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 11	n/a	Title change	Renamed to “Incineration Management Plan”
	6.2	George	Removed George incinerator
	6.5	Incinerator ash	Incinerator ash will be packaged and then landfilled to eliminate any wind-blown effects
	6.5.1	Sewage sludge	Sewage sludge will be incinerated instead of landfilled
	7.4	Used oil guidelines	Replace NWT guidelines with those from GN
	8.1	Emission testing	Elaborate on frequency of stack emissions testing
	8.2	Ash testing	Elaborate on testing parameters and process

BACK RIVER PROJECT
INCINERATION MANAGEMENT PLAN

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Glossary and Abbreviations

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

CCME	Canadian Council of Ministers of the Environment
CEPA	*Canadian Environmental Protection Act*
CWS	Canada-Wide Standards
DEIS	Draft Environmental Impact Statement
EC	Environment Canada
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
FEIS	Final Environmental Impact Statement
GN	Government of Nunavut
IMP	Incineration Management Plan
NIRB	Nunavut Impact Review Board
NWB	Nunavut Water Board
PCDD	Polychlorinated Dibenzo-p-Dioxins
PCDF	Polychlorinated DibenzoFurans
SOP	Standard Operating Procedures
TF	Tailings Facility (Umwelt or Goose Main)
TSF	Tailings Storage Facility
QA	Quality Assurance
QC	Quality Control

1. Introduction

This chapter describes the Incineration Management Plan (IMP) that Sabina Gold & Silver Corp. (Sabina) will follow in the development and operation of the Back River Project (the Project). It represents one plan in a series of environmental management plans that have been prepared for the Project Final Environmental Impact Statement (FEIS). This management plan has been prepared in accordance with Section 9.4.2 of the EIS Guidelines that the Nunavut Impact Review Board (NIRB) issued to Sabina (NIRB, 2013), Environment Canada's (EC) *Technical Document for Batch Waste Incineration* (EC 2010), and best management practises.

The information presented herein is current as of August 2015 and based on Feasibility Study project designs. The IMP is a living document and will be updated based on engineering design, management reviews, incident investigations, regulatory changes, or other Project-specific protocols. The IMP will be included in Sabina's future Type A Water Licence Application and may be updated prior to submitting the application pending comments from review of the FEIS. The plan may be updated again prior to construction if instructed to do so by the NWB during the licensing process. The plan will be reviewed on a regular basis to incorporate any lessons learned, major changes to facility operation or maintenance, and environmental monitoring results. Any updates to the IMP will be filed with the Annual Report submitted under the Type A Water Licence.

2. Scope and Objectives

Incineration is an essential part of waste management at the Back River site. The incineration of acceptable solid waste from the accommodation complex, kitchen, lunch rooms, shops, warehouses and offices will divert waste from directly reporting to the on-site landfill. Incineration has the advantage of eliminating waste that could potentially attract wildlife to the landfill, thereby reducing possible interactions between humans and wildlife.

Waste products will be safely managed from the time they are produced to their final disposal. Reduce, reuse, and recycle initiatives as well as a waste segregation program will be implemented at the Project to minimize the quantity of waste incinerated or directed to the landfill. Waste that is deemed unsuitable for incineration, including hazardous materials, will be handled appropriately. It may be packaged for shipment to a certified waste management facility for treatment, recycling and/or disposal in another provincial or territorial jurisdiction.

By using state of the art incinerator technologies and developing a deliberate and conscientious waste management program, Sabina can ensure that each incinerator achieves full compliance with air quality requirements for the protection of the environment and human health.

The objectives of incineration management through all phases of the Back River Project are to:

1. Characterize the quantity and composition of the waste products to be generated at the Back River site, and effectively separate wastes acceptable for incineration from waste that is not.
2. Select appropriate batch waste incinerators based on the characteristics and quantity of waste.
3. Locate incinerators at appropriate sites set back an appropriate distance from other infrastructure.

4. Operate incinerators to achieve optimal combustion and avoid the formation of dioxins, furans and mercury in the combustion process.
5. Implement incinerator operational practices and to document frequency and incinerator operating parameters, including the safe handling and disposal of incinerator residues.
6. Demonstrate compliance with applicable Federal and Territorial regulations for environmental protection.

To avoid overlap and inconsistencies with other biophysical management plans, Sabina has referenced where appropriate the following management plans:

- Environmental Management Plan.
- Landfill and Waste Management Plan.
- Hazardous Materials Management Plan.
- Fuel Management Plan.
- Occupational Health and Safety Plan.

3. Planning and Implementation

Planning for the IMP started with the development of the draft environmental impact statement (DEIS) and further refined with the FEIS, which identified existing (baseline) conditions, assessed potential impacts of the Project, developed conceptual mitigation strategies and developed specific mitigation measures to execute these strategies. Conceptual strategies and plans will continue to be elaborated and executed throughout the construction, operation, and closure phases of mining. Environmental management and social aspects will be tracked, reviewed, and updated through ongoing maintenance of the plan. These updates will incorporate relevant feedback from the public, obtained during public consultation.

Significance criteria have been developed that assist in identifying priority aspects, establish management criteria and activity-specific mitigation measures. For social issues and effects, a key factor for determining significance is ongoing feedback from public consultation. These efforts will be used to communicate progress, and involve the public where necessary, on environmental performance.

Monitoring will be the principal mechanism to provide feedback to continually gauge the effectiveness of environmental performance. Operational control is facilitated through the contractor job-specific standard operating procedures (SOPs), work instructions, on-the-job instruction, tailgate meetings where required, contract requirements, and service agreements. The effectiveness of physical operational control will be reviewed according to preventative maintenance and review procedures and schedules.

4. Applicable Legislation and Guidelines

Solid waste incinerators and waste oil burners are regulated in Nunavut under the *Nunavut Public Health Act*, the *Nunavut Environmental Protection Act* and the federal *Environmental Protection Act*. Various regulations and guidelines under these Acts as well as guidelines developed by the Canada Council of Ministers of the Environment (CCME) were reviewed in preparing this document (Table 4-1).

Table 4-1. Applicable Legislation to the Incineration Management Plan

Acts	Regulations	Guidelines
Federal		
Canadian Environmental Protection Act (CEPA 1999 c.33)	Schedule 1: List of Toxic Substances Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2002-301)	Environment Canada (EC) Technical Document for Batch Waste Incineration (EC 2010) Canada-Wide Standards for Dioxins and Furans (CCME 2001a) Canada-Wide Standards for Mercury (CCME 2000)
Hazardous Products Act	Controlled Products Regulations	Workplace Hazardous Materials Information System (WHMIS 2015)
Territorial – Nunavut		
Nunavut Environmental Protection Act		Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities (GN 2011b) Environmental Guidelines for the Burning and Incineration of Solid Waste (GN 2012) Environmental Guidelines for Ambient Air Quality (GN 2011a) Environmental Guideline for Mercury-Containing Products and Waste Mercury (GN 2010) Environmental Guideline for Used Oil and Waste Fuel (GN 2012)
Nunavut Public Health Act		

Provincial and/or territorial regulations that pertain to emissions from incinerators are not available for Nunavut or the Northwest Territories. Therefore, performance limits for Project incinerators will be in accordance with the emission guidelines set out by the CCME: Canada-Wide Standard for Dioxins and Furans (CCME 2001a), and Canada-Wide Standards for Mercury Emissions (CCME 2000).

Ash produced from the incineration process will be disposed of in accordance with the Nunavut Environmental Guideline for Industrial Waste Discharges (GN 2011b).

5. Roles and Responsibilities

The General Manager is ultimately responsible for the success of this plan and approves all relevant policies and documents, auditing, action planning and the verification process. His or her direct reports are responsible for the implementation of this plan including overall management of the plan and internal reporting.

The Environmental Superintendent along with his or her direct reports are responsible for the implementation of this plan including ensuring compliance and adaptive management.

Other relevant personnel are responsible for the plans effectiveness by completing required training, maintaining compliance with training requirements as set out by this plan and best management practices. All employees are to work in compliance with Health and Safety Laws and Regulations.

6. Procedures and Operation for Waste Incineration

The Project will select and operate incinerators based on Environment Canada's *Technical Document for Batch Waste Incineration* (EC 2010).

6.1 EQUIPMENT AND INSTALLATION

The Project will utilize state-of the art incinerators capable of satisfying all criteria set forth in EC *Technical Document for Batch Waste Incineration* (EC 2010).

A scale will be used to measure the weight of all material that will be directed to each incinerator. Weights and waste types will be recorded and mixed appropriately to maximize combustion efficiency. Incinerators will be equipped with internal computerized process control and data acquisition systems to monitor the operating parameters each unit.

6.2 INCINERATOR LOCATIONS

The incinerator at the Goose Property will be housed inside a separate building away from the process plant and accommodations building. The final location will be situated down-wind from the main camp buildings. The building will have sufficient floor space and capacity to receive and sort all waste material generated on site for a period of three weeks.

The incinerator at the MLA will also be located away and downwind from the main accommodation complex.

6.3 CONTINGENCY

In the event of an incinerator breakdown, alternative disposal methods shall be implemented until the incinerator is repaired. The presence of putrescibles in the domestic waste makes long term storage impractical due to the potential of attracting wildlife. The following alternative disposal methods for this waste have been identified:

- Short-term shutdown of incinerator (up to 3 weeks) will be mitigated through temporary storage in sealed, wildlife-proof containers.
- Long-term shutdown of incinerator (more than 3 weeks) will require backhauling for off-site disposal by a waste services provider.

6.4 TRAINING

Incinerator operators will complete a training program prior to commencement of operation. This training will include recommendations presented in Environment Canada's *Technical Document for Batch Waste Incineration* (2010) and developed in conjunction with the training manual provided by the incinerator supplier.

At a minimum, the training program will educate operators in the following areas:

- Hazard recognition and safety protocols.
- Identification of waste types and understanding of how waste composition affects operation.
- Incinerator start-up and operating procedures, including identification of adjustments to increase operating efficiency.

- Incinerator clean-out and maintenance procedures.
- Record keeping and reporting requirements.

Initial operator training will be provided by a qualified technician appointed by the incinerator vendor during commissioning.

6.4.1 Staffing and Staff Safety

The incineration process will be automated and requires minimal attendance during operation. A computerized incinerator will typically require one operator to interact with the equipment for approximately 1 to 1.5 hours per day, largely for ash removal, loading and start-up. Each incinerator will be designed, installed and operated so that the operators are not exposed to high temperatures during loading or ash removal due to complete cool down after the burn cycle.

6.5 INCINERATOR OPERATION

A full set of incinerator operating procedures will be developed in consultation with the supplier/manufacturer prior to use. Operation will be conducted in accordance with the EC *Technical Document for Batch Waste Incineration* (EC 2010) and shall include the following general procedures:

- Waste sorting on the basis of origin and heating value. Food waste and waste that has been in contact with food will have priority for incineration.
- Waste mixing to ensure a calorific value within incinerator specifications and to achieve good combustion inside the primary chamber.
- The operator will observe the start of the burn cycle for at least 15 minutes to ensure incinerators are operating correctly, and the primary and secondary chambers operate in the temperature ranges specified by the manufacturer.
- Sizable front doors will be utilized for easy access to manually load-feed waste with a front-end loader.
- Incinerator doors will only be opened after the burn cycle is complete and the unit cooled.

Incinerator ash will be handled and disposed of appropriately, following these steps:

- Ash will be removed from each incinerator before it is charged with the next load of waste to be incinerated.
- Ash will be placed in drums or bags before disposal. Incinerator ash will be packaged in drums or sacks and the whole container land filled, eliminating any wind-blown effects.
- Ash generated at Goose Property will be disposed in the nearest landfill, TSF, Umwelt TF or Goose Main TF. Ash generated at MLA will be containerized and backhauled to either Goose Property or off-site for disposal; if the concentration of trace metals exceeds the Government of Nunavut's *Environmental Guidelines for Industrial Waste Discharges* (GN 2011b) for on-site disposal, ash will be sent to a *licensed hazardous waste disposal facility off-site*.

To facilitate the initial sorting of material, waste will be collected in transparent bags so that the contents are readily visible. Verification of correct sorting and mixing procedures will be ensured by periodic spot checks and QA/QC management by a trained staff member.

6.5.1 Incinerator Waste Stream

Food, food covered packaging, and other combustible (non-recyclable) office wastes will be collected and stored in sealed wildlife-resistant containers. As soon as practical, these waste products will be relocated from the source site for incineration.

Authorized incinerator waste includes domestic food waste, paper, cardboard, lumber scraps, and plastic food wrap or other food encrusted packaging which cannot be reasonably washed of food. Bag lunches and kitchen food waste and packaging will be stored in plastic bags, collected and incinerated to minimize potential wildlife attractants associated with domestic waste at the site. Oil and grease collected from the kitchen is to remain stored in the kitchen until transferred to the incinerator for immediate disposal.

Other combustible waste such as dewatered sewage sludge, used oil, rags and sorbent pads, laboratory chemical wastes (spent acids, caustics, solvents, washings and solutions), corrugated cardboard, paper, waste lumber and other clean, untreated wood waste will also segregated in the waste stream for incineration.

6.5.2 Waste Volumes

The materials being used, the number of individuals working on-site and the nature of activities shall determine the volume of waste destined for landfills, incinerators, and the amount removed from waste streams for reuse and recycling.

6.5.3 Waste Incineration Rate

Waste will be batch-incinerated on an as-required basis up to the maximum frequency of the incinerator's design.

6.5.4 Odour and Dust Control

Current state of the art incinerators are designed with a non-turbulent atmosphere in the primary burn chamber which reduces the formation of particulate matter. Any additional dust or odour control needed to meet discharge requirements will be supplied with the equipment. Ash residues generated in the primary chamber will be manually removed on a daily basis and loaded into a labelled container.

7. Environmental Protection Measures

Sabina has an ongoing commitment to implementing environmental protection measures in all aspects of its operations and is committed to reducing incinerator emissions through the use of technologically advanced, best available and economically feasible procedures.

Sabina is committed to reducing waste volumes to be incinerated, while managing and minimizing dioxin, furan and mercury emissions. In addition, Sabina will implement appropriate material handling procedures for the disposal of ash material generated by incineration.

A summary of the Canada-Wide Standards, as prepared by CCME, for dioxins, furans and mercury emission limits is presented in Table 7-1.

Table 7-1. Canada-Wide Standards for Waste Incineration Emissions

Waste Incineration Compound	Sector	Emission Limit (Max)
Dioxins and Furans[1]	Municipal Solid Waste[3] Sewage Sludge Incineration	80 picograms of International Toxic Equivalents (I-TEQ) per cubic metre (pg/m^3)
Mercury[2]	Municipal Solid Waste	20 micrograms per cubic metre ($\mu g/m^3$)
	Sewage Sludge Incineration	70 micrograms per cubic metre ($\mu g/m^3$)

[1] *CCME 2001a,*
[2] *CCME 2000*
[3] *According to the Canada-Wide Standards (CWS) , "municipal solid waste" includes any waste that might be disposed of in a non-secure landfill site if not incinerated (i.e., non-hazardous wastes regardless of origin), but does not include "clean" wood waste.*

The emission limits apply to waste incineration at new facilities across Canada. Compliance with these standards will be achieved through the use of state of the art technologies and a detailed and conscientious waste management program. The incinerator at the Project is expected to achieve full compliance immediately upon attaining normal full scale operation.

7.1 WASTE REDUCTION AND MITIGATION STRATEGIES

Waste reduction, reuse, and recycling initiatives as well as a waste segregation program will be developed at the Project as per the Landfill and Waste Management Plan to minimize the quantity of waste to be incinerated or directed to the landfill.

A waste audit will be completed prior to operation of the incinerator to identify waste stream volumes that can be minimized prior to incineration. The waste audit will inform the development of waste segregation procedures and policies.

Sabina will develop a comprehensive list of acceptable and unacceptable waste for incineration based on the waste audit and at the time that all on site waste materials have been identified. The identification of unacceptable waste for incineration will be based on the EC *Technical Document for Batch Waste Incineration* (EC 2010) and the regulations discussed in Section 4.0

7.2 DIOXINS AND FURANS

Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), commonly known as dioxins and furans, are toxic chemicals, which are persistent and subject to bio-accumulation. Their presence in the environment results predominantly from human activity, most notably the large-scale incineration of municipal and medical wastes. Sabina recognizes the importance of reducing the presence of dioxins and furans in emissions.

7.3 MERCURY

Mercury is a naturally occurring substance, which can be transformed through biological processes to methyl mercury, a persistent substance which bio-accumulates in the food chain and is particularly toxic to humans and wildlife. Sabina understands the importance of reducing the concentrations of mercury in emissions.

7.4 USED OIL AND WASTE FUEL

The incinerator will be capable of efficiently and safely burning oil and waste fuel. Sabina will manage used oil and waste fuel according to the Environmental Guideline for Used Oil and Waste Fuel (GN 2012).

The regulations stipulate the maximum level of contaminants in used oil that is allowed for incineration. Specifics of the used oil and waste fuel regulations are referenced in the Fuel Management Plan.

7.5 INCINERATOR ASH

The incinerator ash produced will be non-hazardous provided that the incinerated material excludes all hazardous waste. In order to confirm the ash concentration, an ash testing protocol developed by the Government of Nunavut will be implemented to ensure that the ash is suitable for landfill disposal. If the concentration of trace metals exceeds the Government of Nunavut's *Environmental Guideline for Industrial Waste Discharges* (GN 2011b), ash will be packaged and sent to a *licensed hazardous waste disposal facility*.

8. Monitoring Program

Sabina will implement a testing and monitoring program to ensure that criteria for applicable air quality standards and guidelines and ash disposal are being met. The monitoring program is outlined in the following sections.

8.1 INCINERATOR EMISSIONS TESTING

The incinerator stack design will incorporate sampling ports, with caps where necessary, at appropriate locations to allow for stack testing to be undertaken during incineration. Complete stack emissions testing for all incinerators will occur upon attaining full scale normal operation to ensure achievement of the Canada-wide Standards for Dioxins and Furans and the Canada-wide Standards for Mercury (CCME 2000, 2001a). The frequency of recurring individual incinerator emissions testing at Sabina will be determined based on discussions with the appropriate regulatory authorities.

8.2 ASH TESTING

Provided the materials that go into the incinerator are controlled to exclude all hazardous materials, then the incinerator ash should be non-hazardous. Ash testing will be implemented as required to ensure that the incinerator ash is suitable for disposal in the landfill. The samples will be compared to the "Government of Nunavut guidelines for solid waste/process residual concentrations" suitable for landfill, as described in the "Environmental Guideline for Industrial Waste Discharges" into Municipal Solid Waste and Sewage Treatment Facilities and presented in Table 8.2-1.

Table 8.2-1. Guidelines for Solid Waste/Process Residuals (Ash) Suitable for Landfill

Parameter	Maximum concentration (mg/L)
Arsenic	2.5
Barium	100
Cadmium	0.5
Chromium	0.5
Lead	5
Mercury	0.1
Slenium	1
Silver	5
Zinc	500

If monitoring indicates the ash is above the guidelines and not suitable for landfilling, an investigation will be undertaken to identify the cause and eliminate the source of exceedance. Ash with elevated metals concentrations will be packaged in drums and sent to a licensed hazardous waste disposal facility. If monitoring indicates the ash meets the guidelines, it will be packaged in drums or sacks and the whole container landfilled, thereby eliminating any windblown effects.

9. Record Keeping

A maintenance log is required to be kept for regulatory review. The maintenance log will be used to record routine maintenance activities, the date completed, personnel responsible and observations during maintenance activities. The maintenance log will also note any problems encountered. The maintenance log will include a description of any maintenance or operational changes, the date the work was completed, and who performed the work. As part of the maintenance, operators/maintenance personnel should determine the cause of any failure to help avoid or reduce similar failures.

Operational data will be collected by a data logger and stored continuously, even when the incinerator is not operating. The data will be used to monitor operating conditions to ensure that normal operating parameters are not exceeded. In the event that normal operating conditions are not met, the data will be used to identify causes of failure and to optimize the system.

Prior to incineration, the type of waste in each bag will be determined, weighed and the source noted. The total weight of each type of waste will be recorded before the burn cycle is started. After the cool-down period, the ash will be removed and weighed before it is sent for disposal. This information will be stored electronically with the operational data from the incinerator. This data will assist Sabina in determining incinerator waste generation rates at the facility, and in turn, provide data on the effectiveness of waste diversion, reduction and recycling programs.

10. Environmental Reporting

To demonstrate conformity with performance limits, an annual incineration management report will be prepared and submitted as part of annual reporting to authorizing agencies. The incinerator reporting will also be integrated into the annual air quality monitoring report which Sabina is committed to developing every year.

At the minimum, the following information will be included for incinerator reporting:

- The quantity and type of materials incinerated on-site during operations.
- Results from the stack emissions and ash monitoring.
- Record of ash disposal, including weight of ash disposed, location of disposal, and the transportation/load details.
- Record of any use of auxiliary fuel, referenced to the fuel management plan for fuel log, shipment and handling).

- Summary of operational data that is recorded continuously throughout the year. This includes, but not limited to, temperature, carbon monoxide and oxygen levels, auxiliary burner operating times, and differential pressures.
- Details of operating personnel and summary of their training.

The annual reporting will also identify any major changes to the operation and efficiency of the incinerator. Staff changes or amendments to training requirements will be noted.

11. Plan Review and Effectiveness

The IMP will be updated for the Type A Water Licence application, and regularly thereafter to reflect the operating conditions at the Project during construction, operation and closure. The IMP will be reviewed annually by the Project management team and an updated version will be produced every two (2) years of operation. The IMP will be reviewed in conjunction with the preparation of the annual report to incorporate any lessons learned, major changes to the incinerator operation or maintenance, and environmental monitoring results.

All employees will be informed of relevant updates and the updated IMP will be stored appropriately on site.

Sabina will retain all raw data records and annual reporting for at least two (2) years in digital format. The updated IMP, raw data and annual reporting will be made available by Sabina at all times for review by the Government of Nunavut, Nunavut Impact Review Board, and Environment Canada.

12. QA/QC

Sabina will implement a series of Quality Assurance (QA) and Quality Control (QC) plans and programs at all levels of the incinerator operation and management. This includes emissions and ash testing procedures. QC procedures implemented as part of the IMP are variable and program-specific. QA/QC procedures will be implemented immediately and updated as necessary based on findings of the year-end reporting.

The following QA/QC procedures for incineration will be implemented:

- Incinerator operational data including temperature, differential pressure in the primary chamber, auxiliary burner operation, fan amperage will be recorded continuously, consistent with detailed written operating instructions from qualified personnel.
- Detailed training programs will be implemented to ensure that all staff working with the incinerator are competent and qualified for their respective task.
- Analysis of sampled emissions during monitoring will be completed by an accredited laboratory.
- Stack testing samples of emissions and ash samples will be collected and handled according to operating instructions prepared by qualified personnel.
- Qualified personnel will calculate emission concentrations for monitored air quality parameters based on laboratory results and compare against the applicable guidelines.

References

Canadian Council of Ministers of the Environment (CCME). 2000. Canada-Wide Standards for Mercury.

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12. Hazardous Materials Management Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Hazardous Materials Management Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 12	1	Introduction	Removed references to George, renamed Port as MLA, and other general updates to terminology
	4	Applicable Legislation	Updated and added TDG, added Cyanide Code. Also captured in References.
	6.1 and App. C	Cyanide	Specific mention of cyanide and reference to cyanide management plan in Appendix C
	7	Site plans	Proposed spill kit locations added to figures 7.2-1 and 7.2-2; also added detail site plan figured with spill kits (figure 7.2-3)
	7.3		Added Table 7.3-1. Example Hazardous Materials Inventory
	8		Merged appendix A with table 8.1, Added estimated quantities of waste by type and by project phase, added detail to Table 8-1
	App. C	Cyanide Management Plan	Added Cyanide Management Plan

BACK RIVER PROJECT
HAZARDOUS MATERIALS MANAGEMENT PLAN

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Glossary and Abbreviations

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

AANDC	Aboriginal Affairs and Northern Development Canada
AN	Ammonium Nitrate
ANFO	Ammonium Nitrate / Fuel Oil
ANSI	American National Standards Institute
CCME	Canadian Council of Ministers of the Environment
CEPA	*Canada Environmental Protection Act*
FEIS	Final Environmental Impact Statement
DFO	Fisheries and Oceans Canada
DOE	Department of Environment
EIS	Environmental Impact Statement
EPS	Environmental Protection Service
ERP	Emergency Response Plan
ERT	Emergency Response Team
FO	Fuel Oil
FS	Fuel Storage Area
HAZCOM	Hazard Communication
HMMP	Hazardous Materials Management Plan
HR	Human Resources
HSC	Occupational Health & Safety Committee
HW	Hazardous Waste Storage Area
IPC	Instantaneous Pressure Change
ISO	International Organization for Standardization
KIA	Kitikmeot Inuit Association
SDS	Materials Safety Data Sheets
NIOSH	National Institute for Occupational Safety and Health
NRC	Natural Resources Canada
OPEP	Oil Pollution Emergency Plan
OHSA	Occupational Health and Safety Administration
OHSP	Occupational Health & Safety Plan

PPE	Personal Protective Equipment
SD	Support Document
SCP	Spill Contingency Plan
SMBS	sodium metabisulphite
SOP	Standard Operating Procedures
TDG	Transportation of Dangerous Goods
TDGA	*Transportation of Dangerous Goods Act*
WCB	Workers' Compensation Board
WHMIS	Workplace Hazardous Materials Information System

1. Introduction

This Hazardous Materials Management Plan (HMMP) outlines Sabina Gold & Silver Corp.'s (Sabina) plan for managing hazardous materials at the Back River Project (the Project) including safe handling, storage, transport and disposal. This HMMP was prepared in accordance with best management practices and Applicable legislation (Section 4.0). It represents one management plan in a series of environmental management plans (EMPs) that have been prepared for the Project Final Environmental Impact Statement (FEIS). This plan was developed with support from, and in conjunction with the other environmental management plans.

The HMMP is a living document which will be updated as required based on management reviews, incident investigations, and regulatory changes prior to mine construction / operation and periodically thereafter as needed to reflect changes to Project-specific requirements. At this stage, the information presented herein is current as of July, 2015.

1.1 SITE NAMES AND LOCATIONS

The Back River Project is located at approximately 65° to 66° north latitude, and 106° to 107° west longitude (Figure 1.1-1). The Project includes the Goose Property, a Marine Laydown Area (MLA) in southern Bathurst Inlet, and connecting all-weather and/or winter roads.

1.2 SABINA'S ENVIRONMENTAL POLICY

Sabina's Safety and Environmental Policy relates specifically to waste management by:

- Recognizing that environmental quality is vital to the Corporation's existence, progress and continued development.
- Committing to high environmental standards, conserving natural resources, and minimizing the impact of its activities through the diligent application of appropriate technology and responsible conduct.
- Providing a framework to measure performance.
- Ensuring compliance with applicable legislation, regulations and guidelines.

2. Scope and Objectives

This HMMP provides information on hazardous material management including the environmental hazards; safe handling requirements; transportation, storage, and disposal at the Project and conforms to Section 9.4.8 of the NIRB EIS Guidelines for the Back River Project April 2013 (NIRB File No. 12MN036). Sabina intends to use, generate and dispose of hazardous materials as part of the development, operation and closure phases of the Project.

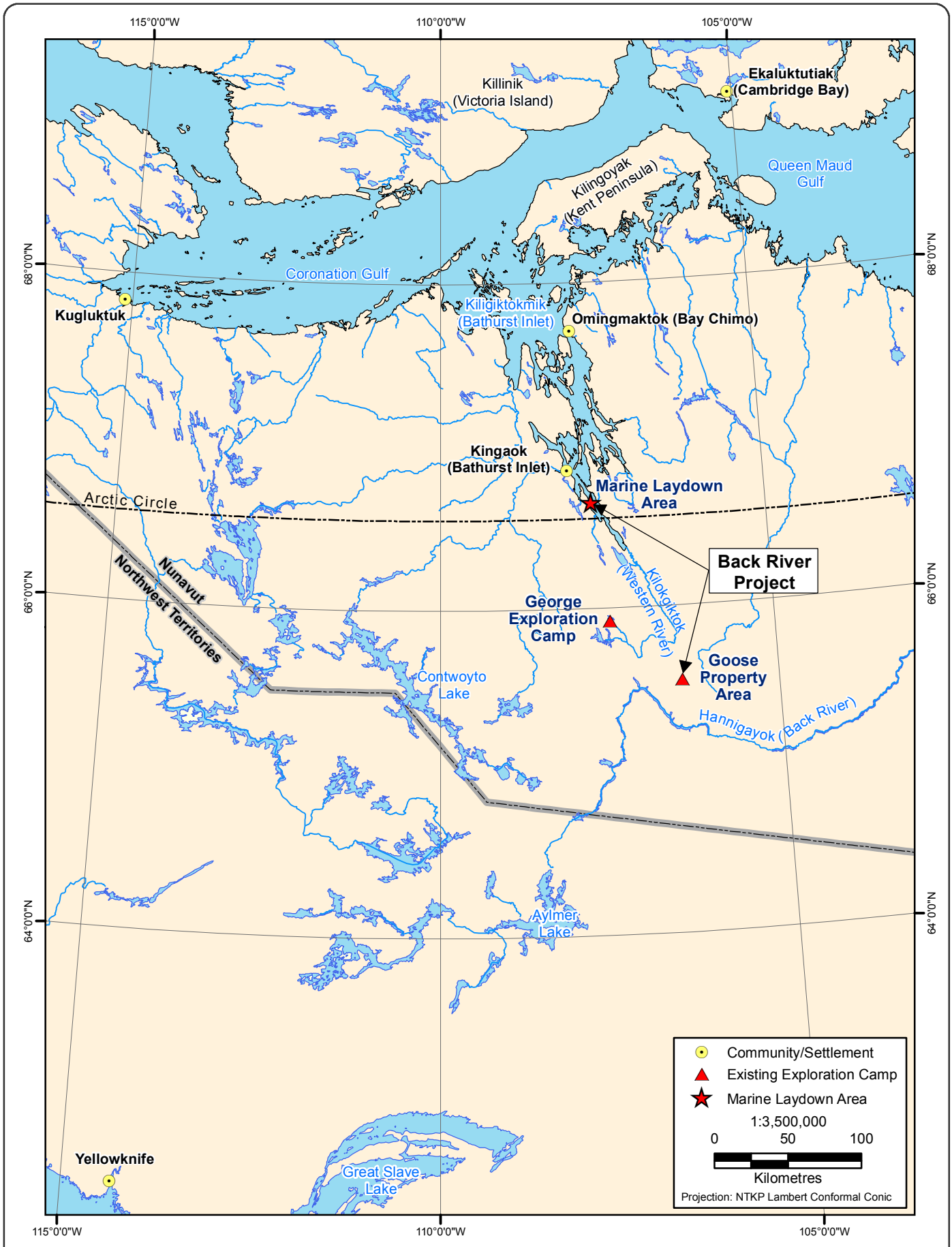

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Figure 1.1-1

Location Map of the Back River Project Area

The main objectives of Sabina's HMMP are summarized as follows:

1. Identify hazardous materials types potentially generated during the construction, operations, and reclamation and closure phases.
2. Characterize the potential environmental hazards associated with the proposed materials.
3. Assign responsibilities for the management of hazardous materials.
4. Identify practices for handling, storing, and disposal of hazardous materials at the Back River mine site that are safe, secure, and environmentally sound.
5. Identify required training for all staff related to hazardous materials.
6. Implement waste monitoring and mitigation measures.
7. Confirm conformance with applicable Federal and Territorial regulations.
8. Conform with Section 9.4.8 of the NIRB EIS Guidelines for the Back River Project, April 2013 (NIRB File No. 12MN036).

To avoid overlap and inconsistencies with other biophysical management plans, Sabina has referenced the following management plans where appropriate:

- Waste Management Plan (WMP).
- Fuel Management Plan.
- Spill Contingency Plan (SCP).
- Oil Pollution Emergency Plan (OPEP).
- Risk Management and Emergency Response Plan.
- Occupational Health and Safety Plan.
- Shipping Management Plan.
- Explosives Management Plan (ExMP)

This Plan is at a developmental stage given the mine has not yet been permitted. Hazardous material volumes have been estimated based on the current mine plan size. Suppliers have not been identified. From development to closure, transport of hazardous material from site and disposal will be contracted to licensed contractor(s) who will have adequate certification for the transportation, handling, and disposal of hazardous materials.

This Plan has been aligned to conform to the general strategies to be used to achieve the waste management objectives presented in Sabina's LWMP. This includes strategies to reduce waste through a proactive procurement policy, material and chemical substitution and waste segregation, as well as application of the 4 Rs (reduction, reuse, recycling and recovery).

3. Planning and Implementation

Planning for the HMMP started with the development of the DEIS and FEIS, both of which identified existing (baseline) conditions, assessed potential impacts of the Project, developed conceptual mitigation strategies and developed specific mitigation measures to execute these strategies.

Conceptual strategies and plans will continue to be elaborated and executed throughout the construction, operation, and closure phases of mining. Environmental management and social aspects will be tracked, reviewed, and updated through ongoing maintenance of the plan. These updates will incorporate relevant feedback from the public, obtained during public consultation.

Significance criteria have been developed that assist in identifying priority aspects, establish management criteria and activity-specific mitigation measures. For social issues and effects, a key factor for determining significance is ongoing feedback from public consultation. These efforts will be used to communicate progress, and involve the public where necessary, on environmental performance.

Monitoring will be the principal mechanism to provide feedback to continually gauge the effectiveness of environmental performance. Operational control is facilitated through the contractor job-specific standard operating procedures (SOPs) work instructions, on-the-job instruction, tailgate meetings where required, contract requirements, and service agreements. The effectiveness of physical operational control will be reviewed according to preventative maintenance and review procedures and schedules.

4. Applicable Legislation and Guidelines

The generation, storage, transport, and disposal of hazardous materials within Canada and the Territorial area are covered by existing federal and territorial Acts and Regulations. Sabina will also be bound by the terms and conditions of its land use permits to be issued by Aboriginal Affairs and Northern Development Canada (AANDC) for Crown Lands and the Kitikmeot Inuit Association (KIA) for Inuit Owned Land, and its Type A Water Licence to be issued by the Nunavut Water Board (NWB).

The Project will put into place operational policies and procedures (e.g. SOPs) which meet or exceed the requirements of the applicable legislation and authorizations. Applicable Acts, Regulations and Guidelines related to hazardous material management are summarized in Table 4-1.

Ore processing will utilize a cyanide leach circuit that will require the transport, storage and use of sodium cyanide. A cyanide destruction circuit will reduce concentrations of residual cyanide in the tailings effluent. The sulphur dioxide (SO_2)/air oxidation process will be utilized to reduce residual cyanide concentrations. A Cyanide Management Plan has been developed as a sub-plan to the HMMP (Appendix C) and is in accordance with the International Cyanide Management Code (International Cyanide Management Institute 2015).

The *International Cyanide Management Code For the Manufacture, Transport, and Use of Cyanide In the Production of Gold* (Cyanide Code) was developed by a multi-stakeholder Steering Committee under the guidance of the United Nations Environmental Program (UNEP) and the then-International Council on Metals and the Environment (ICME). Signatories of the Cyanide Code commit to follow the Cyanide Code's Principles and Standards in the use of cyanide. The Standards of Practice listed under each Principle in the Cyanide Code set performance goals and objectives that an operation must achieve in order to be certified as in compliance with the Cyanide Code.

Additional documentation which also will be followed includes guidelines and operational policies and procedures developed by suppliers.

Table 4-1. Applicable Legislation to the Hazardous Material Management Plan

Acts	Regulations	Guidelines
Federal		
Canadian Environmental Protection Act (CEPA)	Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations	Canadian Council of the Ministers of Environment (CCME) - Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil CCME Environmental Quality Guidelines Canada – Wide Standards for Dioxins and Furans
Fisheries Act (1985, c. F-14)	Metal Mining Effluent Regulations (SOR/2002-2222)	
Hazardous Products Act	Controlled Products Regulations	Workplace Hazardous Materials Information System (WHMIS)
National Fire Code of Canada (2010)		
International Maritime Organization (IMO)	International Maritime Dangerous Goods Code (IMDG)	
Transport of Dangerous Goods Act (TDGA)	Transportation of Dangerous Goods Regulations	2012 Emergency Response Guidebook (Transport Canada and U.S. Department of Transportation 2012).
International Air Transport Association (IATA)	International Air Transport Association (IATA) Dangerous Goods Regulations	International Civil Aviation Organization (ICAO) Technical Instructions
Territorial – Nunavut		
Environmental Protection Act	Spill Contingency Planning and Reporting Regulations Used Oil and Waste Fuel Management Regulations The removal of hazardous materials will require the registration with the Government of Nunavut, Department of Environment (DOE) as a waste generator as well as carrier (if applicable) prior to transport	Government of Nunavut (GN) Environmental Guidelines for the Management of: • General Management of Hazardous Waste in Nunavut (GN 2010a) • Waste Paint (GN 2010b) • Mercury-Containing Products and Waste Mercury (GN 2010c) • Industrial Waste Discharges into Municipal Solid Waste and Sewage Disposal Facilities (GN 2011a) • Waste Batteries (GN 2011b) • Waste Solvent (GN 2011c) • Waste Antifreeze (GN 2011d) • Used Oil and Waste Fuel (GN 2012) • Biomedical and Pharmaceutical Waste (GN 2014) Canada-Wide Standards for Petroleum Hydrocarbons (PHC) In Soil (CCME 2008)
Mine Health And Safety Act	Mine Health And Safety Regulations	
Explosives Use Act (RSNWT (Nu) 1988, c E-10)	Explosives Regulations (RRNWT (Nu) 1990 c E-27)	
Fire Prevention Act	Fire Prevention Regulations	
Safety Act	General Safety Regulations Work Site Hazardous Materials Information System Regulations	
Transportation of Dangerous Goods Act	Transportation of Dangerous Goods Regulations	

5. Roles and Responsibilities

The Sabina General Manager in charge of the Back River Project will be ultimately responsible for the success of this plan and will approve all relevant policies and documents, auditing, action planning and the verification process.

The Mine Manager, Plant Manager and Safety Superintendent, along with their direct reports will be responsible for the implementation of this plan including overall management of the plan and internal reporting. All other Project personnel involved with hazardous waste management activities will be responsible for the effective implementation of this plan including: completion of required training, maintain compliance with training requirements as set out by this Plan or by Sabina's Standard Operating Procedures (SOPs), and Best Management Practices. All employees are to work in compliance with Health and Safety Laws and Regulations.

6. Hazardous Materials and Management Approach

For the purpose of Sabina's HMMP, hazardous materials are defined as materials that are covered by the *Transportation of Dangerous Goods Act* under Classes 2 through 6, and 8 through 9, that are no longer used for its original purpose and are intended for storage, treatment, recycling, or disposal. Class 1 – Explosives, are discussed in the Explosives Management Plan.

The classifications under the *Transportation of Dangerous Goods Act* which are included are as follows:

- Class 2 – Gases.
- Class 3 – Flammable liquids.
- Class 4 – Flammable solids.
- Class 5 – Oxidizing substances and organic products.
- Class 6 – Poisonous (toxic) and infectious substances.
- Class 8 – Corrosives.
- Class 9 – Miscellaneous products or substances.

A hazardous waste does not include materials that are:

- Household in origin.
- Included in class 1 - Explosives or class 7 - Radioactive materials.
- An empty container.
- Intended for disposal in a sewage system or by landfilling.

6.1 PRODUCTS

The typical types of hazardous materials that will be located at the Project include:

- Used petroleum products or new fuel/lubricants/oils/greases.
- Contaminated snow/water/soil (oil/fuel).
- Oil and fuel filters.
- Used sorbents and rags.
- Hydraulic fluid.
- Empty petroleum hydrocarbon containers and drums.
- Glycol.
- Sodium cyanide and other process reagents.
- Tailings supernatant containing cyanide and elevated metals.
- Laboratory reagents.
- Solvents.
- Paints.
- Fluorescent light tubes.
- Electronics and electrical waste.
- Waste equipment batteries.
- Hazardous medical waste.
- Kitchen grease.

The Project phase(s) and location(s) of use, potential environmental effects, and proposed handling and disposal measures for the above hazardous materials are presented in Section 8 (Table 8-1).

6.1.1 Petroleum Products (Fuel/Lubricants/Oils/Greases)

Regular preventive maintenance of Project vehicles and machinery will require the periodic replacement of products such as fuel, lubricants, oils and greases at the MLA and the Goose Property. Such wastes may pose a risk to human or environmental health if not managed and disposed of properly. The types of waste generated within this category may include:

- Fuel for machinery.
- Lubricants.
- Waste oil from vehicles/equipment.
- Waste oil from oily water separators.

6.1.2 Contaminated Snow/Water/Soil (Oil/Fuel)

All spills will be contained and cleaned in accordance with the SCP and OPEP. The materials that are contaminated and the materials that are used for the clean-up will require handling under this HMMP, and remediation or final disposal according to the LWMP.

6.1.3 Oil and Fuel Filters

Regular preventive maintenance of vehicles and machinery will require the periodic replacement of oil and fuel filters in the maintenance facilities at the MLA and the Goose Property. The used material poses a risk to human or environmental health if not managed and disposed of properly.

6.1.4 Used Sorbents and Rags

Used sorbents and rags may be generated from regular maintenance and occasional spill response activities. All spill materials will be contained and cleaned up in accordance with the SCP and OPEP. Hydrocarbon-contaminated materials, including the materials used for the clean-up will require handling under this HMMP, and remediation or final disposal according to the LWMP.

6.1.5 Hydraulic Fluid

Regular preventive maintenance of Project vehicles and machinery will require the periodic replacement hydraulic fluid in the maintenance facilities at the MLA and Goose. These used fluids pose a risk to human or environmental health if not managed and disposed of properly. All spills will be contained and cleaned in accordance with the SCP and OPEP.

6.1.6 Glycol

As a result of the regular use of glycol in Project operations, spent or contaminated glycol will be generated. All glycol spills will be contained and cleaned up in accordance with the SCP. Spent or contaminated glycols will require disposal under this HMMP. The types of waste generated within this category will include (Government of Nunavut 2011c):

- Glycol solutions from heat recovery and building HVAC.
- Waste antifreeze from vehicles.
- Waste antifreeze from equipment.
- Airport de-icing solutions.
- Used glycol products.

6.1.7 Empty Petroleum Hydrocarbon Containers and Drums

Empty petroleum hydrocarbon containers and drums will be stored and returned for recycling and disposal. When possible, Sabina will bring supplies in bulk to limit the number of empty containers generated. Empty containers will also be used for the containment of spent or used products such as oil, glycol, and hydraulic fluid.

6.1.8 Process Reagents

Process reagents to be stored onsite include hydrated lime, sodium cyanide, activated carbon, sodium hydroxide, hydrochloric acid, sulphur, copper sulphate, sodium metabisulphite (SMBS), flocculant, lead nitrate and anti-scalant. Best practices will be in place to reduce or eliminate the generation of hazardous waste from the mill process (i.e. use all reagents within the process circuits). Process reagents identified as hazardous waste will require disposal under this HMMP except cyanide-containing products and wastes, to be managed according to the Cyanide Management Plan (Appendix C). All reagent spills will be contained and cleaned in accordance with the SCP.

6.1.9 Laboratory Reagents

Laboratory reagents will be stored onsite for use during operations. Best practices will be in place to reduce or eliminate the generation of hazardous waste from laboratory processes. Laboratory reagents identified as hazardous waste will require disposal under this HMMP. All reagent spills will be contained and cleaned in accordance with the SCP.

6.1.10 Solvents

Used solvents may be generated as a result of maintenance and operations. All solvent spills will be contained and cleaned in accordance with the SCP. Spent or contaminated solvents will require disposal under this HMMP. The types of waste generated within this category may include (Government of Nunavut 2011b):

- Cleaning agents (degreasers).
- Oil-based paints.
- Paint thinner.
- Industrial glues.
- Other solvents.

6.1.11 Paints

Used paints may be generated by the Project. All paint spills will be contained and cleaned in accordance with the SCP. The materials that are spent or contaminated will require disposal under this HMMP. When feasible, water-based paints will be used on site. Waste water-based paints under 5 litres should be collected in a covered area and opened to dry. After they have been dried, the paint and cans can be landfilled (Government of Nunavut 2010a).

Unused full containers of paint will be returned to the manufacturer when possible. Paint containing hazardous materials over 5 litres that cannot be used will be sealed and shipped off-site to a registered hazardous waste receiver.

6.1.12 Fluorescent Light Tubes

Used florescent light tubes are expected to be generated by the Project. Used tubes will be collected in the original boxes and stored for disposal. If the fluorescent tubes are not broken and are packaged in their original shipping box, no special requirements are needed for transport purposes and transport, as a hazardous waste is not necessary. If tubes are broken, compliance with the hazardous waste regulations will be required (Government of Nunavut 2003).

6.1.13 Waste Equipment Batteries

Waste batteries will be generated by the Project. All batteries will be collected and shipped off-site to a recycling facility or a registered hazardous waste receiver. Types of batteries that might be used during operation and recommended disposal methods are summarized in Table 6.1-1 (Government of Nunavut 2011c).

6.1.14 Electronics and Electrical Materials

Electrical devices from the Project that cannot be repaired or recycled will be collected for disposal. Sabina's environment staff will determine the risk of electronic devices and classify them as hazardous or non-hazardous waste and determine the appropriate method of recycling/disposal.

Table 6.1-1. Battery Type and Recommended Disposal Methods

Battery Type	Sizes Available	Disposal Method
Alkaline	AAA, AA, C, D, 6V and 9V	Dispose along with household garbage
Carbon-Zinc	AAA, AA, C, D, 6V and 9V	Dispose along with household garbage
Button Cell – Silver Oxide, Lithium, Alkaline, Zinc-Air	Various sizes	Alkaline – dispose along with household garbage. All other types – return to a licensed recycler.
Vehicle Lead-Acid	6V and 12V	Return to a licensed recycler
Sealed Lead-Acid	2V, 6V and 12V	Return to a licensed recycler
Nickel-Cadmium (NiCd)	AAA, AA, C, D, 6V and 9V	Return to a licensed recycler
Nickel-Metal-Hydride (NiMH)	AAA, AA, C, D, 6V and 9V	Return to a licensed recycler
Lithium-Ion	Various sizes	Return to a licensed recycler

Source: Government of Nunavut 2011c

6.1.15 Hazardous Medical Waste/Biomedical Waste

Hazardous medical waste/biomedical waste originates from human health care and personal health requirements on site, such as First Aid rooms. A portion of that waste stream may be infectious or potentially infectious and presents a potential hazard to the public health and the environment.

All hazardous medical waste/biomedical waste will be handled, transported and disposed of according to the Guidelines for the Management of Biomedical Waste in Canada, Environment Canada (1992) (CCME-EPC-WM-42E). Additional guidelines pertaining to northern environmental conditions are found in the Government of Nunavut Environmental Guideline for Biomedical and Pharmaceutical Waste.

6.2 SAFETY REQUIREMENTS

Each chemical component will be handled and disposed of in accordance with information found within its respective materials safety data sheet (SDS). An SDS is a source of health and safety information for workers and emergency personnel. Information found within the SDS includes the following:

- Identification of the material.
- Hazard Information.
- Composition / Ingredients.
- First Aid Measures.
- Fire Fighting Measures.
- Accidental Release Measures.
- Handling and Storage.
- Exposure Controls / PPE.
- Physical and Chemical Properties.
- Stability and Reactivity.
- Toxicological Information.
- Ecological Information.
- Disposal Considerations.
- Transport Information.
- Regulatory Information.
- Other Information.

SDSs will be available for hazardous material products to be stored on site. This information will be available at various designated Project locations such as the maintenance areas and hazardous material generation and storage areas.

6.3 TRAINING AND CERTIFICATION REQUIREMENTS

All personnel working on the Back River Project will undertake formal training, to ensure compliance with legislation and Sabina's Standard Operating Procedures (SOPs). The training requirement for all staff may include:

- Site Specific Orientation.
- Workplace Hazardous Materials Information System (WHMIS).
- Emergency and Spill Response Training.
- Additional site specific procedures (such as SOPs).

Only trained personnel will be assigned to work with and around hazardous materials. Personnel working with hazardous materials will undertake formal training, including on-the-job training to ensure compliance with legislation and SOPs. The additional training requirements for staff handling hazardous materials or fuel may include:

- First Aid.
- Transportation of Dangerous Goods (TDG).
- Emergency and Spill Response Team Training.
- Additional site-specific procedures (such as SOPs pertaining to fuel handling, waste oil incineration, oily liquid treatment plant, reagent loading and transfer, and job specific training).

The training requirements for contractors and other visiting personnel will be the same as for Sabina employees. It is expected that contractors will have been provided adequate training from their employer. Contractors may be requested to provide copies of any current certificates of requested individuals, such as First Aid, WHIMS, and TDG. Site specific training will be provided by Sabina and renewed as required according to SOPs and legislative requirements.

Records for training will maintained for employees and contractors.

7. Procedures and Operations

7.1 SET-UP AND USE PROCEDURES

Sabina has implemented general strategies for the management of waste in an effort to reduce impacts to the environment. The strategies outlined in Section 2 of the LWMP and the HMMP outline the policies and controls used to reduce impacts to the environment and reduce quantities required for use.

7.2 STORAGE LOCATIONS

The main hazardous waste storage facility will be located at the Marine Laydown Area (MLA). Temporary hazardous waste storage areas will be developed at the Goose property. Hazardous waste that is generated onboard cargo ships will remain on board the ship, stored and labelled in accordance with carrier / ship specific plans.

7.2.1 Marine Laydown Area

A 5000 m^2 dedicated lined storage pad will be constructed at the MLA to receive and temporarily store hazardous wastes until the backhaul sealift can transport it from the site. The hazardous waste storage pad at the MLA will be constructed to prevent pooling of water. The pad will be fenced and appropriate signage will be posted. The storage facility will be proximal to the landfarm (Figure 7.2-1).

At this stage of the Project, a contaminated soil /material remediation area (landfarm) will be constructed at the MLA to treat contaminated soil or snow.

7.2.2 Goose Property

Hazardous wastes originating from the Goose Property will be temporarily stored on site until it can be packaged in appropriate containers for transportation to the main hazardous waste storage area at the MLA. Storage at the Goose Property will be predominantly outdoors on a lined pad and, where appropriate, sea containers will be used (Figures 7.2-2 and 7.2-3). Collection sites within buildings will be identified and labelled. Materials and containers will be inspected for proper storage as part of regular environmental site inspections. At the Goose Property, a secure area for hazardous materials will be identified for items such as mill reagents.

7.3 HANDLING REQUIREMENTS

All waste material will be handled in accordance with the Canadian and Territorial waste regulations and all applicable guidelines identified in Table 4-1. This includes compliance with the GN Environmental Guidelines. Hazardous materials will be handled in accordance with the SDSs and safe handling requirements. When possible, materials will re-used.

All waste manifests will be completed according to applicable legislation and retained for the required time periods.

General requirements are included in Sections 7.3.1 through 7.3.5

7.3.1 Hazardous Materials Inventory at Back River Project

An accurate and detailed inventory of hazardous materials and dangerous goods is required to implement best materials management practices at the site. A hazardous materials inventory will list all chemicals on the site, and include additional information on the products applicable for use by mine personnel including specific spill response considerations and procedures.

An example table listing hazardous materials to be utilized at the mine site is provided in Table 7.3-1. The inventory is identified based on planned process and consumption rates.

7.3.2 Containment and Labelling

All hazardous materials will be contained in designated containers appropriate for their WHMIS hazard classification, and in accordance with any other information contained in their respective SDS to prevent chemical reactions or corrosion that could result in spills or emergency situations (i.e., fire and explosions).

When possible, original containers will be used for storage (e.g., fuel drums, and reagent containers). All containers should be sealable and in good condition, void of cracks or potential for leaks. Containers will be kept closed except when adding or removing product. Each container of hazardous waste material will be clearly labelled with the contents being stored, in accordance with the requirements of WHMIS and the applicable SDS.

GIS # BAC-50-010_S

October 26 2015

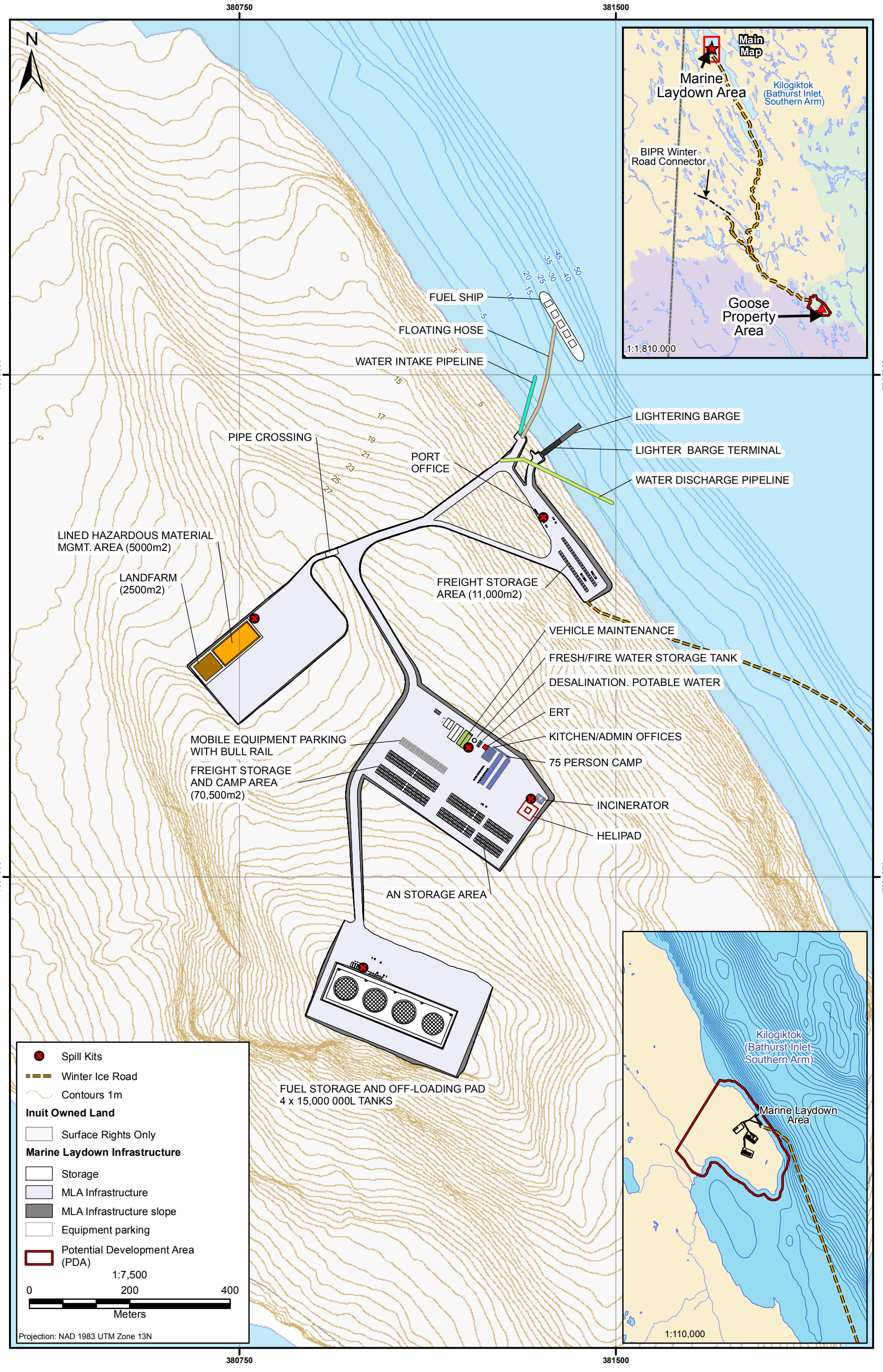

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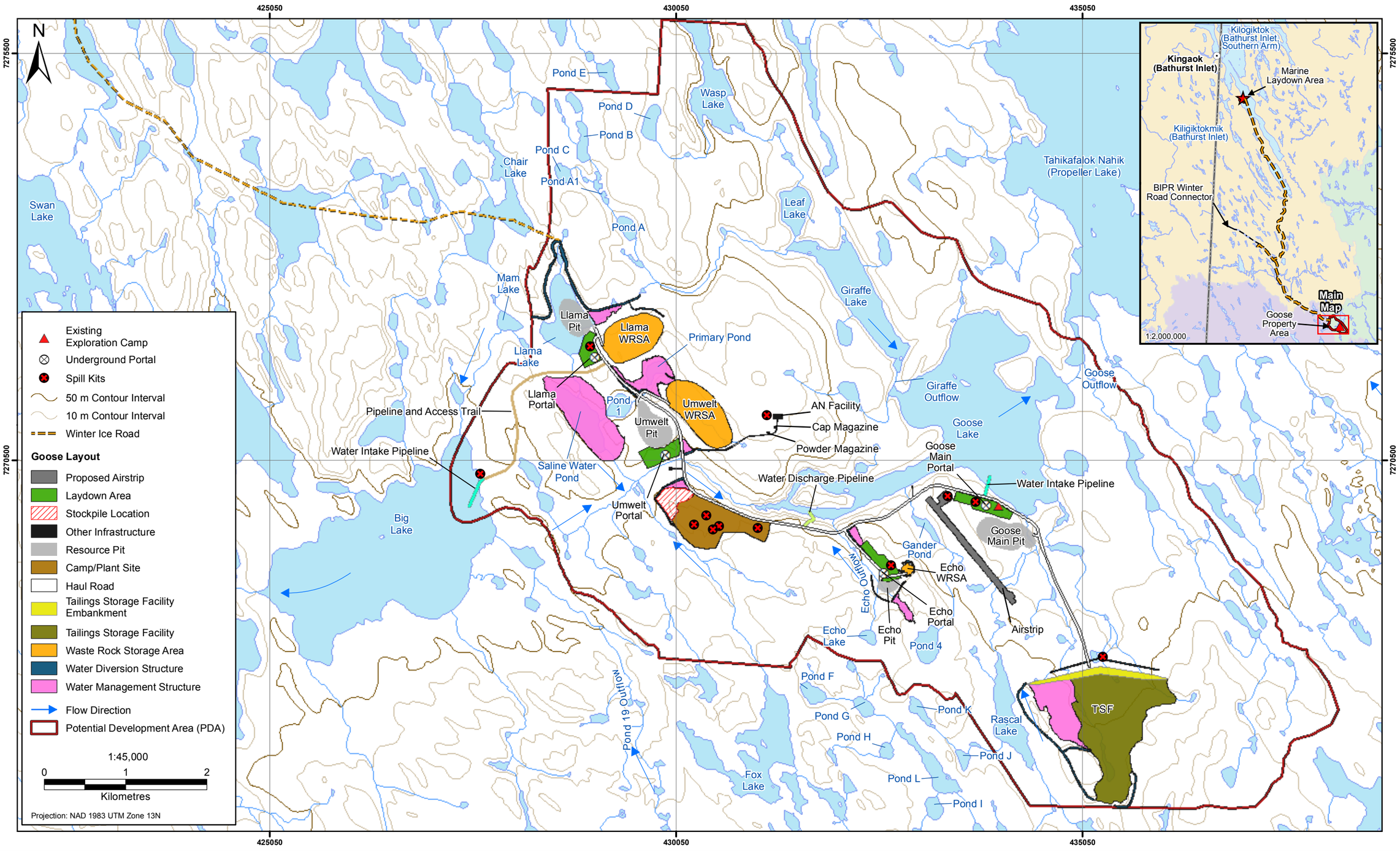
Figure 7.2-1

Marine Laydown Area General Arrangement



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Goose Property
General Arrangement

Figure 7.2-2

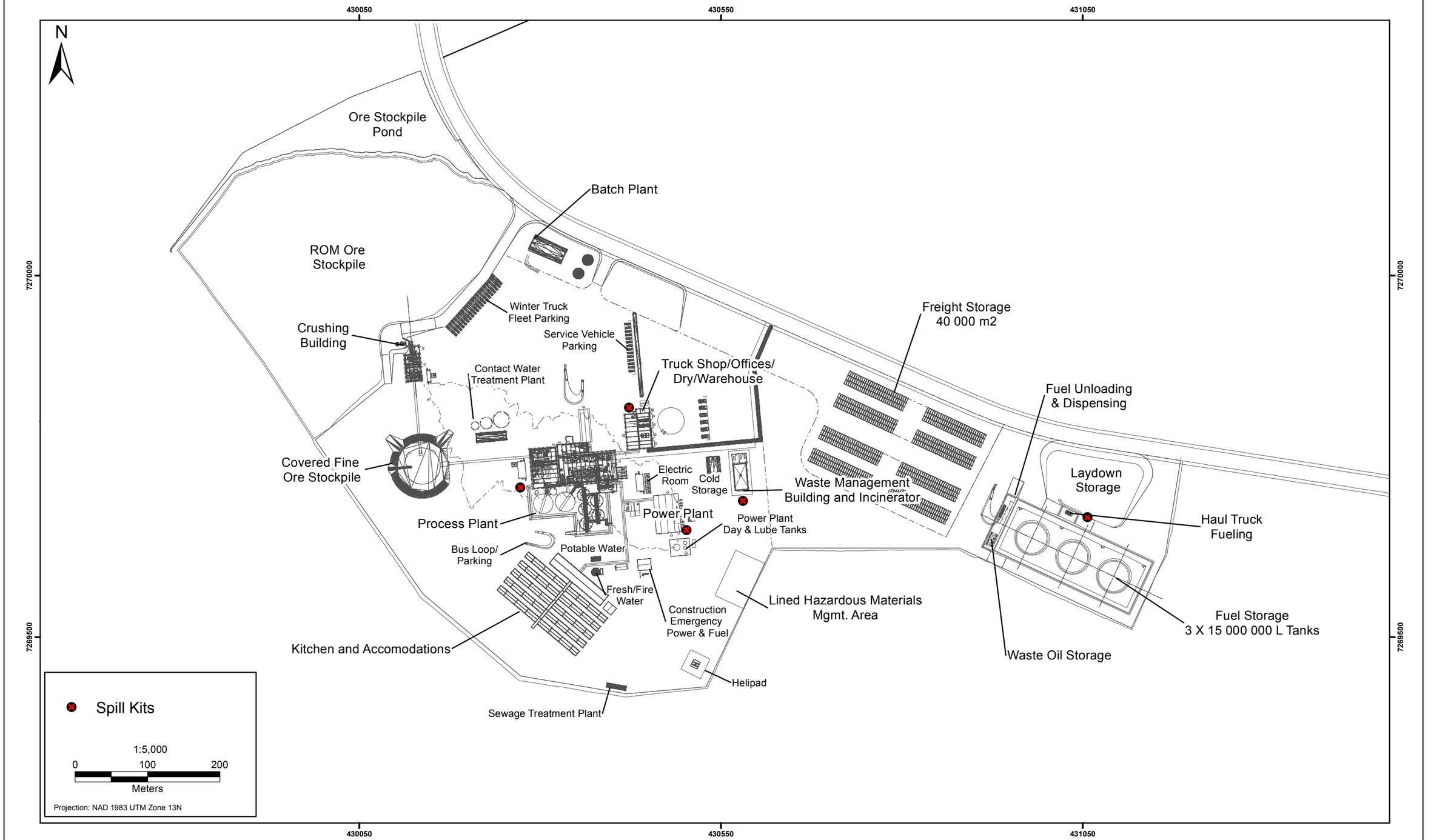

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Figure 7.2-3

Goose Site Plan General Arrangement

Table 7.3-1. Example Hazardous Materials Inventory

Substance (by area)	Use	Delivered Form, Typical Volume in Site Storage	Storage vessels
Goose Camp Chlorine	Potable water treatment	200 cylinders, via MLA	Potable water storage tank
Goose Mill Area			
Sodium Metabisulphite	CN destruction	1,000 kg bags, granular,1,360 t/a via MLA	Sea Can
Lead Nitrate	Process - Leaching	Granular, 44 t/a via MLA	Sea Can
Sodium Cyanide	Process - Leaching	1,000 kg bags, granular, 3,132 t/a via MLA	Sea Can
Flocculant	Thickening	750 kg bags, granular, 44 t/a via MLA	Sea Can
Copper Sulphate	CN destruction	2,500 kg bags, granular, 51 t/a	Sea Can
Lime	Process – Grinding	1,700 kg bags, granular, 4,380 t/a	Sea Can
Sodium Hydroxide	Elution – Regeneration	1,000 kg bags, granular, 469 t/a	Sea Can
Antiscalant	Mill	Granular, 92 t/a	Sea Can
Hydrochloric Acid	Elution - Regeneration	Bulk Liquid, 72 t/a	Sea Can

The anticipated consumptions of selected hazardous materials are provided in tabular form in Table 7.3-2.

Table 7.3-2. Anticipated Consumption of Hazardous Materials

Material	Area of Use	Construction Consumption Estimate (t)	Production Consumption Estimate (t)
Ammonium Nitrate	Goose Site	4,633	18,824
Packaged Explosives	Goose Site	900	2,062
Packaged Explosives	MLA	692	0
Sodium Metabisulphite	Goose Site Mill	0	1,360 t/a
Lead Nitrate	Goose Site Mill	0	44 t/a
Sodium Cyanide	Goose Site Mill	0	3,132 t/a
Flocculant	Goose Site Mill	0	44 t/a
Copper Sulphate	Goose Site Mill	0	51 t/a
Lime	Goose Site Mill	0	4,380 t/a
Sodium Hydroxide	Goose Site Mill	0	469 t/a
Antiscalant	Goose Site Mill	0	92 t/a
Hydrochloric Acid	Goose Site Mill	0	72 t/a
Process Reagents Total	**Goose Site Mill**	**0**	**9,709 t/a**

7.3.3 Collection and Onsite Transport

Collection sites within the buildings and around the Project will be identified and labelled. Hazardous materials and containers will be inspected to ensure appropriate storage/transport containers and methods prior to transport

Hazardous materials will be collected from these areas at regular intervals and transported to the temporary storage areas. During winter road access, such materials will be transported to the main

storage facility at the MLA. All transportation of goods will be in accordance with on-site best management practices (i.e., speed limits and shipping hours), SOPs (i.e., truck spill kit requirements, and communication procedures) and required laws and regulations including the TDG Act and Regulations.

7.3.4 Storage

Hazardous materials may be stored on site for greater than 180 days; therefore, Sabina will be registered with Nunavut's DOE as a Hazardous Waste Management Facility. Hazardous materials will be stored in accordance with applicable laws and regulations. To assist in the safe and secure storage of fuels, hazardous materials and hazardous wastes, the following general guidelines for storage areas/facilities will be applied:

- All hazardous material storage areas will be adequately signed indicating that hazardous materials/wastes are stored therein.
- All hazardous material storage areas will be clearly defined and designed to protect containers from physical damage, such as barriers or fencing.
- Storage areas will be designed to comply with the National Fire Code, where appropriate.
- Hazardous materials will be segregated by chemical compatibility within the storage area to prevent contact of incompatible materials in the event of a release.
- Storage areas will be maintained in an organized fashion to make them accessible for firefighting and other emergency procedures.
- Adequate ventilation will be provided to prevent the build-up of noxious or toxic vapours.
- Containment of liquid hazardous materials (including fuel, oils as well as other liquid hazardous materials) with capacity equal to the greater of the volume of the largest tank plus 10 % of the volume of the remaining tanks or 110 % of the volume of the largest tank within the containment area.
- Drums containing hazardous materials or wastes will be placed on pallets or on a well-drained storage area to prevent rusting.
- All containers containing product shall be stored in the upright position to prevent leaking.
- Containers shall be arranged within the storage area in a manner as to prevent damage from falling or dislodging.
- Containers shall be arranged to allow for easy access and inspections.
- All wastes should be stored in conditions recommended by the SDS, such as temperature requirements.

7.3.5 Transport

All hazardous materials will be transported to and from site by commercial carriers in accordance with the applicable legislation for transport by air, road/rail or marine (Table 4-1). All carriers will be registered with Nunavut DOE as a hazardous waste carrier.

A preliminary estimate of the annual consumption of key hazardous materials is provided in Table 7.3-2, and a more detailed inventory of the types and quantities of hazardous materials is provided in Section 8 (Table 8-1). Nearly all hazardous materials will be transported to the MLA via sealift, and materials required at the Goose Property will be transported over the winter road. Therefore, the quantities

presented in these tables provide some indication of what will be delivered to the MLA by sealift and to the Goose Property by winter road.

A large number of the hazardous materials delivered to site will be consumed at site, including fuel and both process and lab reagents. Therefore, the volume of hazardous wastes requiring transport to an off-site licensed disposal facility will be relatively limited. Hazardous wastes such as biomedical waste or spent solvents will likely be transported to Yellowknife as backhaul during regular scheduled flights. Larger quantities such as waste oil, oil and fuel filters, etc. will be stored in drums within secondary containment and will be delivered to the MLA hazardous waste storage facility over the winter road, prior to backhaul to the south on sealifts.

Hazardous Materials will be transported by truck on the winter ice road from project sites to the MLA. At all times, hazardous materials will be transported in compliance with the safety standard prescribed by the TDG Regulations. All containers used to transport hazardous materials will be designed, constructed, filled, closed, secured and maintained so that under normal conditions of transport, including handling, there will be no accidental release of dangerous goods that could endanger public safety.

Carriers will be licensed and inspected as required by the Department of Transportation. All required permits, licences, and certificates of compliance will be the responsibility of the carrier. The Project will not be managing any shipping waste from sealift vessels or tankers delivering supplies to the MLA.

To assist in the safe and secure transport of hazardous materials and hazardous wastes, the following general guidelines for carrier storage areas/facilities will include:

- The hazardous materials will be shipped in approved containers.
- All shipments will be properly identified and labelled, such as placarding and labeling all transport vehicles and containers in accordance with the appropriate legalisation.
- Shipping papers and waste manifests will be filled in completely and accessible during transport.
- Each transportation company will have a spill prevention, control, and counter measures plan to address the materials they are importing / exporting. In the event of a release during transport, the commercial transportation company is responsible for first response and cleanup. Sabina will periodically review this plan for Sabina requirements.
- Hazardous waste will only be transported to a registered receiver or hazardous waste management facility.
- An inventory of the types and predicted volumes/quantities of hazardous wastes to be generated or produced by the Project activities

7.3.6 Off-Site Disposal

Sabina will ensure that all hazardous materials will be shipped to approved hazardous waste disposal facilities. This means the hazardous waste receiver has been registered and approved by the jurisdiction in which it is located to accept and dispose of the specified hazardous wastes.

7.4 SPILLS

Adequate emergency and spill response equipment will be located at all hazardous materials storage areas. Figures 7.2-1, 7.2-2, and 7.2-3 show proposed spill kit locations. All spills will be contained and cleaned up according to the SCP. All spills of hazardous waste over the reporting requirements will be reported immediately to the NWT/Nunavut Spill Report Line at (867) 920-8130 as per the SCP.

7.5 SECURITY

Security measures for the management of hazardous materials include design and procedural measures. All hazardous material storage areas will have controlled access and only authorized personnel will have access/permission to enter hazardous materials management areas.

8. Environmental Protection Measures

Sabina has an ongoing commitment to implementing environmental protection measures in all aspects of its operations. Sabina is committed to undertaking waste collection, storage, transportation and disposal in a safe, efficient, and environmentally compliant manner, by actively encouraging and implementing the four R's of waste management, namely: waste reduction, reuse, recycling and recovery. Sabina will implement monitoring programs to satisfy regulatory requirements and achieve environmental protection from hazardous waste contamination.

Liquid hazardous materials will be stored within secondary containment to prevent possible spills or leaching of hazardous waste products into the environment. Where appropriate, hazardous waste material will be stored in a covered building or sea cans to prevent exposure to the influences of weather.

Environment Protection measures will be implemented in all aspects of the hazardous waste management program, from waste segregation and waste handling to ultimate storage and disposal. The Environmental Protection measures will be implemented from project design and construction through operations and into the closure phase (Table 8-1).

9. Monitoring Program

Monitoring programs for the HMMP will include inventory checking. Any materials that are reported as excess will be reported to purchasing in an effort to adaptively manage future hazardous waste generation. All fuel and waste fuel will be monitored according to the Fuel Management Plan (FMP). Records will be available for review.

10. Checking and Corrective Action

Sabina will implement a series of checking and corrective action measures to ensure the effectiveness of this plan. Best management practices will be implemented to check the function and may include:

- Hazardous material inventory accounting.
- Internal inspections and audits.
- External inspection and audits.

Table 8-1. Hazardous Waste Types, Source, Quantities Generated, Potential Environment Effects, and Waste Management and Pollution Prevention Strategies

Type	Source	Estimated Quantity Generated by Project Phase	Project Location Generated	Potential Environmental Effects	Waste Management and Pollution Prevention Strategies
Fuels and Used Petroleum Products (oils/ lubricants/ greases)	Vehicles and equipment including generators and pumps	Construction: 167 t/a Operations: 627 t/a Closure: 63 t/a	Goose Property and MLA	Petroleum products can accumulate on the surface of waterbodies or may sink to the bottom. Fish can uptake hydrocarbons in the environment. Feeding and reproduction of aquatic life (e.g., fish, plants, and insects) may be affected. Micro-organisms in soil degrade hydrocarbons, sometimes at the expense of plant nutrition. Petroleum products can damage the respiratory system if aspirated and be toxic if ingested.	Spill Response Procedures (safety procedures, initial assessment, spill report, containment, storage, and disposal) will be employed. When possible waste oil will be used in incinerators or designed used-oil heaters. Waste oil may be collected and stored in empty bulk lubricant cubes to be stored in the designated hazardous waste section of the waste storage facility. Contaminated snow/water will be stored in clearly-marked, sound, sealed containers in the laydown yard and may be shipped off-site to an appropriate facility. Bioremediation may be considered for contaminated soil.
Oil and Fuel Filters	Vehicles and equipment	Construction: 13 t/a Operations: 39 t/a Closure: 4 t/a	Goose Property and MLA	Petroleum products can accumulate on the surface of waterbodies or may sink to the bottom. Fish can uptake petroleum hydrocarbons once it is in their environment. Feeding and reproduction of aquatic life (e.g., fish, plants, and insects) may be affected. Micro-organisms in soil degrade hydrocarbons, sometimes at the expense of plant nutrition. Petroleum products can damage the respiratory system if aspirated and be toxic if ingested.	Waste oil and fuel filters will be drained in a heated and ventilated section of the maintenance shop. Filters will then be crushed to minimize volume and release any additional oil. This area of the maintenance shop will adhere to Sabina's Spill contingency plan and have a liner or tray to catch any spills or splashes. The filters will be placed in sealed containers and labelled and stored at the waste management facility. These containers may be shipped off-site to a registered hazardous waste receiver. Bioremediation of contaminated soils and treatment of contaminated water, snow and ice (see LWMP).

(continued)

Table 8-1. Hazardous Waste Types, Source, Quantities Generated, Potential Environment Effects, and Waste Management and Pollution Prevention Strategies (continued)

Type	Source	Estimated Quantity Generated by Project Phase	Project Location Generated	Potential Environmental Effects	Waste Management and Pollution Prevention Strategies
Used Sorbents and Rags	Used in the maintenance of vehicles, equipment and spill control	Construction: 2 t/a Operations: 6 t/a Closure: <1 t/a	Goose Property and MLA	Petroleum products can accumulate on the surface of waterbodies or may sink to the bottom. Fish can uptake petroleum hydrocarbons once it is in their environment. Feeding and reproduction of aquatic life (e.g., fish, plants, and insects) may be affected. Micro-organisms in soil degrade hydrocarbons, sometimes at the expense of plant nutrition. Petroleum products can damage the respiratory system if aspirated and be toxic if ingested.	Where possible, used rags and sorbents will be incinerated on-site. If incineration is not practical, used sorbents and rags will be stored in clearly-marked, sound, sealed containers in the laydown yard and then shipped off-site to a registered hazardous waste receiver.
Hydraulic Fluid	Used in vehicles and equipment (e.g., brakes, power steering, forklifts, underground hauling equipment)	Construction/ Operations/ Closure Included in Fuels and Used Petroleum Products quantities	Goose Property and MLA	Hydraulic fluid may enter the environment from spills and leaks from equipment or from improper storage. Once in the environment some hydraulic fluids break down and have the potential to mix with water and, in high quantities, may harm fish.	Equipment will be regularly maintained to prevent spills from ruptured hydraulic fluid lines. Biodegradable, low toxicity hydraulic fluids will be used where practical. Where possible, used hydraulic fluid will be incinerated on-site. Used hydraulic fluid that cannot be incinerated will be stored in clearly marked, sound, sealed containers. These containers may be shipped off-site to a registered hazardous waste receiver. Unused hydraulic fuel in the original containers will be return to the manufacture for disposal or reuse at closure.
Empty Petroleum Hydrocarbon Containers and Drums	Packaging for oils, solvents and penetrating oils	Construction: 8 t/a Operations: 28 t/a Closure: 3 t/a	Goose Property and MLA	Petroleum products may accumulate on the surface of waterbodies or may sink to the bottom. Fish can uptake petroleum hydrocarbons once in the environment. Feeding and reproduction of aquatic life (e.g., fish, plants, and insects) may be affected. Micro-organisms in soil degrade hydrocarbons, sometimes at the expense of plant nutrition. Petroleum products can damage the respiratory system if aspirated and be toxic if ingested.	Sabina and its contractors will purchase these items in bulk to minimize the amount of packaging. Empty containers will be backhauled to the original supplier or a licensed recycling facility.

(continued)

Table 8-1. Hazardous Waste Types, Source, Quantities Generated, Potential Environment Effects, and Waste Management and Pollution Prevention Strategies (continued)

Type	Source	Estimated Quantity Generated by Project Phase	Project Location Generated	Potential Environmental Effects	Waste Management and Pollution Prevention Strategies
Glycol	Used as a coolant, capturing waste heat from generators, and antifreeze in equipment	Construction: 9 t/a Operations: 33 t/a Closure: 3 t/a	Goose Property and MLA	Glycol's odour is a known wildlife attractant. Glycol can have toxic effects on aquatic organisms and wildlife.	Environmentally benign glycols will be used where practical. Equipment will be regularly maintained to prevent spills from ruptured glycol lines. Waste glycol will be stored in the waste storage facility in clearly marked, sound, sealed containers. These containers may be shipped off-site to a registered hazardous waste receiver. Unused glycol in the original containers may be returned to the manufacture for disposal or reuse at closure.
Reagents	Additives required for mine processing and laboratory testing	Operations: ~9,700 t/a (consumed) Closure: <100 kg/a	Goose Property and MLA	Lab and processing reagents (hydrated lime, sodium cyanide, activated carbon, sodium hydroxide, hydrochloric acid, sulphur, copper sulphate, MBS, flocculant, and antiscalant) may enter the environment from spills and leaks from containers, process equipment or from improper storage. Once in the environment, some may cause harm to the terrestrial and aquatic ecosystem by entry of deleterious and other polluting substances (e.g., cyanide).	Spill prevention procedures will be developed. Spill Response Procedures to respond to the spill (safety procedures, initial assessment, spill report, containment, storage, and disposal). Spent reagents will be collected and stored in clearly-marked, sound, sealed empty bulk containers. Containers will be stored in the designated hazardous waste section of the waste storage facility. Reagents may be shipped off-site to a registered hazardous waste receiver Unused reagents will be sent back to the manufacture as required in original containers at closure. Management of cyanide-containing materials (sodium cyanide reagent, residual cyanide in process water and tailings supernatant) described in stand-alone management plan, presented as Appendix C of the HMMP.

(continued)

Table 8-1. Hazardous Waste Types, Source, Quantities Generated, Potential Environment Effects, and Waste Management and Pollution Prevention Strategies (continued)

Type	Source	Estimated Quantity Generated by Project Phase	Project Location Generated	Potential Environmental Effects	Waste Management and Pollution Prevention Strategies
Solvents	Used to degrease machinery in the maintenance shop	2000 L/a Construction/ Operations/ Closure	Goose Property and MLA	Petroleum fuels can accumulate on the surface of waterbodies or may sink to the bottom. Fish can uptake petroleum hydrocarbons once it is in their environment. Feeding and reproduction of aquatic life (e.g., fish, plants, and insects) may be affected. Petroleum products can damage the respiratory system if aspirated and be toxic if ingested.	Low toxicity solvents and physical cleaning (e.g., steam jet) will be used where practical. Petroleum-based solvents will not be allowed into the environment and will be subject to the spill response plan. Waste or excess solvents will be stored in the waste storage facility in clearly marked, sound, sealed containers. These containers may be shipped off-site to a registered hazardous waste receiver. Unused solvents in the original containers may be returned to the manufacturer for disposal or reuse at closure.
Paints		100 L/a Construction/ Operations/ Closure	Goose Property and MLA		When feasible, latex paints will be used on site. Latex paints should be collected in a covered area and opened to dry. Unused full containers of paint will be returned to the manufacturer, if possible. Paint containing hazardous materials, that cannot be used will be sealed and shipped off site to a registered hazardous waste receiver.
Fluorescent Light Tubes	Indoor lighting	<1 t/a Construction/ Operations/ Closure	Goose Property and MLA	Fluorescent tubes contain mercury phosphor powder and traces of lead and cadmium.	Lights should be equipped with motion sensors to reduce usage where practical. Discarded fluorescent lights will be consolidated together and stored indoors in the waste storage facility in their original packaging. Fluorescent light tubes may be shipped off-site to a registered hazardous waste receiver.
Electronics and Electrical Materials	Electrical devices that cannot be repaired and cannot be recycled	<1 t/a Construction/ Operations/ Closure	Goose Property and MLA	Electrical waste and devices may or may not contain polluting substances (such as mercury, lead, arsenic, cadmium, and polyvinyl chloride (PVC) that could enter the ecosystem.	Sabina's environment staff will determine the risk of electronic devices and classify them as hazardous or non-hazardous waste and determine the appropriate method of recycling/ disposal.

(continued)

Table 8-1. Hazardous Waste Types, Source, Quantities Generated, Potential Environment Effects, and Waste Management and Pollution Prevention Strategies (completed)

Type	Source	Estimated Quantity Generated by Project Phase	Project Location Generated	Potential Environmental Effects	Waste Management and Pollution Prevention Strategies
Equipment Batteries	Equipment batteries	4 t/a Construction/ Operations/ Closure	Goose Property and MLA	Lead batteries (i.e., vehicle batteries) contain sulphuric acid and lead harmful to environmental receptors. Rechargeable batteries (i.e., industrial forklift, radio and transmitter batteries) usually contain either potassium hydroxide or nickel cadmium with toxic effects.	Protect and service batteries to prevent damage and loss of charge. Test batteries prior to disposal to confirm the battery is spent. All batteries will be shipped off-site to a recycling facility or a registered hazardous waste receiver.
Biomedical Waste	Small amounts of medical waste from First Aid (e.g., syringes, used medical supplies)	<100 kg/a Construction/ Operations/ Closure	Goose Property and MLA	May be sharp or may contain bacteria and viruses which can be a risk to human or wildlife health.	Written procedures will be developed and implemented regarding the handling, storage, transport and disposal of biomedical waste, consistent with the Nunavut guideline (GN 2014). Pollution prevention strategies include training staff in the adopted procedures for handling of biomedical waste; permitting only trained workers to handle biomedical waste; appropriate segregation and disposal of biomedical wastes separate from generate garbage and according to the type of biomedical waste; using appropriate containers for safe storage of biomedical wastes (e.g., sharps containers for used needles and other sharps); appropriately labelling biomedical waste in accordance with WHMIS requirements; record keeping; use of appropriate personal protective equipment (PPE); waste transport in accordance with applicable regulations; and final disposal at a registered hazardous biological waste receiver. Medical waste will not be incinerated on-site as it poses a handling risk from sharps for the incinerator operator and workers collecting waste.
Aerosol Cans		<100 kg/a Construction/ Operations/ Closure	Goose Property and MLA		Pressurized aerosol cans will be punctured on site and landfilled.

Notes: Goose = Goose Property, MLA = Marine Laydown Area

10.1 INVENTORY ACCOUNTING

Hazardous material inventory accounting will be verified against purchasing requirements and waste manifests to identify waste generation amounts and ensure all materials are removed from site.

10.2 INTERNAL INSPECTIONS AND AUDITS

Internal audits and inspections will be conducted on a regular basis and adapted to each phase of the mine life. Inspections will be completed by qualified personnel on a regular basis for physical condition and serviceability, and the results recorded according to quality and safety standard operating procedures. In addition, qualified personnel will perform inspections to ensure that each inventory is documented.

Inspections will be required and reported for:

- Waste manifests.
- Inspection of all hazardous waste collection areas.
- Storage areas.
- Storage containers.
- Transportation containers.
- Fuel management areas.
- Waste oil collection systems.

10.3 EXTERNAL INSPECTIONS AND AUDITS

On occasion external inspections and audits may be required by regulatory authorities. All recommendations and orders made by regulatory authorities, Fire Marshals, and Insurance Inspectors will be responded to and acted upon accordingly.

11. Record Keeping

Hazardous material inventories, waste manifest libraries, spill reports (as per the SCP) will be completed to track the volume, hazardous material type and hazardous material source for all hazardous materials that are generated. The transportation of hazardous waste to the on-site hazardous material management facilities will be tracked and recorded.

Sabina will retain all raw data records and annual reporting for at least two (2) years. The updated HMMP, raw data and annual reporting will be made available by Sabina at all times for review by the regulatory inspectors.

All internal and external inspections and audits will be documented and stored digitally and available for review by on-site personnel and regulatory agencies as part of the annual review process.

Staff training records will be filed per Safety SOPs and made available for review with this plan.

12. Environmental Reporting

Any spills or releases of hazardous materials will be reported as part of this plan and will follow the incident response procedures identified in Sabina's SCP, OPEP and FMP. All information about the spill or release will be documented according to the requirements of the SCP, OPEP and FMP.

13. Plan Effectiveness

The HMMP will be reviewed and updated periodically to incorporate any lessons learned, and records outlined in Section 11.

All employees will be informed of relevant updates and the updated HMMP will be stored at designated Project sites. A record will document all significant changes that have been incorporated in the HMMP subsequent to the latest annual review. The record will include the names of the persons who made and approved the change, as well as the date of the approval.

14. Quality Assurance/Quality Control

The monitoring described in Section 10 and the checking and corrective measures described in Section 11 form the basis of the Quality Assurance (QA) and Quality Control (QC) program relating to hazardous waste management.

References

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Transportation of Dangerous Goods (TDG)

Transport Canada and the U.S. Department of Transportation. 2012. *2012 Emergency Response Guidebook: A Guidebook for First Responders During the Initial Phase of a Dangerous Goods / Hazardous Materials Transportation Incident*.

Workplace Hazardous Materials Information System (WHMIS)

Appendix A
NWT-NU Spill Report Form

Sabina
GOLD & SILVER CORP.

NT-NU SPILL REPORT

OIL, GASOLINE, CHEMICALS AND OTHER HAZARDOUS MATERIALS

NT-NU 24-HOUR SPILL REPORT LINE
TEL: (867) 920-8130
FAX: (867) 873-6924
EMAIL: spills@gov.nt.ca

REPORT LINE USE ONLY

A	REPORT DATE: MONTH – DAY – YEAR	REPORT TIME	☐ ORIGINAL SPILL REPORT, OR ☐ UPDATE # _____ TO THE ORIGINAL SPILL REPORT	REPORT NUMBER ____-_____
B	OCCURRENCE DATE: MONTH – DAY – YEAR	OCCURRENCE TIME		

C	LAND USE PERMIT NUMBER (IF APPLICABLE)	WATER LICENCE NUMBER (IF APPLICABLE)
D	GEOGRAPHIC PLACE NAME OR DISTANCE AND DIRECTION FROM NAMED LOCATION	REGION ☐ NWT ☐ NUNAVUT ☐ ADJACENT JURISDICTION OR OCEAN
E	LATITUDE DEGREES MINUTES SECONDS	LONGITUDE DEGREES MINUTES SECONDS

F	RESPONSIBLE PARTY OR VESSEL NAME	RESPONSIBLE PARTY ADDRESS OR OFFICE LOCATION	
G	ANY CONTRACTOR INVOLVED	CONTRACTOR ADDRESS OR OFFICE LOCATION	
H	PRODUCT SPILLED	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER
	SECOND PRODUCT SPILLED (IF APPLICABLE)	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER
I	SPILL SOURCE	SPILL CAUSE	AREA OF CONTAMINATION IN SQUARE METRES
J	FACTORS AFFECTING SPILL OR RECOVERY	DESCRIBE ANY ASSISTANCE REQUIRED	HAZARDS TO PERSONS, PROPERTY OR ENVIRONMENT
K	ADDITIONAL INFORMATION, COMMENTS, ACTIONS PROPOSED OR TAKEN TO CONTAIN, RECOVER OR DISPOSE OF SPILLED PRODUCT AND CONTAMINATED MATERIALS		

L	REPORTED TO SPILL LINE BY	POSITION	EMPLOYER	LOCATION CALLING FROM	TELEPHONE
M	ANY ALTERNATE CONTACT	POSITION	EMPLOYER	ALTERNATE CONTACT LOCATION	ALTERNATE TELEPHONE

REPORT LINE USE ONLY

N	RECEIVED AT SPILL LINE BY	POSITION STATION OPERATOR	EMPLOYER	LOCATION CALLED YELLOWKNIFE, NT	REPORT LINE NUMBER (867) 920-8130

LEAD AGENCY ☐ EC ☐ CCG ☐ GNWT ☐ GN ☐ ILA ☐ INAC ☐ NEB ☐ TC | SIGNIFICANCE ☐ MINOR ☐ MAJOR ☐ UNKNOWN | FILE STATUS ☐ OPEN ☐ CLOSED

AGENCY	CONTACT NAME	CONTACT TIME	REMARKS
LEAD AGENCY			
FIRST SUPPORT AGENCY			
SECOND SUPPORT AGENCY			
THIRD SUPPORT AGENCY			

Appendix B

Sabina Internal Spill Report Form

Sabina
GOLD & SILVER CORP.

SABINA INTERNAL SPILL REPORT FORM

This form is to be used for internal documentation of spills of any petroleum product, chemical, ethylene glycol (antifreeze), or other hazardous material. See recent Spill Contingency Plan for reporting thresholds and structure. Once complete file with the Operations Superintendent.

***Report Date and Time*:**	***Spill Date and Time*:** ☐ Spill occurred ☐ Spill observed
***Spill Location*:** ☐ Goose ☐ Marine Laydown Area ☐ George ☐ Other (e.g. Drill, Boulder Pond)	***Describe Location*:**
***Coordinates (Lat/Long or UTM)*:**	

***Product(s) Spilled*:**	Jet fuel	Diesel (P50)	Gasoline	AvGas	Oil (type)	Antifreeze	Other (describe)
***Quantity (L or kg)*:**							

Personnel Involved:	☐ Sabina	☐ Contractor	☐ Visitor	☐ Other

***Cause of Spill*:**
***Containment/Cleanup Measures Taken*:**
***Factors Affecting Spill or Recovery (weather, snow, ground conditions, etc.)*:**
***Additional Action Required*:**
***Additional Comments*:**

	Name	***Employer***	***Signature***
***Reported by*:**			
***Reported to*:**			

Appendix C
Cyanide Management Plan

Sabina
GOLD & SILVER CORP.

Plan

Cyanide Management Plan

H347084-0000-05-126-0001

2015-08-24	0	Approved for Use	K. Lee	G. Schwab	G. Schwab	J. Eng
DATE	REV.	STATUS	PREPARED BY	CHECKED BY	APPROVED BY	APPROVED BY
				Discipline Lead	Functional Manager	Client

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1. Introduction

This Cyanide Management Plan provides a description of the engineering designs and operations procedures that will be implemented to contain and manage cyanide at Sabina Gold and Silver Corporation's Back River site and thereby minimize risk to on-site employees and the environment. Standard operating procedures (SOPs), which will detail the procedures for safe handling of the entire lifecycle of cyanide, will be developed during the execution phase of the project.

Gold ores require cyanide to efficiently extract gold interlocked within gangue minerals. Gold ore is first liberated by means of comminution, or size reduction, to expose gold surfaces. Gold is then subject to cyanidation for dissolution of gold particles into solution; gold in solution is adsorbed onto carbon for final gold production. The tailings in cyanide solution are then detoxified prior to disposal to tailings storage facilities. Cyanide is a potentially hazardous chemical which requires careful management and control.

The cyanide life-cycle consists of the items listed below:

- Worker Training
- Dialogue
- Cyanide Production
- Cyanide Transportation
- Cyanide Handling and Storage
- Cyanide Use in Operations
- Site Decommissioning
- Worker Safety
- Emergency Response

This plan addresses the necessary elements of design, construction, and operation of facilities for unloading and storage of cyanide, its use in the gold recovery process, and the detoxification process for safe disposal into the environment.

1.1 Codes and Standards

This document was prepared with reference to the codes and standards listed below:

- International Cyanide Code – Cyanidecode.org
- Transportation Canada – https://www.tc.gc.ca/
- United Nations Handling of Dangerous Goods – http://www.unece.org/trans/danger/danger.html

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1.2 Standard Operating Procedures (SOPs)

Sabina will develop a suite of SOPs that encompass the safe handling of cyanide. Below is a list of example SOPs from other operating mine sites using cyanide:

- Unloading and Storage of Reagent Cyanide
- Cyanide Leach and Carbon-in-Pulp Facility Operation
- Inspections of Cyanide Tanks, Pipelines, and other Cyanide Facilities
- Maintenance and Calibration of Hydrogen Cyanide Monitoring Equipment
- Decontamination of Cyanide Handling Equipment
- Emergency Power Generation for Cyanide Handling Equipment
- Emergency Response Preparedness
- Alcohol Testing for Drivers/Equipment Operators
- Hazardous Material Storage and Transfer Operations
- Environmental and Social Management Training.
- Emergency Response Preparedness
- Operations Start-up
- Normal Operating Procedures- Tailings Deposition
- Tailings Management Facility- Operations Inspection
- Tailings Management Facility- Operations Reporting
- Tailings Management Facility- Emergency Maintenance/ Inspection
- Tailings Management Facility- Emergency Response Action
- Tailings Management Facility- Emergency Notification Requirement
- Tailings Management Facility- Health and Safety
- Tailings Management Facility- Health and Safety Monitoring

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2. Cyanide Management Plan

2.1 Cyanide Production

Sabina is an end-user of sodium cyanide and does not control the production of cyanide. Sabina will purchase cyanide in solid form and from producers who are committed to limiting exposure of cyanide to their workforce and for preventing and controlling release of cyanide into the environment, or signatories to the International Cyanide Code.

2.2 Cyanide Transportation

Sodium cyanide briquettes will be transported from the point of manufacture to Vancouver, then to the Marine Laydown Area (MLA) at Bathurst Inlet. The sodium cyanide briquettes will be packaged in 2 tonne bags contained within wooden boxes. The boxes will be properly labelled by UN standards. It is expected that the boxes will be loaded into standard 20 foot steel shipping containers ('sea cans') at the point of manufacture. No other materials or equipment will be loaded into the cyanide shipping containers.

Although Sabina may not be directly responsible for the transport from the manufacturing/ production facility to the MLA Sabina will establish responsibility for safety, security, release prevention, training and emergency response in written agreements with producers, distributors and transporters.

Sabina will require that cyanide transporters implement appropriate emergency response plans and capabilities, and employ adequate measures for cyanide management.

From the MLA, cyanide will be transported to the Goose site storage area where cyanide will be stored in original shipping containers until used in ore processing. The cyanide boxes will only be removed from the shipping containers at the make-up facility within the process plant.

2.3 Cyanide Handling and Storage

2.3.1 Cyanide Storage on Site

All cyanide brought on site for use at the Back River mine site will be recorded in an Inventory Register which is updated (as materials arrive on site) and available for inspection by the appropriate authorities. Material Safety Data Sheets (MSDSs) for solid sodium cyanide, sodium cyanide solution and HCN gas will also be included in the Inventory Register. The MSDSs are provided in Appendix B. The purpose of the Inventory Register is to facilitate efficient audit functions as well as to conform to best practice for environmental and safety management.

Cyanide shipping containers will be separated from shipping containers for other equipment and materials. The cyanide shipping containers will be appropriately labelled and tracked with the Inventory Register.

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2.3.2 Cyanide Handling

To ensure safe storage, the following requirements for storage and handling of cyanide in bulk are listed below:

- design and construction requirements for containers
- bunds and compounds

Although Sabina will not be directly handling cyanide at the MLA, the above provisions are for handling bulk solid cyanide within storage containers at their respective locations.

The drainage provision for the storage area will slope away from the tanks to a sump. A pump will be fitted at the sump and will transfer any rainfall, hose down or spilt liquid collected to the leach tanks, or alternatively back into the cyanide solution tanks in the event that spillage does occur within the bunded area. Storage areas, tanks, pipelines, pumps and valves will have high visibility labelling and will be inspected regularly for signs of leakage, presence of solution outside of the tanks in the bunded areas and integrity of the containment. Any aspects requiring maintenance or repair will be addressed immediately and records documenting the inspection and corrective measures will be kept and presented when required.

2.3.3 Cyanide Packaging Disposal

All cyanide packaging will be incinerated at the Goose site with a proper burning permit obtained from the appropriate authorities.

2.4 Cyanide in Operations

2.4.1 Overview of Cyanide Use in Operations

Solid cyanide will be dissolved in water, in a mixing tank, to prepare a solution for use in the processing plant. Bulk cyanide supersacs will be lowered onto a bag-breaker located on top of the mixing tank. Fume hood(s) will be installed over the mixing tank to capture any cyanide dust particles to be properly disposed. Carmoisine dye is added to the mix to give the solution a highly visible red colour.

After dissolution, the sodium cyanide solution in the mixing vessel is transferred into the cyanide storage tank. From the cyanide storage tank, the sodium cyanide solution is distributed to the leach tanks, elution circuits, and intensive leach reactor within a cyanide reagent solution loop.

The cyanide destruction system is based on the well proven SO_2 air process to oxidize cyanide to the compound, cyanate, (OCN^-). The process uses sodium metabisulphite as the source of SO_2, copper sulphate as a soluble copper catalyst and lime for pH control.

Oxygen is required for the reaction and is supplied by sparging air into the reaction vessels. The reaction is optimally carried out at a pH level between 8 and 9, and lime is added to neutralize the acid generated by the reaction to maintain the required pH range.

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The cyanide concentration of the solution discharged to the tailings storage facility must comply with, at minimum, the limits and specifications imposed by the local environmental permitting regulations in Nunavut.

2.4.2 *Process Plant*

Cyanide will be contained within the Back River processing plant utilizing the following measures:

- Cyanide mixing tank with dust extraction system, and all personnel handling bulk cyanide issued with the requisite personal protective equipment (PPE) including face masks and respirators.
- Cyanide mixing tanks, cyanide storage tanks, and process tanks utilizing cyanide are located within concrete bunded areas having a capacity to contain 110% of the volume of the largest tank.
- A spillage pump, located within the bunded area, will be operated under direct operator supervision to ensure the solution is safely disposed.
- The storage tank is required to be located in a well ventilated area or have a forced air ventilation system.
- Integrated cyanide destruction circuit to treat the leaching plant residue process stream before discharge to tailings.
- A back-up power supply system / generators is provided for key equipment related to the cyanide make-up and cyanide addition.
- Further cyanide destruction occurs at the tailings storage facility through oxidation and volatilization.
- Piping containing cyanide in solution will be routed away from any acidic solution and will be self draining. All cyanide piping lines will also be properly labelled within the process plant.

2.4.3 *Cyanide Detoxification Circuit*

At a minimum, the detoxification plant influent and effluent will be monitored for the following parameters, at the frequencies indicated in Table 2-1.

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Table 2-1 Detoxification Influent/Effluent Parameters

Parameter	Frequency
pH	Continuous monitor and alarm
WAD cyanide	During each shift
Total cyanide	During each shift
Copper	During each shift
Thiocyanate (SCN) concentrations	Weekly
Selected metals and other parameters that may be required	Monthly

A continuous sample will be taken from both sample streams throughout the day and will be tested in the assay lab for the above parameters once per shift as there are no cyanide on-stream analyzers. Slurry pH will be monitored continuously through the use of a pH probe in the cyanide detoxification tanks.

2.4.4 Tailings and Reclaim

The tailings stream will be pumped to the tailings storage facility. Cyanide detoxification will reduce CN_{WAD} levels at the discharge point at the tailings storage facilities to <1 ppm. Solution reclaimed from the tailings storage facility will be re-used in the processing plant. It is expected that the amount of cyanide returning to the processing plant from the tailings storage facility will be negligible due to the natural degradation process and from dilution from other sources.

Solution decanted from the tailings in the TSF is exposed to ultraviolet radiation (sunlight) and atmospheric air, resulting in natural degradation (oxidation) of cyanide. Degradation and retention processes also take place in the anaerobic zone of the tailings.

2.4.5 On-site Laboratory

Cyanide in solution (CN_{WAD} and CN_{TOTAL}) will be closely monitored in the tailing slurry stream, tailings storage facility, reclaim water, effluent treatment discharge, and process water streams. The following monitoring programs will be established on site:

- The on-site assay laboratory will determine CN_{WAD} levels in the tailings stream, discharge at the tailings storage facility, in the reclaim water, and effluent treatment plant discharge.

An off-site laboratory will be used to confirm the results.

2.5 Site Decommissioning

Sabina will decommission the mine site and ensure the proper closure of cyanide facilities. This will entail the removal or detoxification of unused reagent cyanide and the cleanup of cyanide-containing residues in process tanks and equipment.

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2.6 Worker Safety

Sabina will conduct routine safety meetings and regularly scheduled formal safety meetings of which cyanide management will be the key topic to solicit worker input to safety issues and to insure that employees perform their tasks in a manner that is protective of their health and safety and that of their co-workers. At each meeting, employees will have the opportunity to ask questions and identify health and safety concerns. Sabina will also establish a suggestion box that employees may use to identify concerns with health and safety issues.

2.6.1 Safety Equipment for (HCN Exposure)

Hydrogen cyanide is a hazardous gas compound. When inhaled, the gas will cause restriction in air intake causing asphyxiation, and in large enough quantities, death. Hydrogen cyanide evolution occurs when cyanide solution comes into contact with acidic solutions.

In the case of cyanide poisoning, safety kits with cyanide antidote, resuscitator, and other medical necessities can be utilized to reverse cyanide poisoning when exposure occurs. Cyanide safety kits will be located in the following areas: MLA, Goose sit storage, and the processing plant. Routine check-ups on the safety kits will be completed to ensure the kit is up to date.

All workers that may be exposed to cyanide will be provided guidelines and safety protocols on how to respond to hydrogen cyanide exposure. Standard operating procedures will be easily accessible to workers.

Administration of cyanide antidotes are restricted to qualified medical personnel. The emergency response team will be trained in the use of the antidote.

2.6.2 Monitoring

2.6.2.1 Monitoring Locations

Sabina will remotely monitor HCN levels at locations where employees are operating. Audible and visual local alarms will also be installed where required. In the event that an emergency brings employees into contact with HCN, the appropriate emergency response will be initiated.

HCN, CN_{WAD} and CN_{TOTAL} levels will be monitored in the processing plant and associated storage facilities to provide information relevant to process control and/or cyanide detoxification.

The on-line monitoring of HCN gas will be carried out at the cyanide sparging and storage area and in the processing plant, at the following locations:

- Grinding area
- Pre-leach thickener
- Carbon-in-Column tanks
- Intensive leach reactor
- Cyanidation leach tanks

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- Carbon-in-pulp tanks
- Tailings thickener
- Cyanide detoxification tanks
- Cyanide mix and storage tanks
- Elution circuit
- Electrowinning room

CN_{WAD} and CN_{TOTAL} will be measured where process samples are taken.

The optimum location of alarms will be determined during detailed engineering. The alarm units will continuously monitor for hydrogen cyanide (HCN) and provide the readings directly to the operating control centre. Operators/ Maintenance personnel may be required to carry personal monitoring units in special circumstances, i.e. maintenance of the leach tanks. Sabina will ensure that the appropriate personnel are trained and that the required equipment and resources are provided.

2.7 Cyanide Emergency Response

2.7.1 Alarms and Procedures

If excessive HCN gas (>10ppm) is detected within the processing plant, the following steps will be undertaken:

- An alarm will activate notifying all personnel in the area: a siren and flashing lights will be activated and HCN levels will be displayed in the process control centre.
- All personnel in the process plant will evacuate from the area and into the designated evacuation zone. The process plant will then be off-limits to all personnel until HCN levels decrease to acceptable levels or unless wearing proper PPE to investigate and apply appropriate measures to correct the situation.
- Once acceptable HCN levels are achieved and after all alarms have been reset and the “all-clear” has been communicated, the operation will resume.

The procedures will be periodically reviewed by appropriate stakeholders and will be revised when required.

2.7.2 Safety Measures

The following events will trigger contingency measures at the Back River site:

- HCN levels within the process plant above 10ppm.
- CN levels within the tailings stream are higher than acceptable environmental limits.
- CN levels within the tailings pond are higher than acceptable environmental limits.

If any of the safety measures are triggered, the following steps will be implemented to correct the events that occurred.

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- Increase cyanide detoxification reagent dosage, SO_2 and lime, to increase chemical reactivity.
- Decrease cyanide addition rate.
- Decrease mill feed rate.
- Change the ratio of the ore blend.
- Addition of dilution water to the tailings stream to reduce cyanide concentrations.

In the event that one or more safety measures are implemented, regular monitoring of the effectiveness of the safety measures will be undertaken. It is expected that the list above will be refined as methods to improve are identified.

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Appendix A
International Cyanide Code

http://www.cyanidecode.org/about-cyanide-code/cyanide-code

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PRINCIPLES AND STANDARDS OF PRACTICE

1. PRODUCTION Encourage responsible cyanide manufacturing by purchasing from manufacturers who operate in a safe and environmentally protective manner.

Standard of Practice

1.1 Purchase cyanide from manufacturers employing appropriate practices and procedures to limit exposure of their workforce to cyanide and to prevent releases of cyanide to the environment.

2. TRANSPORTATION Protect communities and the environment during cyanide transport.

Standards of Practice

2.1 Establish clear lines of responsibility for safety, security, release prevention, training and emergency response in written agreements with producers, distributors and transporters.

2.2 Require that cyanide transporters implement appropriate emergency response plans and capabilities, and employ adequate measures for cyanide management.

3. HANDLING AND STORAGE Protect workers and the environment during cyanide handling and storage.

Standards of Practice

3.1 Design and construct unloading, storage and mixing facilities consistent with sound, accepted engineering practices and quality control and quality assurance procedures, spill prevention and spill containment measures.

3.2 Operate unloading, storage and mixing facilities using inspections, preventive maintenance and contingency plans to prevent or contain releases and control and respond to worker exposures.

4. OPERATIONS Manage cyanide process solutions and waste streams to protect human health and the environment.

Standards of Practice

4.1 Implement management and operating systems designed to protect human health and the environment including contingency planning and inspection and preventive maintenance procedures.

4.2 Introduce management and operating systems to minimize cyanide use, thereby limiting concentrations of cyanide in mill tailings.

4.3 Implement a comprehensive water management program to protect against unintentional releases.

4.4 Implement measures to protect birds, other wildlife and livestock from adverse effects of cyanide process solutions.

4.5 Implement measures to protect fish and wildlife from direct and indirect discharges of cyanide process solutions to surface water.

4.6 Implement measures designed to manage seepage from cyanide facilities to protect the beneficial uses of ground water.

4.7 Provide spill prevention or containment measures for process tanks and pipelines.

4.8 Implement quality control/quality assurance procedures to confirm that cyanide facilities are constructed according to accepted engineering standards and specifications.

4.9 Implement monitoring programs to evaluate the effects of cyanide use on wildlife, surface and ground water quality.

5. DECOMMISSIONING Protect communities and the environment from cyanide through development and implementation of decommissioning plans for cyanide facilities.

Standards of Practice

5.1 Plan and implement procedures for effective decommissioning of cyanide facilities to protect human health, wildlife and livestock.

5.2 Establish an assurance mechanism capable of fully funding cyanide-related decommissioning activities.

6. WORKER SAFETY Protect workers' health and safety from exposure to cyanide.

Standards of Practice

6.1 Identify potential cyanide exposure scenarios and take measures as necessary to eliminate, reduce and control them.

6.2 Operate and monitor cyanide facilities to protect worker health and safety and periodically evaluate the effectiveness of health and safety measures.

6.3 Develop and implement emergency response plans and procedures to respond to worker exposure to cyanide.

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7. EMERGENCY RESPONSE Protect communities and the environment through the development of emergency response strategies and capabilities.

Standards of Practice
7.1 Prepare detailed emergency response plans for potential cyanide releases.

7.2 Involve site personnel and stakeholders in the planning process.

7.3 Designate appropriate personnel and commit necessary equipment and resources for emergency response.

7.4 Develop procedures for internal and external emergency notification and reporting.

7.5 Incorporate into response plans monitoring elements and remediation measures that account for the additional hazards of using cyanide treatment chemicals.

7.6 Periodically evaluate response procedures and capabilities and revise them as needed.

8. TRAINING Train workers and emergency response personnel to manage cyanide in a safe and environmentally protective manner.

Standards of Practice
8.1 Train workers to understand the hazards associated with cyanide use.

8.2 Train appropriate personnel to operate the facility according to systems and procedures that protect human health, the community and the environment.

8.3 Train appropriate workers and personnel to respond to worker exposures and environmental releases of cyanide.

9. DIALOGUE Engage in public consultation and disclosure.

Standards of Practice
9.1 Provide stakeholders the opportunity to communicate issues of concern.

9.2 Initiate dialogue describing cyanide management procedures and responsively address identified concerns.

9.3 Make appropriate operational and environmental information regarding cyanide available to stakeholders

- See more at: http://www.cyanidecode.org/about-cyanide-code/cyanide-code#sthash.ER5NiUwm.dpuf

Appendix B
Cyanide Material Safety Data Sheets (MSDS)

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Material Safety Data Sheet

This material is hazardous according to criteria of NOHSC.
Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for Transport by Road and Rail.

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name: **SODIUM CYANIDE**

Supplier: Orica Australia Pty Ltd
ABN: 004 117 828
Street Address: 1 Nicholson Street,
Melbourne 3000
Australia
Telephone Number: +61 3 9665 7111
Facsimile: +61 3 9665 7937

Emergency Telephone: **1 800 033 111 (ALL HOURS)**

2. COMPOSITION/INFORMATION ON INGREDIENTS

Product Description: Uses: Extraction of gold and silver from ores; electroplating; heat treatment of metals; chemical intermediate.

Components / CAS Number	Proportion	Risk Phrases
Sodium cyanide	>60%	R26/27/28, R32
143-33-9		

3. HAZARDS IDENTIFICATION

Risk Phrases: Very toxic by inhalation, in contact with skin and if swallowed. Contact with acids liberates very toxic gas.

Poisons Schedule: S7 Dangerous Poison.

4. FIRST AID MEASURES

For advice, contact a Poisons Information Centre (Phone eg. Australia 131 126; New Zealand 0 800 764766) or a doctor at once. Urgent hospital treatment is likely to be needed.

Inhalation: Take precautions to ensure rescuer is not overcome. Remove victim from area of exposure - avoid becoming a casualty. Remove contaminated clothing and loosen remaining clothing. Allow patient to assume most comfortable position and keep warm. Keep at rest until fully recovered. If patient finds breathing difficult and develops a bluish discolouration of the skin (which suggests a lack of oxygen in the blood - cyanosis), ensure airways are clear of any obstruction and have a qualified person give oxygen through a face mask. Apply artificial respiration if patient is not breathing. Seek

immediate medical advice.

Skin Contact: If skin contact occurs, remove contaminated clothing and wash skin with running water. If irritation occurs seek medical advice.

Eye Contact: If in eyes, wash out immediately with water. In all cases of eye contamination it is a sensible precaution to seek medical advice.

Ingestion: Immediately rinse mouth with water. If swallowed, remove from contaminated area. Apply artificial respiration if not breathing. Do not give direct mouth-to-mouth resuscitation. To protect rescuer, use air-viva, oxy-viva or one-way mask. Resuscitate in a well-ventilated area. Never give anything by the mouth to an unconscious patient. Get to a doctor or hospital quickly.

Notes to physician: May be fatal if inhaled, swallowed or absorbed through skin. At all places where there is a risk of cyanide poisoning, the following items should be kept in an accessible and convenient location: An oxygen resuscitator and a source of oxygen; a clearly marked CYANIDE ANTIDOTE box containing an approved airway, elasticised tournequet, disposable in dwelling intravenous cannulae, 20ml sterile disposable syringes and needles, fluoride heparinised blood sample tubes, skin prep swabs, dressings and adhesive tape, and ampoules of kelocyanor (dicobalt edetate), including the prescribing information outlining side effects and precautions (a copy of the appropriate Material Safety Data Sheet and a copy of the Worksafe Australia Guide, 'Cyanide Poisoning'). antidote for cyanide poisoning is the intravenous administration of dicobalt edetate. Due to adverse reactions which can occur in the absence of poisoning, this should be administered when absorption of cyanide is beyond doubt. Cyanide poisoning occurs apidly after exposure. If the patient is conscious after the usual time taken to reach hospital then exposure to cyanide either from inhalation, ingestion or skin contamination is unlikely to have resulted in a significant amount of cyanide being absorbed. In these circumstances the patient should be observed carefully with particular attention being given to the state of consciousness. Over zealous administration of the antidote is contraindicated and may result in serious adverse reactions of an anaphylactic (allergic) nature. Adverse reactions reported include gross oedema of the face and neck, urticaria, palpitations, hypotension, convulsions, vomiting, chest pains, difficulty in breathing, and collapse. If after clinical assessment the patient is considered to require the antidote, that is, the patient is known to have been exposed to cyanide and is unconscious or lapsing into unconsciousness, administer one ampoule containing 300 mg Dicobalt edetate in 20 mL glucose solution (Kelocyanor) intravenously by slow injection. The initial effect is a fall in blood pressure, rise in pulse rate, and sometimes retching. Immediately after this phase, lasting about one minute, the patient should recover. The injection should be discontinued if allergic adverse effects are noted. A second dose may be given if the response is inadequate and allergic adverse effects are absent.

5. FIRE FIGHTING MEASURES

Specific Hazards: Non-combustible material.

Fire-fighting advice: Decomposes on heating emitting toxic fumes, including those of hydrogen cyanide , and ammonia . If safe to do so, remove containers from path of fire. Fire fighters to wear self-contained breathing apparatus and suitable protective clothing if risk of exposure to products of decomposition.

Suitable Extinguishing Media: Not combustible, however, if material is involved in a fire use: Water fog (or if unavailable fine water spray), foam, dry chemical powder.

Unsuitable Extinguishing Media: DO NOT USE the following as extinguishing media: Carbon dioxide.

6. ACCIDENTAL RELEASE MEASURES

Clear area of all unprotected personnel. Avoid breathing in dust. Work up wind or increase ventilation. Wear protective equipment to prevent skin and eye contact and breathing in vapours/dust. DO NOT allow material to get wet. Contain - prevent run off into drains and waterways. Spillage area and contaminated solids can be detoxified by treatment with an excess of dilute sodium hypochlorite, calcium hypochlorite, or ferrous sulfate after the addition of soda ash or lime to raise the pH to greater than 10.5. Allow 1 hour for complete decomposition before washing spillage area down with large quantities of water to ensure maximum dilution. Collect and seal in properly labelled containers or drums for disposal. If contamination of sewers or waterways has occurred advise local emergency services.

7. HANDLING AND STORAGE

Handling advice: Avoid skin and eye contact and breathing in dust. Avoid handling which leads to dust formation.

Storage advice: Store in a cool, dry, well ventilated place and out of direct sunlight. Keep dry - reacts with water. Protect from moisture. Store away from foodstuffs. Store away from incompatible materials described in Section 10. Keep containers closed when not in use - check regularly for spills.

This material is a Scheduled Poison S7 and must be stored, maintained and used in accordance with the relevant regulations.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits:
No value assigned for this specific material by the National Occupational Health and Safety Commission. However, Exposure Standard(s) for constituent(s):

Cyanides (as CN): 8hr TWA = 5 mg/m3, Sk
Decomposition product(s): Hydrogen cyanide: Peak Limitation = 11 mg/m3 (10 ppm), Sk

As published by the National Occupational Health and Safety Commission.

TWA - The time-weighted average airborne concentration over an eight-hour working day, for a five-day working week over an entire working life.

`Sk' Notice – absorption through the skin may be a significant source of exposure. The exposure standard is invalidated if such contact should occur.

Peak Limitation - a ceiling concentration which should not be exceeded over a measurement period which should be as short as possible but not exceeding 15 minutes.

These Exposure Standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. These exposure standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.

Engineering Control Measures:
Ensure ventilation is adequate and that air concentrations of components are controlled below quoted Exposure

Standards. Avoid generating and breathing in dusts. If inhalation risk exists: Use with local exhaust ventilation or while wearing air supplied mask. Keep containers closed when not in use.

Personal Protective Equipment:
Orica Personal Protection Guide No. 1, 1998: J - OVERALLS, RUBBER BOOTS, AIR MASK , GLOVES (Long), APRON.

Wear overalls, full face shield, elbow-length impervious gloves, splash apron and rubber boots. Use with adequate ventilation. If inhalation risk exists, wear air-supplied mask meeting the requirements of AS/NZS 1715 and AS/NZS 1716. Always wash hands before smoking, eating, drinking or using the toilet. Wash contaminated clothing and other protective equipment before storage or re-use.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state:	Solid
Colour:	White
Odour:	Faint 'Bitter almonds'
Molecular Formula:	NaCN
Solubility:	Soluble in water.
Specific Gravity:	1.6-1.62 @20°C
Relative Vapour Density (air=1):	Not available
Vapour Pressure (20 °C):	Not available
Flash Point (°C):	Not applicable
Flammability Limits (%):	Not applicable
Autoignition Temperature (°C):	Not applicable
Melting Point/Range (°C):	ca. 560
pH:	Not available

10. STABILITY AND REACTIVITY

Stability: Incompatible with acids , moisture , metals , oxidising agents , and halogens . Hazardous polymerization will not occur. Reacts with water liberating toxic hydrogen cyanide gas.

11. TOXICOLOGICAL INFORMATION

No adverse health effects expected if the product is handled in accordance with this Safety Data Sheet and the product label. Symptoms or effects that may arise if the product is mishandled and overexposure occurs are:

Ingestion: Swallowing can result in nausea, vomiting, diarrhoea, abdominal pain, convulsions and loss of consciousness. Collapse and possible death may occur.

Eye contact: May be an eye irritant. Exposure to the dust may cause discomfort due to particulate nature. May cause physical irritation to the eyes.

Skin contact: Contact with skin may result in irritation. Can be absorbed through the skin. Effects can include those described for 'INGESTION'.

Inhalation: Breathing in high concentrations may result in the same symptoms described for 'INGESTION'. High inhaled concentrations may lead to a feeling of suffocation and cause difficulty in breathing, headaches, dizziness and loss of consciousness. Can cause suffocation.

Long Term Effects:

Repeated or prolonged skin contact may lead to irritant contact dermatitis - 'cyanide rash' - characterised by itching and skin eruptions. (1)

Toxicological Data:

Oral LD50 (rat): 6440 ug/kg. (2)
Dermal LD50 (rabbit): 10400 ug/kg. (2)

12. ECOTOXICOLOGICAL INFORMATION

Avoid contaminating waterways.

13. DISPOSAL CONSIDERATIONS

Refer to Waste Management Authority. Dispose of material through a licensed waste contractor. Empty containers must be decontaminated and destroyed.

14. TRANSPORT INFORMATION

Road and Rail Transport
Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for Transport by Road and Rail.

UN No: 1689
Class-primary 6.1 Toxic
Packing Group: I
Proper Shipping Name: SODIUM CYANIDE

Hazchem Code: 2X

Marine Transport
Classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea.
This material is classified as a Marine Pollutant (P) according to the International Maritime Dangerous Goods Code.

UN No: 1689
Class-primary: 6.1 Toxic
Packing Group: I
Proper Shipping Name: SODIUM CYANIDE, SOLID

Air Transport
Classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air.

UN No: 1689
Class-primary: 6.1 Toxic
Packing Group: I
Proper Shipping Name: SODIUM CYANIDE, SOLID

15. REGULATORY INFORMATION

Classification: This material is hazardous according to criteria of NOHSC.
T+ : Very Toxic

Risk Phrase(s): R26/27/28: Very toxic by inhalation, in contact with skin and if swallowed.
R32: Contact with acids liberates very toxic gas.

Safety Phrase(s): S7: Keep container tightly closed.
S22: Do not breathe dust.
S29: Do not empty into drains.
S45: In case of accident or if you feel unwell, seek medical advice immediately (show the label whenever possible).

Poisons Schedule: S7 Dangerous Poison.

This material is listed on the Australian Inventory of Chemical Substances (AICS).

16. OTHER INFORMATION

(1) Worksafe Australia Cyanide Poisoning; National Occupational Health and Safety Commission; Australian Government Publishing Service, 1989.
(2) `Registry of Toxic Effects of Chemical Substances'. Ed. D. Sweet, US Dept. of Health & Human Services: Cincinatti, 2005.

This material safety data sheet has been prepared by SH&E Shared Services, Orica.

Reason(s) for Issue:
5 Yearly Revised Primary MSDS

This MSDS summarises to our best knowledge at the date of issue, the chemical health and safety hazards of the material and general guidance on how to safely handle the material in the workplace. Since Orica Limited cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, assess and control the risks arising from its use of the material.

If clarification or further information is needed, the user should contact their Orica representative or Orica Limited at the contact details on page 1.

Orica Limited's responsibility for the material as sold is subject to the terms and conditions of sale, a copy of which is available upon request.

Material Safety Data Sheet

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

Product name: Sodium Cyanide Solution - (30% w/w)

Synonyms: Cyanide of Sodium Solution - (30% w/w)

CAS-No.:

Molecular Formula:

Supplier: Orica Australia Pty Ltd
ACN: 004 117 828
Street Address: 1 Nicholson Street
Melbourne 3000
Australia
Telephone: + 61 3 9665 7111
Facsimile: + 61 3 9665 7937

Emergency telephone number: **1 800 033 111 (ALL HOURS)**

2. COMPOSITION/INFORMATION ON INGREDIENTS

Recommended use: Extraction of gold and silver from ores; electroplating; heat treatment of metals; chemical intermediate.

Appearance: Colourless to straw-coloured liquid with a faint, 'bitter almonds' odour.

CHEMICAL ENTITY	CAS NO.	PROPORTION (% weight per weight)
Water	7732-18-5	70
Sodium cyanide	143-33-9	30
		100%

All the constituents of this material are listed on the Australian Inventory of Chemical Substances (AICS).

3. HAZARDS IDENTIFICATION

Hazardous according to criteria of Worksafe Australia.

Hazard Category
T+ Very toxic

R-phrase(s)
R26/27/28 Very toxic by inhalation, in contact with skin and if swallowed.

R32 Contact with acids liberates very toxic gas.

Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by road or rail.
Class: 6.1 Toxic

Poisons Schedule (Aust)/Toxic Substance (NZ): S7

This material is a Scheduled Poison S7 and must be stored, maintained and used in accordance with the relevant regulations.

4. FIRST AID MEASURES

* Poison Information Centres in each State Capital City can provide additional assistance for scheduled poisons.
* CONCURRENTLY WITH THE FOLLOWING FIRST AID PROCEDURES, TRANSFER PATIENT IMMEDIATELY TO HOSPITAL OR MEDICAL CENTRE, ACCOMPANIED BY AN ATTENDANT WITH THE CYANIDE EMERGENCY KIT.
For all routes of exposure, remove patient from contaminated area and ensure rescuers avoid contamination. Give oxygen and if necessary, artificial respiration. If giving mouth-to-mouth resuscitation wash out patient's mouth and lips - do not inhale patient's expired air. Remove contaminated clothing and wash contaminated skin thoroughly. Get to ahospital or doctor quickly.

Ingestion: * IF THE PATIENT IS CONSCIOUS:
- Do not give anything by mouth.
- Rest and reassure the patient who may become agitated.
- If available, oxygen should be administered by a qualified person.
* IF THE PATIENT IS UNCONSCIOUS AND BREATHING:
- Do not give anything by mouth.
- Lie the patient on their side, ensuring the airway is clear. If available, oxygen should be administered by aqualified person.
* IF THE PATIENT IS NOT BREATHING:
- Ensure airway is clear.
- Commence expired air resuscitation using a pocket mask with a one-way valve. If available, oxygen should be administered by a qualified person. Take care to prevent contamination of the rescuer by removing all contaminated clothing and if giving mouth-to-mask recuscitation wash out patient's mouth and lips - do not inhale patient's air.
- If cardiac arrest occurs (no pulse present), commence cardiopulmonary resuscitation (CPR).

Eye contact: * Immediately irrigate with copious quantities of water for at least 15 minutes. Eyelids to be held open. Remove clothing if contaminated and wash skin. Treat as for 'INGESTION'.

Skin contact: * If skin contact occurs, remove contaminated clothing and wash skin thoroughly. Can be absorbed through the skin with resultant toxic effects. Treat as for 'INGESTION'.

Inhalation: * Remove victim from exposure - avoid becoming a casualty. Treat as for 'INGESTION'.
EMERGENCY KIT FOR CYANIDE POISONING:
At all places where there is a risk of cyanide poisoning, the following items should be kept in an accessible andconvenient location:
. an oxygen resuscitator and a source of oxygen;
. a clearly marked CYANIDE ANTIDOTE box containing:
- an approved airway,
- elasticised tournequet,

- disposable in dwelling intravenous cannulae,
- 20 ml sterile disposable syringes and needles,
- fluoride heparinised blood sample tubes,
- skin prep swabs, dressings and adhesive tape, and
- ampoules of kelocyanor (dicobalt edetate), including the prescribing information outlining side effects andprecautions;

. a copy of the appropriate Material Safety Data Sheet and
. a copy of the Worksafe Australia Guide, 'Cyanide Poisoning'.

Notes to physician: The antidote for cyanide poisoning is the intravenous administration of dicobalt edetate (trade name - Kelocyanor). Due to adverse reactions which can occur in the absence of poisoning, this should only be administered when absorption of cyanide is beyond doubt. The antidote should only be administered by a suitably qualified professional health attendant (3).
Cyanide poisoning occurs rapidly after exposure. If the patient is conscious after the usual time taken to reach hospital then exposure to cyanide either from inhalation, ingestion or skin contamination is unlikely to have resulted in a significant amount of cyanide being absorbed. In these circumstances the patient should be observed carefully with particular attention being given to the state of consciousness.
Over zealous administration of the antidote is contraindicated and may result in serious adverse reactions of an anaphylactic (allergic) nature. Adverse reactions reported include gross oedema of the face and neck, urticaria, palpitations, hypotension, convulsions, vomiting, chest pains, difficulty in breathing, and collapse (3).
If, after clinical assessment the patient is considered to require the antidote, ie. the patient is known to have been exposed to cyanide and is unconscious or lapsing into unconsciousness, administer one ampoule containing 300 mg Dicobalt edetate in 20 ml glucose solution (Kelocyanor) intravenously by slow injection. The initial effect is a fall in blood pressure, rise in pulse rate, and sometimes retching. Immediately after this phase, lasting about one minute, the patient should recover. The injection should be discontinued if allergic adverse effects are noted. A second dose may be given if the response is inadequate and allergic adverse effects are absent.

5. FIRE-FIGHTING MEASURES

Specific hazards: Non-combustible material.

Fire fighting further advice: Not combustible. Can decompose on heating or on contact with acidic media emitting highly toxic fumes including those of hydrogen cyanide, ammonia, oxides of carbon, and oxides of nitrogen. If safe to do so, remove containers from path of fire. Fire fighters to wear self-contained breathing apparatus if risk of exposure to products of decomposition.

Suitable extinguishing media: Not combustible, however, if material is involved in a fire use water fog (or if unavailable fine water spray), foam, dry agent (carbon dioxide, dry chemical powder).

6. ACCIDENTAL RELEASE MEASURES

Immediate action required. Avoid inhalation of mists. Work up wind or increase ventilation. Clear area of all unprotected personnel to a minimum of 20 metres. Vacate completely if spill occurs in a confined area. Wear protective equipment to prevent skin and eye contamination and inhalation of highly toxic hydrogen cyanide gas. Contain - prevent run off into drains andwaterways.
FOR SMALL SPILLS TO SOIL Remove a conservative amount of soil, collect all contaminated soil and seal in clean, dry, properly labelled drums.
FOR LARGE SPILLS TO SOIL
Remove top layers of contaminated soil for treatment or treat in situ. Contact supplier for expert advice required for this treatment.
DO NOT wash to drain. If contamination of sewers or waterways has occurred advise local emergency services.
Spillage area and contaminated soils can be detoxified by treatment with an excess of dilute sodium hypochlorite or calcium hypochlorite. Expert advice is required for this treatment. Take care to avoid contact with detoxification solutions which are corrosive.
SPILLS TO WATERWAYS Seek advice from emergency services and local authorities prior to treating spills to waterways.
Spills to waterways can be detoxified with ferrous sulphate or sodium hypochlorite, however expert advice is required for this treatment.
Note: The detoxification procedure converts the cyanide ion to the cyanate ion which on continued reaction breaks down to carbon dioxide and nitrogen.

7. HANDLING AND STORAGE

Storage: Not to be available except to authorised or licensed persons. Sodium cyanide solution is only available in bulk and should be stored in mild steel or stainless steel tanks; the solution is corrosive to zinc and aluminium. Tanks should be vented to a safe atmosphere as they may develop a build-up of highly toxic hydrogen cyanide gas. The storage area must be fully bunded and facilities available to detoxify any spillage. Check tanks regularly for leaks. A safety shower and eye wash facility must be available at the discharge point. Store away from acids, oxidising agents and foodstuffs.

This material is a Scheduled Poison S7 and must be stored, maintained and used in accordance with the relevant regulations.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

National occupational exposure limits
No value assigned for this specific material by the National Occupational Health and Safety Commission (Worksafe Australia).

However, Exposure Standards for constituent and decomposition product:

	TWA		STEL		NOTICES
	ppm	mg/m3	ppm	mg/m3	
Cyanides (as CN)	-	5	-	-	Sk
Hydrogen cyanide **	10	11	(Peak limitation)		Sk

** (decomposition product).
As published by the National Occupational Health and Safety Commission

(Worksafe Australia).
Peak Limitation - a ceiling concentration which should not be exceeded over a measurement period which should be as short as possible but not exceeding 15 minutes.
'Sk' notice - absorption through the skin may be a significant source of exposure. The exposure standard is invalidated if such contact should occur.
TWA - the Time-Weighted Average airborne concentrations over an eight-hour working day, for a five-day working week over an entire working life.
STEL (Short Term Exposure Limit) - the average airborne concentration over a 15 minute period which should not be exceeded at any time during a normal eight-hour work day. According to current knowledge these concentrations should neither impair the health of, nor cause undue discomfort to, nearly all workers.
These Exposure Standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. Exposure Standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.

Engineering measures: Ensure ventilation is adequate and that air concentrations of components and decomposition products are controlled below quoted Exposure Standards. Use with local exhaust ventilation or while wearing respirator (see PERSONAL PROTECTION section below) or air supplied mask.

Personal protection equipment: Orica Personal Protection Guide No.1, 1998: J - OVERALLS, RUBBER BOOTS, FACE SHIELD OR AIR MASK, GLOVES (L), APRON.

Avoid all contact. Wear overalls, full face shield, elbow-length impervious gloves, splash apron and rubber boots. Use with adequate ventilation. If inhalation risk exists wear full-face respirator (Type B2 or B3 gas filter combined with Class P3 particulate filter) or air supplied mask meeting the requirements of AS/NZS 1715 and AS/NZS 1716. Always wash hands before smoking, eating, drinking or using the toilet. Wash clothing and other protective equipment before storage or re-use.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form / Colour / Odour: Colourless to straw-coloured liquid with a faint, 'bitter almonds' odour.

Solubility: Miscible with water. Insoluble in organic solvents.

Specific Gravity (20 C)	: 1.170	Freezing Point (C)	: ca. 1
Rel Vapour Density (air=1)	: N Av	Boiling Point (C)	: ca. 111
Vapour Pressure (20 C)	: 1.73 kPa	Decomp. Point (C)	: N Av
Flash Point (C)	: N App	Sublimation Point	: N App
Flammability Limits (%)	: N App	pH	: >12
Autoignition Temp (C)	: N App	Viscosity	: N Av
% Volatile by volume	: 70	Evaporation Rate	: N Av
Solubility in water (15 C)	: Miscible	(n-Butyl acetate=1)	

(Typical values only - consult specification sheet)
(N Av = Not available N App = Not applicable)

10. STABILITY AND REACTIVITY

Stability: Will liberate highly toxic hydrogen cyanide gas upon contact with acids or acidic media. Incompatible with oxidising agents. Will decompose when heated generating toxic ammonia gas and hydrogen cyanide gas. For hydrogen cyanide gas (decomposition product): Rel Vapour Density (air=1): 0.94; Explosive Limits (%): 5.6-40; Flash Point (C): -17.

11. TOXICOLOGICAL INFORMATION

No adverse health effects expected if the product is handled in accordance with this Safety Data Sheet and the product label. Symptoms that may arise if the product is mishandled are:
Short term exposure by all routes is considered to be highly toxic. May be fatal if inhaled, swallowed or absorbed through skin.
Possible exposure routes are (1,2):
- Breathing hydrogen cyanide gas from decomposing solid or solutions, or by breathing cyanide dust.
- Swallowing solid or solutions.
- By absorption through skin or eyes as a result of contact with solutions, dust or solid material.

Early symptoms of exposure (1,2,3):
- Irritation of mucous membranes in eyes, nose and throat. Burning sensation of the the tongue.
- Salivation.
- Irritation of skin or eyes with discomfort or burning sensation.
- Headaches.
- Unusual behaviour.
- Nausea.
- General weakness, and heaviness in arms and legs.
- Rapid pulse.
- Increased difficulty in breathing.

Signs of severe poisoning (1,2,3):
- Cherry-red complexion.
- Feeling of suffocation, gasping for breath.
- Vomiting.
- Convulsions and collapse.
- Decreasing consciousness.
- Cessation of breathing.

Acute Effects
Ingestion: See Main symptoms above.

Eye contact: See Main symptoms above.

Skin contact: See Main symptoms above.

Inhalation: See Main symptoms above.

Long Term Effects:
Repeated or prolonged skin contact may lead to irritant contact dermatitis - 'cyanide rash' - characterised by itching and skin eruptions (3).

Acute toxicity / Chronic toxicity
No LD50 data available for the product.

For Sodium Cyanide (solid):
Oral LD50 (rat): 6.4 mg/kg; Oral Lowest Lethal Dose (human): 2.9 mg/kg (4)
Ocular LD50 (rabbit): 5.0 mg/kg (4)
For Hydrogen Cyanide (gas) -
Oral LD50 (mouse): 3.7 mg/kg (4)
Inhalation LC50 (rat): 160 ppm/30 min (4)
Inhalation Lowest Lethal Concentration (human): 120 mg/m3/1 hr (4)
Inhalation Lowest Lethal Concentration (human): 200 mg/m3/10 min (4)
Inhalation Lowest Lethal Concentration (human): 400 mg/m3/2 min (4)
Ocular LD50 (rabbit): 1.0 mg/kg (4)
No signs of cyanide toxicity were observed in a 2 year feeding study in rats given food containing 100 and 300 ppm of hydrogen cyanide. (5)
The high toxicity of cyanide compounds results from their ability to interfere with the body's utilisation of oxygen at the cellular level by inhibiting the cytochrome oxidase enzyme system (1,3)
In a study of the effect of chronic cyanide exposure at up to twice the current recommended exposure standard (ie 6.4 to 10.4 ppm) (6)

. No signs of hypo- or hyperthyroidism.
. 56% of the workers had thyroid enlargement to a mild or moderate degree.
. Workers were exposed to other chemicals.
. There was no association between the period of exposure and the incidence of enlargement or size of the thyroid.

12. ECOLOGICAL INFORMATION

Avoid contaminating waterways. Very toxic to aquatic organisms.
For Hydrogen Cyanide - (7)
96 hr LC50 (rainbow trout): 57 ug/L
TLm 24 (sunfish): 0.18 mg/L
TLm 24 (pinperch): 0.05 mg/L in sea water
TLm 24: Median Tolerance Limit - the concentration of toxicant or substance at which 50% of the test organisms survive over a 24 hour test period.

13. DISPOSAL CONSIDERATIONS

Refer to State/Territory Land Waste Management Authority. Waste treatment is essential. Empty containers must be decontaminated and destroyed. Dispose of material through a licensed waste contractor.

14. TRANSPORT INFORMATION

Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by road or rail.

UN-No: 1935
Class: 6.1 Toxic

Hazchem code: 2X
EPG: 6.0.009
Packing group: Packing Group 1

Proper shipping name: CYANIDE SOLUTIONS

Segregation Dangerous Goods: Not to be loaded with explosives (Class 1), nitromethane, acids of Class 8, food and food packaging in any quantity, however exemptions may apply.

15. REGULATORY INFORMATION

Hazardous according to criteria of Worksafe Australia.

Hazard Category	
T+	Very toxic

R-phrase(s)	
R26/27/28	Very toxic by inhalation, in contact with skin and if swallowed.
R32	Contact with acids liberates very toxic gas.

S-phrase(s)	
S 7	Keep container tightly closed.
S23	Do not breathe spray.
S24	Avoid contact with the skin.
S28	After contact with skin, wash immediately with plenty of water.
S29	Do not empty into drains.
S45	In case of accident or if you feel unwell, seek medical advice immediately (show label where possible).

Poisons Schedule (Aust)/Toxic Substance (NZ): S7

16. OTHER INFORMATION

Literary reference

(1), 'Various authors', In 'Patty's Industrial Hygiene and Toxicology Vol.IID 4th Edition' (Ed. Clayton, G.D., Clayton, F.E.), p 3119-3136, (John Wiley and Sons: New York 1994).
(2), Toxicology Profile for Cyanide; Agency for Toxic Substances and Disease Registry; US Department of Health and Human Services; 08/95
(3) Worksafe Australia Cyanide Poisoning; National Occupational Health and Safety Commission; Australian Government Publishing Service; 1989.
(4), On 'CC Info Disc No. C2 ' (Canadian Centre for Occupational Health and Safety; Ontario 1996)
(5), Howard, J. W. and Hanzal, R. F., J. Agric. Food Chemistry, April 1955, 3(4), 325-329.
(6), El Gwhawabi, S. H. et al, Br, J. Ind. Med., 1975, 3, 215-219.
(7), In 'Handbook of Environmental Data on Organic Chemicals Second

Edition' (Ed Verschveren, Karel), (Van Nostrand Reinhold Company: New York 1983).
This Material Safety Data Sheet has been prepared by SHE Pacific Pty Ltd on behalf of Orica Ltd and its subsidiary companies.
Contact Point: SHE Pacific Pty Ltd, MSDS Services

Within Australia:	Telephone	1 800 624 132
	Facsimile	(03) 9665 7929
Outside Australia:	Telephone	+61 3 9665 7500
	Facsimile	+61 3 9665 7929

Reason(s) For Issue: Change to Dangerous Goods requirements.

Safety Data Sheets are updated frequently. Please ensure that you have a current copy.

This MSDS summarises at the date of issue our best knowledge of the health and safety hazard information of the product, and in particular how to safely handle and use the product in the workplace. Since Orica Limited and its subsidiaries cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, review this MSDS in the context of how the user intends to handle and use the product in the workplace.

If clarification or further information is needed to ensure that an appropriate assessment can be made, the user should contact this company.

Our responsibility for product as sold is subject to our standard terms and conditions, a copy of which is sent to our customers and is also available upon request.

Material Safety Data Sheet

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

Product name: HYDROGEN CYANIDE GAS

Synonyms: HYDROGEN CYANIDE GAS (DECOMPOSITION PRODUCT OF SODIUM CYANIDE), Hydrocyanic acid gas

CAS-No.: 74-90-8

Molecular Formula: H-C-N

Supplier: Orica Australia Pty Ltd
ACN: 004 117 828
Street Address: 1 Nicholson Street
Melbourne 3000
Australia
Telephone: + 61 3 9665 7111
Facsimile: + 61 3 9665 7937

Emergency telephone number: **1 800 033 111 (ALL HOURS)**

2. COMPOSITION/INFORMATION ON INGREDIENTS

Recommended use: Decomposition product of sodium cyanide. Hydrogen cyanide will be encountered as a gas associated with the spillage of sodium cyanide liquid or solid.

Appearance: Colourless gas with a distinctive 'bitter almonds' odour.

3. HAZARDS IDENTIFICATION

Hazardous according to criteria of Worksafe Australia.

Hazard Category
T+ Very toxic

R-phrase(s)
R26 Very toxic by inhalation.

Classified as Dangerous Goods for the purpose of transport by road or rail. Refer to relevant regulations for storage and transport requirements.
Class: 6.1 Toxic
Subsidiary Risk 1: 2.1 Flammable Gas

Poisons Schedule (Aust)/Toxic Substance (NZ): S7

This material is a Scheduled Poison S7 and must be stored, maintained and used in accordance with the relevant regulations.

4. FIRST AID MEASURES

Poison Information Centres in each State capital city can provide additional assistance for scheduled poisons.

CONCURRENTLY WITH THE FOLLOWING FRIST AID PROCEDUTRES, TRANSFER PATIENT IMMEDIATELY TO HSPITAL OR MEDICAL CENTRE, ACCOMPANIED BY AN ATTENDANT WITH THE CYANIDE EMERGENCY KIT.

For all routes of exposure, remove patient from source and ensure rescuers avoid contamination.

Ingestion: Not applicable.

Eye contact: Immediately irrigate with copious quantities of water for at least 15 minutes. Eyelids to be held open. Removeclothing if contaminated and wash skin. Treat as for 'INHALED'.

Skin contact: If skin contact occurs, remove contaminated clothing and wash skin thoroughly. Can be absorbed through the skinwith resultant toxic effects. Treat as for 'INHALED'.

Inhalation: Remove victim from exposure - avoid becoming a casualty.

IF THE PATIENT IS CONSCIOUS:
- Do not give anything by mouth.
- Rest and reassure the patient who may become agitated.
- If available, oxygen should be administered by a qualified person.

IF THE PATIENT IS UNCONSCIOUS AND BREATHING:
- Do not give anything by mouth.
- Lie the patient on their side, ensuring the airway is clear. If available, oxygen should be administered by a qualified person.

IF THE PATIENT IS NOT BREATHING:
- Ensure airway is lear.
- Commence expired air resuscitation using a pocket mask with one-way valve. If available, oxygen should be administered by a qualified person
- If cardiac arrest occurs (no pulse resent), commenc cardiopulmonary resuscitation (CPR).
- Take are to prevent contamination of the rescuer by removing all contaminated clothing and if giving mouth-to-mask resuscitation wash out patient's mouth and lips - do not inhale patient's air.

EMERGENCY KIT FOR CYANIDE POISONING:
At all places where there is a risk of cyanide poisoning, the following items should be kept in an accessible and convenient locatiation:

- an oxygen resuscitator and a source of oxygen;

- a clearly marked CYANIDE ANTIDOTE box containing:
- an approved airway,
- elasticised tournequet,

- disposable in dwelling intravenous cannulae,
- 20 ml sterile disposable syringes and needles,
- fluoride heparinised blood sample tubes,
- skin prep swabs, dressings and adhesive tape,
- ampoules of kelocyanor (dicobalt edetate), including the prescribing information outlining side effects and precautions;
- a copy of the appropriate Material Safety Data Sheet.
- a copy of the Worksafe Australia Guide, 'Cyanide Poisoning'.

Notes to physician: The antidote for cyanide poisoning is the intravenous administration of dicobalt edetate (trade name - Kelocyanor). Due to adverse reactions which can occur in the absence of poisoning, this should only be administered when absorption of cyanide is beyond doubt. The antidote should only be administered by a suitably qualified professional health attendant.
Cyanide poisoning occurs rapidly after exposure. If the patient is conscious after the usual time taken to reach hospital then exposure to cyanide either from inhalation, ingestion or skin contamination is unlikely to have resulted in a significant amount of cyanide being absorbed. In these circumstances the patient should be observed carefully with particular attention being given to the state of consciousness.
Over zealous administration of the antidote is contraindicated and may result in serious adverse reactions of an anaphylactic (allergic) nature. Adverse reactions reported include gross oedema of the face and neck, urticaria, palpitations, hypotension, convulsions, vomiting, chest pains, difficulty in breathing, and collapse.
If, after clinical assessment the patient is considered to require the antidote, ie. the patient is known to have been exposed to cyanide and is unconscious or lapsing into unconsciousness, administer one ampoule containing 300 mg Dicobalt edetate in 20 ml glucose solution (Kelocyanor) intravenously by slow injection. The initial effect is a fall in blood pressure, rise in pulse rate, and sometimes retching. Immediately after this phase, lasting about one minute, the patient should recover. The injection should be discontinued if allergic adverse effects are noted. A second dose may be given if the response is inadequate and allergic adverse effects are absent.

5. FIRE-FIGHTING MEASURES

Specific hazards: Highly flammable gas. Avoid all ignition sources. Flameproof equipment necessary in area where this chemical is present. Nearby equipment must be earthed.

Fire fighting further advice: Highly flammable gas. Do not spray sodium cyanide containers with water. Fire fighters to wear self-contained breathing apparatus

Suitable extinguishing media: Dry chemical powder. (DO NOT use carbon dioxide.)

6. ACCIDENTAL RELEASE MEASURES

NOTE: HCN is a decomposition product which may be released in a solid or liquid sodium cyanide spill.
For solid or liquid sodium cyanide spill see MSDS's for solid or liquid sodium cyanide (3,4).
Immediate action required. Clear area of all unprotected personnel and move upwind. Increase ventilation. Wearfull protective equipment (see PERSONAL PROTECTION above) to prevent skin and eye contamination and inhalation of highly toxic hydrogen cyanide gas (liberated upon contact with water).

7. HANDLING AND STORAGE

Storage: Not applicable as hydrogen cyanide is a decomposition product of sodium cyanide.

This material is a Scheduled Poison S7 and must be stored, maintained and used in accordance with the relevant regulations.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

National occupational exposure limits

Peak Limitation/ Ceiling Limit		STEL		Carcin-ogen Category	Notices
10 ppm	11 mg/m3				'Sk'

As published by National Occupational Health and Safety Commission (Worksafe Australia).

Exposure Standard (TWA) is the time-weighted average airborne concentration over an eight-hour working day, for afive-day working week over an entire working life. According to current knowledge this concentration should neither impair the health or, not cause undue discomfort to, nearly all workers.

Peak limitation - a ceiling concentration which should not be exceeded over a measurement period which should be as short as possible but not exceeding 15 minutes.

'Sk' Notice - absorption through the skin may be a significant source of exposure. The exposure standard is invalidated if such contact should occur.

These Exposure Standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. These Exposure Standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.

Engineering measures: Ensure ventilation is adequate to maintain air concentrations below Exposure Standards. Hydrogen cyanide gas is lighter than air DO NOT enter confined spaces where gas may have collected. Refer to AS 2865 for requirements for entry to confinedspaces.

Personal protection equipment: Orica Personal Protection Guide No.1, 1998: J - OVERALLS, RUBBER BOOTS, FACE SHIELD OR AIR MASK, GLOVES (L), APRON.

Avoid all contact. Use with adequate ventilation. Wear polypropylene disposable overalls, elbow-length impervious gloves, enclosed rubber boots. Wear full-face respirator (Type B2 or B3 gas filter combined with Class P3 particulate filter) orair supplied mask meeting the requirements of AS 1715 and AS 1716. Always wash

hands before smoking, eating, drinking or using thetoilet. Wash clothing and other protective equipment before storing or re-using.
Where exposure to sodium cyanide solid or liquid is likely refer to the appropriate MSDS for personal protectionrequirements (3,4)

9. PHYSICAL AND CHEMICAL PROPERTIES

Form / Colour / Odour: Colourless gas with a distinctive 'bitter almonds' odour.

Solubility: Soluble in water and organic solvents.

Specific Gravity (4 C)	: N App	Melting Point (C)	: N App
Rel Vapour Density (air=1)	: 0.93 (26 C)	Boiling Point (C)	: N App
Vapour Pressure (20 C)	: 62 kPa	Decomp. Point (C)	: N Av
Flash Point (C) (CC)	: -17.8	Sublimation Point	: N Av
Flammability Limits (%)	: 6-41	pH	: N App
Autoignition Temp (C)	: 538	Viscosity	: N App
% Volatile by volume	: 100	Evaporation Rate	: N Av
Solubility in water	: N App	(n-Butyl acetate=1)	

(Typical values only - consult specification sheet)
(N Av = Not available N App = Not applicable)

10. STABILITY AND REACTIVITY

Stability: If not stabilised, can polymerise violently. Reacts with oxidising agents.

11. TOXICOLOGICAL INFORMATION

No adverse health effects expected if the product is handled in accordance with this Safety Data Sheet and the product label. Symptoms that may arise if the product is mishandled and overexposure occurs are:

Acute Effects
Short term exposure at concentrations greater than the TLV by all routes is considered to be highly toxic. Can kill by any exposure route. The adverse effects depend on concentration and duration of exposure.

Possible exposure routes are:
- Breathing hydrogen cyanide gas.
- By absorption through skin or eyes as a result of contact with gas in a confined area at high concentrations.

Early symptoms of exposure:
- Irritation of mocous membranes in eyes, nose and throat.
- Burning sensation of the tongue.
- Salivation
- Irritation of skin or eyes with discomfort or burning sensation.
- Headaches.
- Unusual behaviour.

- Nausea
- Cessation of breathing.
- General weakness, and heaviness in arms and legs.
- Rapid pulse
- Increased difficulty in breathing.

Signs of severe poisoning:
- Cherry-red complexion.
- Feeling of suffocation, gasping for breath.
- Vomiting.
- Convulsions and collapse.
- Decreasing consciousness.

Long Term Effects:
Repeated or prolonged skin contact may lead to irritant contact dermatitis - 'cyanide rash' - characterised by itching and skin eruptions.

Acute toxicity / Chronic toxicity
Inhalation (gaseous) LC50 (rat): 160 ppm/30 min (1)
Inhalation Lowest Lethal Concentration (human): 113 ppm/1 hr (1)
Inhalation Lowest Lethal Concentration (human): 188 ppm/10 min (1)
Inhalation Lowest Lethal Concentration (human): 376 ppm/2 min (1)
Ocular LD50 (rabbit): 1.0 mg/kg (1)
The high toxicity of cyanide compounds results from their ability to interfere with the body's utilisation of oxygen at the cellular level by inhibiting the cytochrome oxidase enzyme system.
In a study of the effect of chronic cyanide exposure at up to twice the current recommended exposure standard:
. No signs of hypo- or hyperthyroidism.
. 56% of the workers had thyroid enlargement to a mild or moderate degree. (2)

12. ECOLOGICAL INFORMATION

Highly toxic to aquatic life. Avoid contaminating waterways.
For Hydrogen Cyanide - (5)
96 hr LC50 (rainbow trout): 57 ug/L
TLm 24 (sunfish): 0.18 mg/L
TLm 24 (pinperch): 0.05 mg/L in sea water
TLm 24: Median Tolerance Limit - the concentration of toxicant or substance at which 50% of the test organisms survive over a 24 hour test period.

13. DISPOSAL CONSIDERATIONS

Refer to State Land Waste Management Authority. Waste treatment essential. Empty containers MUST BE decontaminated and destroyed.

14. TRANSPORT INFORMATION

Road and Rail Transport

Classified as Dangerous Goods for the purpose of transport by road or rail. Refer to relevant regulations for storage and transport requirements.

UN-No:	1051
Class:	6.1 Toxic
Hazchem code:	2WE Hazchem Code
EPG:	6C3
Packing group:	Packing Group 1
Subsidiary Risk 1:	2.1 Flammable Gas
Proper Shipping Name:	HYDROGEN CYANIDE

Segregation Dangerous Goods:
Dangerous goods segregation: Not applicable. HYDROGEN CYANIDE (HCN) GAS IS A DECOMPOSITION PRODUCT OF SODIUM CYANIDE. THE ABOVE DANGEROUS GOODS CLASSIFICATIONINDICATES THAT HCN IS A COMPRESSED GAS AND COULD BE PRESENT AS A LIQUID. HCN LIQUID OR COMPRESSED GAS ARE NOT SOLD OR USED BY ICI AUSTRALIA.

15. REGULATORY INFORMATION

Hazardous according to criteria of Worksafe Australia.

Hazard Category	
T+	Very toxic
R-phrase(s)	
R26	Very toxic by inhalation.
S-phrase(s)	
S16	Keep away from sources of ignition - No smoking.
S38	In case of insufficient ventilation, wear suitable respiratory equipment.
S45	In case of accident or if you feel unwell, seek medical advice immediately (show label where possible).

Poisons Schedule (Aust)/Toxic Substance (NZ): S7

16. OTHER INFORMATION

Literary reference

(1), In 'Worksafe Disc One' (94/1) - National Material Safety Data Sheet Repository (1994); RTECS (1994) National Institute for Occupational

Safety and Health of the Dept. of Health and Human Services, USA;
Australian Atmospheric Exposure Standards, Commonwealth of Australia
(1991).
(2), El Gwhawabi, S. H. et al, Br, J. Ind. Med., 1975, 3, 215-219.
(3) Safety Data Sheet - Solid Sodium Cyanide; CDS# 10197
ICI Australia Operations Pty Ltd; 07/94
(4) Safety Data Sheet - Liquid Sodium Cyanide; CDS# 36402
ICI Australia Operations Pty Ltd; 12/94
(5), In 'Handbook of Environmental Data on Organic Chemicals Second
Edition' (Ed Verschveren, Karel), (Van Nostrand Reinhold Company: New
York 1983).
This chemical is listed on the Australian Inventory of Chemical
Substances (AICS).
This Material Safety Data Sheet has been prepared by SHE Pacific Pty Ltd
on behalf of Orica Ltd and its subsidiary companies.
Contact Point: SHE Pacific Pty Ltd, MSDS Services
Within Australia: Telephone 1 800 624 132
Facsimile (03) 9665 7929
Outside Australia: Telephone +61 3 9665 7500
Facsimile +61 3 9665 7929
Issue Date: 18/SEP/96/JF Supersedes Issue Date: 01/95
Reason(s) For Issue: Change in Dangerous Goods Requirements. Change in
Physical Properties.
Safety Data Sheets are updated frequently. Please ensure that you have
a current copy.

This MSDS summarises at the date of issue our best knowledge of the health and safety hazard information of the product, and in particular how to safely handle and use the product in the workplace. Since Orica Limited and its subsidiaries cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, review this MSDS in the context of how the user intends to handle and use the product in the workplace.

If clarification or further information is needed to ensure that an appropriate assessment can be made, the user should contact this company.

Our responsibility for product as sold is subject to our standard terms and conditions, a copy of which is sent to our customers and is also available upon request.

13. Explosives Management Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Explosives Management Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 13	6.6.1	Transport	Detail added on methods and containment used during transportation
	6.8.1 and 6.8.2	Spill Prevention and Spill Response	Created new sections to address spill prevention and spill response. More info in ERAP and Spill Contingency Plan
	6.2, 6.4, 6.6, 6.7, 6.8	Safe Handling Procedures	Added or clarified mitigation measures and BMPs within Safe Handling
	Table 8-1	Mitigation Measures	Added or clarified mitigation measures and BMPs
	6.7	Supplier ERAP	Clarified that ERAP will cover all transport of explosives on-site.
	6.7	Supplier ERAP	Added process for applying for ERAP from TC
	7	Environmental Protection Measures	Environmental design criteria added. See also Table 4-1
	6.6, 6.2	Secondary Containment	Added detail describing use of ISO containers as secondary containment for shipping and storage
	6.8	Spills	Expanded to add more detail on spill prevention and spill response
	6.2	Storage Locations and Quantities	Updated quantities, more detail on storage, description of storage containers, pad design and water mgmt.
	6.4	TDG	Specific mention of Transport of Dangerous Goods added
	6.7.1	ERAP Approval Process	Added section: 6.7.1 Application Process for an Emergency Response Assistance Plan Approval. Clarified the ERAP is not yet available since suppliers have not been chosen
	6.6, 6.7	Transportation of explosives	6.6 - Added detail on transport on site. 6.7 - Added clarity that ERAP(s) will cover transportation to all project storage locations.
	6.6.2	Storage and manufacture of explosives on site	Section 6.6.2 Storage renamed to 6.6.2 Storage and Preparation. Additional detail added. 6.2 Storage Locations and Quantities clearly explains that AN but not packaged explosives will be stored at MLA.
	7	Water Balance Loadings due to Blast residue	Added summary of approach to estimated water loadings due to blast residue. Reference to appendix for more detail
	Appendix B, Appendix C	ERAP Info	Added: Appendix B – Sample ERP ToC Added: Appendix C -Transport Canada Emergency Response Guide 112 (explosives) and Guide 140 (AN, ANFO) added to appendices.

BACK RIVER PROJECT
EXPLOSIVES MANAGEMENT PLAN

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Glossary and Abbreviations

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

AN	Ammonium Nitrate
ANFO	Ammonium Nitrate / Fuel Oil
ANSI	American National Standards Institute
CCME	Canadian Council of Ministers of the Environment
DFO	Fisheries and Oceans Canada
EIS	Environmental Impact Statement
EPS	Environmental Protection Service
ERAP	Emergency Response Assistance Plan
ERT	Emergency Response Team
ExMP	Explosives Management Plan
FEIS	Final Environmental Impact Statement
FO	Fuel Oil
HAZCOM	Hazard Communication
HMMP	Hazardous Materials Management Plan
HR	Human Resources
HSC	Occupational Health & Safety Committee
IPC	Instantaneous Pressure Change
ISO	International Organization for Standardization
SDS	Safety Data Sheets
NIOSH	National Institute for Occupational Safety and Health
NRC	Natural Resources Canada
OHSA	Occupational Health and Safety Administration
OHSP	Occupational Health & Safety Plan
PPE	Personal Protective Equipment
PPV	Peak Particle Velocity
PVS	Peak Vector Sum
SCP	Spill Contingency Plan
TDG	Transportation of Dangerous Goods
TDGA	*Transportation of Dangerous Goods Act*

WCB	Workers' Compensation Board
WHMIS	Workplace Hazardous Materials Information System

1. Introduction

This chapter describes the Explosives Management Plan (ExMP or Plan) that Sabina Gold & Silver Corp. (Sabina) will follow in the development and operation of the Project. The ExMP and other management plans are intended to describe the ways in which Sabina will address or mitigate issues identified in the Final Environmental Impact Statement (EIS). This Plan outlines the approach in managing explosives products at the Back River Project (the Project). This includes provisions for the Marine Laydown Area (MLA) in southern Bathurst Inlet and the Goose Property.

This management plan has been prepared in accordance with Section 9.4.13 of the EIS Guidelines that the Nunavut Impact Review Board (NIRB) issued to Sabina (NIRB, 2013). The plan was prepared in accordance with best management practices and applicable legislation (Section 4.0).

The information presented herein is current as of August 2015. This is a living document and will be updated based on engineering design, management reviews, incident investigations, regulatory changes, or other Project-specific protocols. The Plan will be included in Sabina's future Type A Water Licence Application and may be updated prior to submitting the application pending comments from review of the FEIS. The plan may be updated again prior to construction if instructed to do so by the NWB during the licensing process. The plan will be reviewed on a regular basis to incorporate any lessons learned, major changes to facility operation or maintenance, and environmental monitoring results. Any updates to the Plan will be filed with the Annual Report submitted under the Type A Water Licence.

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

This plan provides information on explosives manufacture, transport, storage, handling and use at the Project. Sabina intends to use explosives for controlled blasting of overburden rock, waste rock, ore, construction rock, and granular material on surface and underground during the construction, development, and operation phases of the Project.

Sabina will require the use of ammonium nitrate and fuel oil (ANFO) and other supplies at the Project to conduct blasting during construction and operations. Water-resistant explosives are not currently anticipated to be used at the Project for open pit blasts. ANFO is planned to be used as the main explosive for underground mine development and stoping. Packaged emulsion would be used as a primer and for loading lifter holes in development headings (JDS, 2015).

This plan is at a conceptual stage as the mine has not yet been permitted. Suppliers have not been selected.

To avoid overlap and inconsistencies with other biophysical management plans, Sabina has referenced where appropriate the following management plans:

- Risk Management and Emergency Response Plan;

- Spill Contingency Plan;
- Waste Management Plan;
- Borrow pits and Quarries Management Plan;
- Environmental Management Plan;
- Environmental Protection Plan;
- Hazardous Materials Management Plan;
- Site Water Monitoring and Management Plan;
- Occupational Health and Safety Plan; and
- Shipping Management Plan.

2.1 OBJECTIVES

The objectives of this ExMP are summarized as follows:

1. Identify practices for handling, storing, and using explosives at the Back River Property that are safe, secure, and environmentally sound.
2. To demonstrate compliance with applicable Federal and Territorial regulations.
3. Conform to Section 9.4.13 of the "NIRB EIS Guidelines for the Back River Project" April 2013 (NIRB File No. 12MN036).

3. Planning and Implementation

Planning for the Explosives Management Plan started with the development of the DEIS and was refined for the FEIS. Both the DEIS and FEIS identified existing (baseline) conditions, assessed potential impacts of the Project, developed conceptual mitigation strategies and developed specific mitigation measures to execute these strategies. Conceptual strategies and plans will continue to be elaborated and executed throughout the design, construction, operation, and closure phases of the Project. Environmental management and social aspects will be tracked, reviewed, and updated through ongoing maintenance of the plan. These updates will incorporate relevant feedback from the public, obtained during public consultation.

Significance criteria have been developed that assist in identifying priority aspects, establish management criteria and activity-specific mitigation measures. For social issues and effects, a key factor for determining significance is ongoing feedback from public consultation. These efforts will be used to communicate progress, and involve the public where necessary, on environmental performance.

Monitoring will be the principal mechanism to provide feedback to continually gauge the effectiveness of environmental performance. Operational control is facilitated through the contractor job-specific standard operating procedures (SOPs) work instructions, on-the-job instruction, tailgate meetings, contract requirements, and service agreements. The effectiveness of physical operational control will be reviewed according to preventative maintenance and review procedures and schedules.

4. Applicable Legislation and Guidelines

The control and use of explosives within Canada and Nunavut are covered by existing federal and territorial Acts and Regulations. The Back River Project will implement operational policies and procedures (e.g., SOPs) which meet or exceed the applicable legislation. Applicable Acts, Regulations, and Guidelines related to explosives management are listed in Table 4-1. Additional documentation which also will be followed includes guidelines and operational policies and procedures developed by suppliers.

Table 4-1. Applicable Legislation to the Explosives Management Plan

Acts	Regulations	Guidelines
Federal		
Canadian Environmental Protection Act (1999 c.33)	Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations (SOR/2008-197) Environmental Emergency Regulations (SOR/2003-307) Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2002-301)	Canadian Council of the Ministers of Environment - Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products Notice with respect to substances in the National Pollutant Release Inventory Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil
Explosives Act (1985 c.E-17)	Explosives Regulations (C.R.C., c. 599) Ammonium Nitrate and Fuel Oil Order (C.R.C., c. 598)	Guidelines for Bulk Explosives Facilities – Minimum Requirements (NRCan 2014) Quantity Distance Principles User's Manual (NRCan 2013) National Standard of Canada CAN/BNQ 2910-500/2015 – Explosives – Magazines for Industrial Explosives (BNQ 2015)
Fisheries Act (R.S.C. c. F-14)	Metal Mining Effluent Regulations (SOR/ 2002-2222)	Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998)
National Fire Code of Canada (2010)		
Transport of Dangerous Goods Act (1992, c.34)	Transportation of Dangerous Goods Regulations (SOR/2015-100)	2012 Emergency Response Guidebook (Transport Canada and U.S. Department of Transportation, 2012).
Hazardous Products Act (R.S.C., 1985, c. H-3)	Controlled Products Regulations	Workplace Hazardous Materials Information System (WHMIS)

(continued)

Table 4-1. Applicable Legislation to the Explosives Management Plan (completed)

Acts	Regulations	Guidelines
Territorial – Nunavut		
Environmental Protection Act (RSNWT (Nu) 1988, c E-7)	Spill Contingency Planning and Reporting Regulations (NWT Reg (Nu) 068-93) Used Oil and Waste Fuel Management Regulations (NWT Reg 064-2003)	Guideline for the General Management of Hazardous Waste in Nunavut Guideline for Industrial Waste Discharges in Nunavut Guideline for the Management of Waste
Mine Health And Safety Act (SNWT (Nu) 1994, c 25)	Mine Health And Safety Regulations (NWT Reg (Nu) 125-95)	
Explosives Use Act (RSNWT (Nu) 1988, c E-10)	Explosives Regulations (RRNWT (Nu) 1990 c E-27)	
Fire Prevention Act (RSNWT (Nu) 1988, c F-6)	Fire Prevention Regulations (RRNWT (Nu) 1990 c F-12)	
Safety Act (RSNWT 1988, c.S-1)	General Safety Regulations (RRNWT (Nu) 1990 c S-1) Work Site Hazardous Materials Information System Regulations (RSNWT 1988, C 81 (Supp))	
Transportation Of Dangerous Goods Act (1990, RSNWT (Nu) 1988, c 81 (Supp))	Transportation Of Dangerous Goods Regulations (1991, NWT Reg (Nu) 095-91)	

5. Roles and Responsibilities

The Sabina General Manager in charge of the Back River Project will ultimately be responsible for the success of this plan and will approve all relevant policies and documents, auditing, action planning and the verification process. The General Manager and HSE Manager, along with their direct reports, will be responsible for the implementation of this plan including overall management of the plan and internal reporting.

6. Safe Handling Procedures

6.1 PRODUCTS

The following chemical products will be required for the mixing of explosives at the Back River Project:

- Ammonium nitrate (AN).
- Fuel Oil (FO).

6.1.1 Ammonium Nitrate

Ammonium nitrate is the oxidiser component of the Ammonium Nitrate and Fuel Oil (ANFO) explosive. It is a stable, inorganic, solid compound. It must be kept dry to remain effective if it is to be used in blasting. AN is completely soluble in water and also readily absorbs water from air. AN products vary in

composition, blend, and surface treatment. AN prill (pellets) produced for use in ANFO explosives are intentionally porous to permit the fuel oil to be absorbed. Prill are generally white or off-white, and their shelf life in a tightly closed container is unlimited.

AN is not an explosive, but rather it is an oxidiser which can explode or decompose under specific conditions, such as:

- High temperature (between 160 °C and 200°C);
- Bulk storage in a confined space;
- Contamination with organic substances such as oils or waxes; and
- Contamination with inorganic materials such as chlorides and metals (e.g., chromium, copper, cobalt and nickel).
- Exposure to strong shock waves from other explosions.

AN is not combustible; however, as an oxidizing agent it increases fire hazard when in contact with other combustible materials, even in the absence of air. AN must be stored in a dry, well-ventilated area away from all possible sources of heat, fire, or explosion.

6.1.2 Ammonium Nitrate and Fuel Oil (ANFO)

Ammonium Nitrate and Fuel Oil (ANFO) is a mixture of ammonium nitrate and fuel oil and is the main explosive to be used for mining at the Back River Project. ANFO is formulated of approximately 94% AN and 6% FO by weight. ANFO requires a booster of primary and / or secondary explosives to ensure reliable detonation. ANFO is placed in boreholes for efficient detonation and brisance.

The mixture of AN and FO when activated using a detonator reacts to form nitrogen (N_2), carbon dioxide (CO_2) and Water (H_2O) when complete combustion occurs, and some carbon monoxide (CO) and nitrogen oxides (NO_x) during incomplete combustion.

Water can interfere with the explosive function and the combustion reaction of ANFO. However, given the relatively dry climatic conditions, a water-resistant ANFO / emulsion blend is currently not anticipated to be used for surface blasting at the Project. Underground, ANFO is planned to be used as the main explosive for development and stoping. Packaged emulsion would be used as a primer and for loading lifter holes in development headings (JDS, 2015).

6.1.3 Other Supplies

The following other explosives products will be required to achieve blasting activities:

- Prepackaged explosives;
- Caps;
- Boosters; and
- Detonating cord.

6.2 STORAGE LOCATIONS AND QUANTITIES

The explosive products outlined in Section 6.1.2 will be stored in two locations:

- Marine Laydown Area.
- Goose Property.

The other supplies outlined in Section 6.1.3 are currently planned to be delivered by air and stored only at the Goose Property in dedicated cap and explosives magazines at sites designed and located according to the Quantity/Distance regulations.

The explosives magazines for the Mine will be designed in accordance to Type 4 with the Canadian Regulations for the Storage, Possession, Transportation, Destruction and Sale of Blasting Explosives and Initiation Systems (NRCan 2008). The Regulations state that "a magazine should be situated so that the accidental explosion of its contents is not likely to cause serious damage to other buildings or injury to persons".

6.2.1 Marine Laydown Area

At this facility, there will be a laydown pad with storage area for up to 3,900 tonnes of inert AN within 207 ISO containers (Figure 6.2-1).

The ISO containers provide secondary containment and AN will not be unloaded at the MLA, therefore the risk of AN spills are considered to be very low at the MLA. The ISO containers will be placed on an unlined laydown pad. Under normal conditions, runoff from the laydown areas will not be collected, and will discharge towards the Bathurst Inlet along the same flow paths as the predevelopment topography. Roads and pads will be designed to have runoff as dispersed sheet flow to minimize channelized flow.

During operations, packaged explosives and blasting related products will be shipped by air directly to the Goose Property and therefore will not be stored at the MLA. During the construction of the MLA, there will be temporary storage and use of packaged explosives. Explosives will be stored using the magazines that will be permanently installed at Goose.

6.2.2 Goose Property

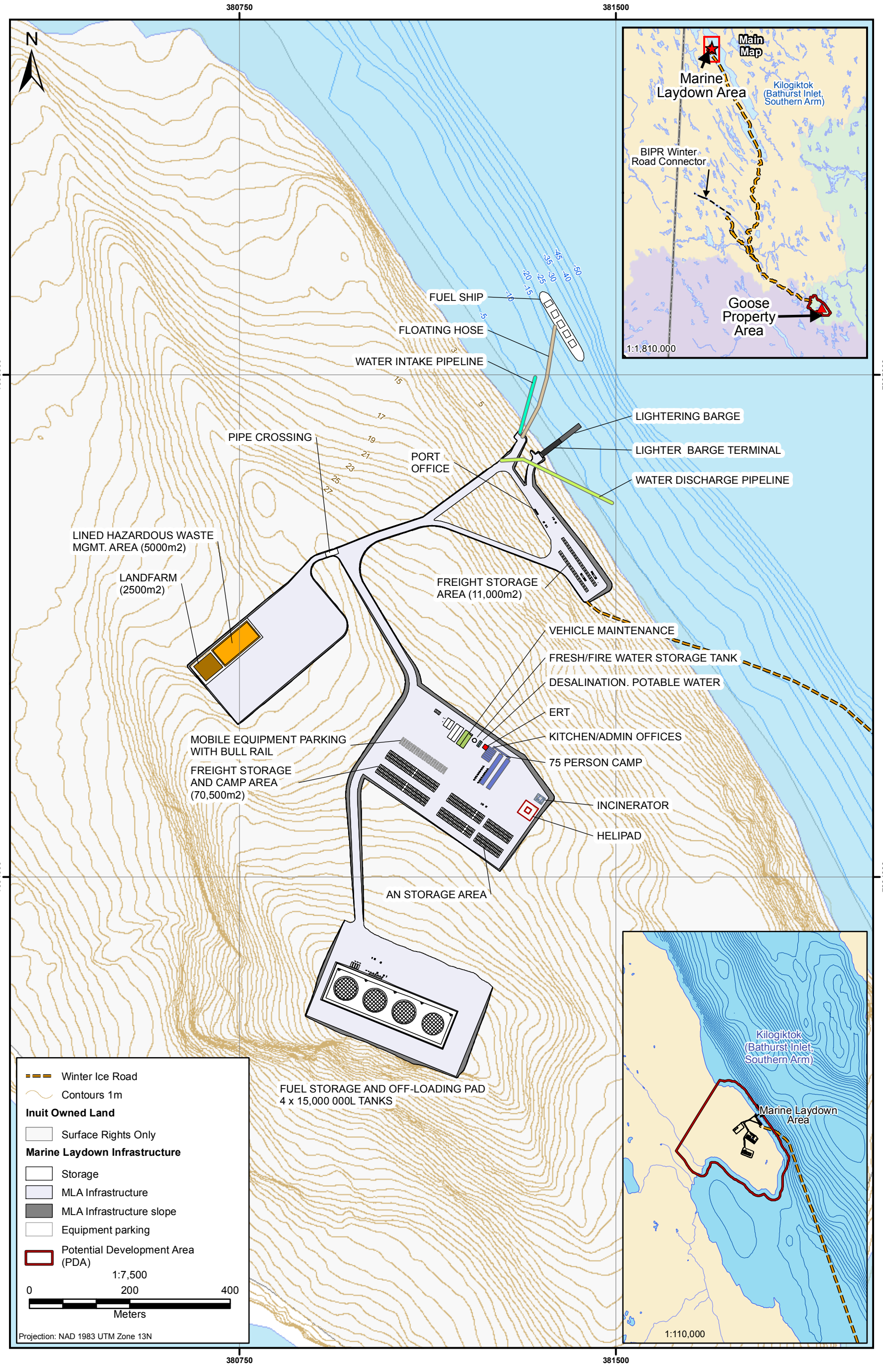
At the Goose Property, there will be a laydown and storage area for up to 3,900 tonnes of inert AN, as well as an AN Facility, a magazine capable of holding 32 t of explosives, and a cap magazine capable of holding approximately 600 cases of detonators (Figure 6.2-2). Explosives magazines for short-term use may be placed in proximity to the pits or construction areas, subject to quantity/distance regulations, and re-supplied from the explosives storage area.

Bulk ammonium nitrate (AN) prill will be shipped to site in 1 t tote bags within 20-ft ISO containers that provide secondary containment for transport and storage. The AN storage area is sized to allow for a maximum of 3,900 t of AN within 207 ISO containers. The ISO containers will be placed on a laydown pad at the AN Facility. Diversion berms will direct any runoff water to a sump at the AN Facility pad. Water from the AN Facility truck wash will be collected and treated in an evaporator. Collected runoff from the AN Facility area will be treated as contact water as described in Volume 10 Chapter 7 Site Water Monitoring and Management Plan. The explosives storage magazines are located on separate pads. Runoff from these pads will not be collected.

In each underground operation, two underground bays are planned for the storage of explosive products. One bay will be designated for the storage of explosives; while the other bay will be designated for the storage of detonators. Day boxes would be used as temporary storage for daily consumption. The magazines would be equipped with fire extinguishers, wooden shelves, and concrete flooring.

GIS # BAC-50-012_S

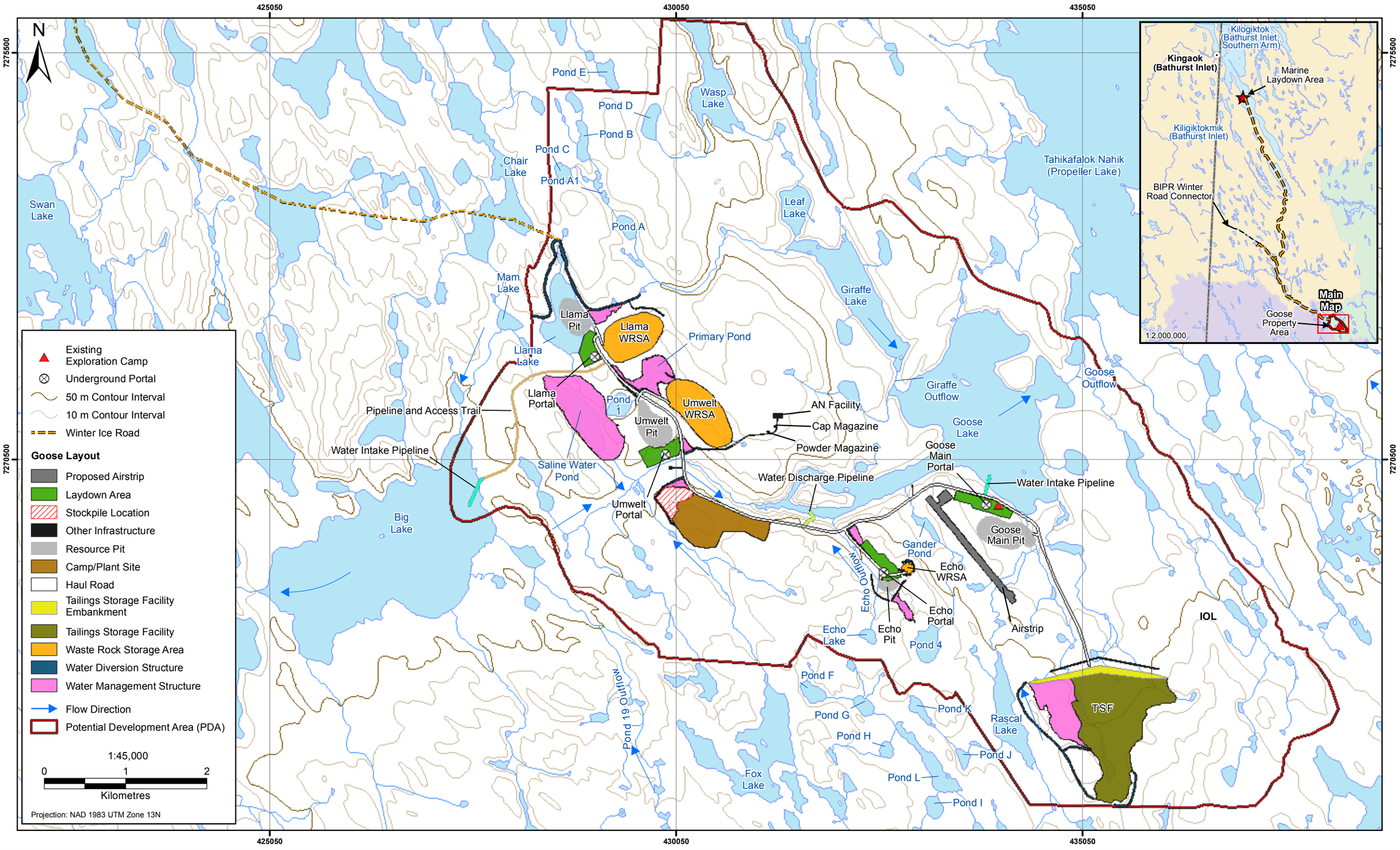
October 22 2015



Sabina GOLD & SILVER CORP.

Figure 6.2-1

Marine Laydown Area General Arrangement



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Goose Property General Arrangement

Figure 6.2-2

6.3 SAFETY REQUIREMENTS

Each chemical component will be handled and used in accordance with information found within its respective safety data sheet (SDS). A SDS is a source of health and safety information for workers and emergency personnel. Information found within the SDS includes the following:

- Identification of the material.
- Hazard Information.
- Composition / Ingredients.
- First Aid Measures.
- Fire Fighting Measures.
- Accidental Release Measures.
- Handling and Storage.
- Exposure Controls / PPE.
- Physical and Chemical Properties.
- Stability and Reactivity.
- Toxicological Information.
- Ecological Information.
- Disposal Considerations.
- Transport Information.
- Regulatory Information.
- Other Information.

Safety Data Sheets (SDS) will be available for all explosive products that are stored on site (Appendix A). This information will be available at various locations on the site such as the explosive storage areas and magazines. As an example, a summary of the minimum product safe handling measures is listed in Table 6.3-1. It must be emphasized that these are protection measures against the materials themselves. They are not a substitute for the safe handling and use of explosives.

Table 6.3-1. Summary of Safe Handling Procedures for Ammonium Nitrate and Fuel Oil

Product	Handling Procedures
Ammonium Nitrate	• Protective clothing and impervious gloves must be worn during handling. • Do not ingest. • Do not smoke while handling. • Keep away from combustible or reducing agents. • Prevent dispersion of dust.
Fuel Oil	• Avoid contact with eyes, on skin or clothing. • Avoid breathing vapours, mist, fumes. • Do not ingest. • Wear protective equipment and/or garments if exposure conditions warrant. • Wash thoroughly after handling. • Launder contaminated clothing before reuse. • Use in areas with adequate ventilation. • Keep away from heat, sparks, and flames. • Store in a closed container in a well-ventilated area. • Bond and ground during transfer.

6.4 TRAINING AND CERTIFICATION REQUIREMENTS

Only trained and certified personnel will be assigned to work with and around explosives. All personnel working with explosives will undertake formal training, including on-the-job training to ensure compliance with the Transportation of Dangerous Goods regulations and any other applicable legislation, or will show evidence of having done so.

The training requirements may include but are not limited to:

- Specific fire procedures as per the federal *Explosives Act*.
- First Aid.
- Transportation of Dangerous Goods (TDG).
- Blasting Certificate.
- Workplace Hazardous Materials Information System (WHMIS).
- Additional site-specific procedures.

6.5 SETUP AND USE REQUIREMENTS

Sabina, the explosives supplier, and the shipping contractors will have or will develop detailed manuals for the transportation, storage, handling and use of explosives and will be responsible for explosives management including employee training, hazardous operations analysis, and quality control.

In addition to the annual resupply of bulk inert ANFO components, explosives may be delivered to site by plane. Upon arrival of the explosives products onsite, the authorized mine blasting personnel will sign to confirm their delivery. It is then the responsibility of the authorized mine blasting personnel to transport the explosives to the designated magazines immediately.

Prior to construction, Sabina will complete the following forms and submit them to the relevant authorities:

- Natural Resources Canada (NRC) Form 10 Magazine License Application (if it not a mine site, this federal form needs to be filled out).
- NRC Form 1 Application for Explosives Manufacture.
- NRC Form 4 Plant, Buildings and Equipment.
- NRC Form 5 Authorized Explosives Manufacture and Storage.
- NRC Form 6 Authorized Operations and Processes.
- NRC Form 7 Distances To Be Maintained Between the Buildings and Process Units of the Site(s) and Other Buildings and Works Outside the Site or Operations.

6.6 HANDLING REQUIREMENTS

The handling of explosives on site will be carried out by certified Sabina employees or certified contractors.

All explosives shall be handled according to the manufacturer's specifications. In addition to the manufacturer's specifications, all applicable WSCC regulations will be complied with.

6.6.1 Transport

During the construction and operation phase of the Project, explosives and inert materials (AN and FO) will be received at the MLA during the annual sealift. Bulk ammonium nitrate (AN) prill will be shipped to site in 1-t tote bags within 20-ft ISO containers. Other supplies, including prepackaged explosives, caps, boosters, and detonating cord will be received by air freight. More detail can be found in Volume 2 Appendix V2-6A: Logistics and Transportation Memo.

All on-site transportation will be done in accordance with Section 14 of the Mines Act and Regulations as well as with the Transportation of Dangerous Goods Act.

Bulk AN will be transported on flatbed trucks from the MLA to the AN Facility at Goose Property on the winter ice road. During transport AN will be contained in 1 t tote bags within 20 ft ISO containers. Inspections will be conducted prior transport to ensure there has not been a leak or that conditions in the area will not result in an accident. These inspections will include the transport equipment, the containers being moved, winter road conditions, and weather conditions.

Packaged explosives will be flown into the Goose Property, and transported to the explosives storage magazines in approved vehicles. Bulk AN will be transported to open pit blast patterns in the bulk ANFO truck. For underground use, ANFO will be mixed on surface and bagged at the AN Facility and transported underground within 1-t tote bags in approved vehicles by qualified personnel.

6.6.2 Storage and Preparation

6.6.2.1 Surface

Explosive storage at the Goose Property consists of three main components:

- Bulk ammonium nitrate (AN) storage;
- Ammonium nitrate – fuel oil (ANFO) manufacturing; and
- Explosive storage magazines.

Bulk ammonium nitrate (AN) prill will be shipped to site and stored in 1 t tote bags within 20-ft ISO containers. The AN storage areas at the MLA and Goose AN Facility are sized to allow for a maximum of 3,900 t of AN prill within 207 ISO containers (Figures 6.1 and 6.2).

The ISO containers will be segregated in approximately 500 t divisions within the storage area with ample spacing around the stacks for access and regular site monitoring. The use of AN during the year will be done on a first in, first out basis to avoid any long term deterioration of the AN prill. As the AN will be restocked annually via the winter road, the maximum time an AN bag would be stored is 12 to 14 months.

ANFO required for open pit blasting will be mixed on a bulk ANFO truck at the blast hole. The bulk ANFO truck will take on ammonium nitrate and fuel oil at the Goose AN facility. Bulk AN will be augered from the 1 t tote bags into a 30 t silo that the bulk ANFO truck will drive under to load its AN bin. The AN auger is housed within the fabric building to prevent wind from spreading any AN dust produced during the transfer of product the tote bags to the silo. Fuel oil will be loaded into the bulk ANFO truck from a 20,000 L double-wall fuel tank also located on the AN Facility pad.

Packaged explosives and explosive detonators will be stored in approved explosive magazines located on separate pads. The powder magazine will be a 40-ft container magazine capable of holding 32 t of explosives while the cap magazine will be a 20-ft container magazine capable of holding approximately 600 cases of detonators.

The design of all storage facilities will meet government regulations and will be located according to required separation distances as regulated by the Explosives Regulatory Division (ERD) of Natural Resources Canada (NRCan).

6.6.2.2 Underground Mines

The primary explosives storage facility is planned to be located on the surface. Secondary facilities would be located in each underground mine to fulfill explosives need for up to seven days. Day boxes would be used as temporary storage for daily consumption.

ANFO required for underground mining will be manufactured and bagged in 1-t totes utilizing bagging equipment located in the AN Facility on surface. The bagged ANFO will then be transported to the various underground mines for use in blasting operations.

Two underground magazines are planned at each operation to separately store bulk explosives and detonators. Each magazine would be located in a bay off the decline. Access would be controlled with lockable gates. The magazines would be equipped with fire extinguishers, wooden shelves, and concrete flooring.

6.6.3 Blasting

Blasting will be required in the open pits and underground operations. Only trained and certified personnel will be assigned to work with and around explosives. Blasting, including preparation of blast sites before blasting and securing of blast sites after blasting, will be carried out in strict compliance with the applicable WSCC regulations.

6.6.4 Disposal

Explosives that have been identified as deteriorated or damaged will be removed from site or destroyed. The supplier will be consulted on the appropriate handling and disposal of deteriorated or damaged explosives.

If the quantities of deteriorated or damaged explosives are small, then they would be added to blast holes in a production blast. This will safely destroy them, since the area will have been evacuated and guarded under normal blasting procedures, which are detailed in the following section.

If larger quantities require disposal or destruction, the explosives supplier would be asked to recommend the appropriate method of disposal and subsequent course of action to be followed.

6.7 SUPPLIER ERAP

An Emergency Response Assistance Plan (ERAP) will be prepared by the explosives supplier for the transportation of explosives to all storage sites for the Project as required by the Transportation of Dangerous Goods (TDG) regulations. The supplier ERAP should include, but will not be limited to, potential incidents involving manufacturing, transport, handling, and storage of explosives and related products. As a minimum, it will outline actions that suppliers, contractors, and Sabina employees must take to ensure employee and public safety in the event of an emergency.

The following worst-case scenarios should be addressed relative to explosives in this ERAP:

- Fire/explosion.
- Spills from product transport trucks.
- Spills from raw material from delivery.
- Shut down due to weather, floods, lightning, fires, explosions and other threats to the security and operation of supplier’s facilities, equipment and material.

- Bomb threats.
- Quantities of spills that are reportable to the supplier and authorities.

An explosives supplier has not yet been selected, therefore the supplier's ERAP is not currently available. The supplier's ERAP will be provided in an appendix in future versions of this ExMP. An example ERAP table of contents is provided for reference in Appendix B. Transport Canada's emergency response guides for ANFO (Guide 112) and AN (Guide 140) are provided in Appendix C.

6.7.1 Application Process for an Emergency Response Assistance Plan Approval

The process for applying for approval of an Emergency Response Assistance Plan (ERAP) is detailed by Transport Canada in section 7.2 of the Transport of Dangerous Goods (TDG) regulations (SOR/2015-100). These guidelines are copied below for reference.

> (1) A person must apply, in writing, to the Minister or a designated person for the approval of an ERAP.
>
> (2) The application for an ERAP approval must be signed by the person submitting it and must include the following information:
>
> (a) the name and address of the place of business of the applicant;
>
> (b) the telephone number, including the area code and, if applicable, the electronic mailing address and facsimile number of the applicant;
>
> (c) the classification of the dangerous goods to which the ERAP relates;
>
> (d) the type and size of the means of containment used to transport the dangerous goods to which the ERAP relates;
>
> (e) the geographical area covered by the ERAP;
>
> (f) the telephone number, including the area code, to call to have the ERAP activated immediately;
>
> (g) a description of the emergency response capabilities available to the person offering for transport or importing dangerous goods including
>
> (i) the number of persons qualified to give, by telephone, technical advice about the dangerous goods,
>
> (ii) the number of persons qualified and available to give advice and assistance at the site of an emergency,
>
> (iii) a list of the specialized equipment that can be transported to and used at the site of an emergency,
>
> (iv) a general description of the response actions capable of being taken at the site of an emergency,

(v) a description of the transportation arrangements to bring specialized emergency response personnel and equipment to the site of an emergency, and

(vi) a description of the communications systems that can be made available at the site of an emergency;

(h) a potential accident assessment including

(i) a general analysis of how an accidental release of dangerous goods could occur,

(ii) a general description of the potential consequences of an accidental release of dangerous goods, and

(iii) a description of the action the applicant is expected to take in the event of an accidental release or an imminent accidental release of dangerous goods; and

(i) a copy of any formal agreement with a third party for the provision of assistance.

6.8 SPILLS

All spills will be reported and recorded as described in Sabina's Spill Contingency Plan. Further information regarding hazardous materials and spill management are provided in Sabina's Hazardous Materials Management Plan and Spill Contingency Plan.

6.8.1 Spill Prevention

With adherence to BMPs for AN storage and handling there is minimal risk of AN spillage. Spill locations would be generally limited to single storage bags within the AN facility or ISO containers in the storage pad areas. These areas will be inspected regularly according to operating procedures. Spill prevention and response actions will include the following:

- establish and use SOPs for handling and working around storage areas;
- ensure proper containers are used for the storage and transport of explosives and AN;
- restrict access to authorized and trained personnel;
- conduct regular inspections of storage areas, containers, and transport vehicles with frequency driven by activity levels;
- clean up dry AN according to established SOPs, to minimize likelihood of nitrates entering watercourses;
- manage and limit contact with snow and water, with particular anticipation of spring thaw/freshet period; and
- properly dispose of spill material and any impacted rock pad material, which could include placing within a blast pattern prior to initiation.

6.8.2 Spill Response

Detailed spill response procedures will be provided with the supplier ERAP as described in section 6.7. Simplified spill response for potential explosives are presented in Table 6.8-1 below. More information will be provided as part of the supplier ERAP when it is available. Transport Canada's emergency response guides for ANFO (Guide 112) and AN (Guide 140) contain basic spill response information and are provided in Appendix C.

Table 6.8-1. Simplified Spill Response Information for Potential Explosives

Product	Location of Potential Spill	Potential Size of Spill	Response
Ammonium nitrate	Broken bags in the explosives storage area	1000 kg or more depending on the number of bags damaged	The blasting contractor or qualified mine personnel will clean up and salvage AN prill; damaged bags will be emptied into new bags and damaged bags burned in the incinerator.
	Broken tote bags in the mixing plant	Part of 1000 kg	
ANFO	Broken transport bags in the mixing plant	Up to 1000 kg	The blasting contractor will clean up and salvage ANFO; the plant area will be completely cleaned of ANFO and damaged bags will be burned in the incinerator.
	Spilled transport bags on the site delivery vehicle	1000 kg or more depending on the number of bags spilled	The blasting contractor will clean up and salvage ANFO. The spill area will be cleaned up and the spilled ANFO burned by the blasting contractor. The delivery truck will be cleaned if required.
Detonators and blasting caps	Transport to blast site	One or more containers of products	Will be cleaned up and disposed by explosive contractor.

6.9 SECURITY

Explosives on site are at risk of theft, unexplained loss, possible sabotage, and unauthorized access. To reduce these risks, Sabina will have procedures in place to control access and document the movement of explosives.

During construction, all storage containers will be locked, and a secondary lock will be used for entrances to explosive storage areas and magazines.

Warning signs such as 'Authorized Access Only' will be posted around these areas and security precautions such as alarms, patrols, and extra lighting will be used. Access keys will only be given to designated responsible employees; Sabina will keep a list of employees who have a key. Documentation will reconcile incoming and outgoing quantities of explosives. In underground magazines, access to the bays will be controlled with a bulkhead and man-door. The documentation will also track the authority of employees to remove and receive explosives. Further details on these procedures will be included in subsequent updates of the Explosives Management Plan.

Security incidents will be reported to the Safety Superintendent. If the incident cannot be resolved internally, the Safety Superintendent will report any unexplained loss, theft, attempted theft, or any other security incident to the authorities.

7. Environmental Protection Measures

Environmental protection measures include the applicable water and air quality guidelines (e.g., MMER and CCME) and guidelines such as DFO Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (DFO 1998). Estimates of AN, nitrite, and nitrate loading from blasting residue can be found in Section 4.2.7 of the Water and Load Balance report in Volume 2 Appendix V2-7H: Water and Load Balance Report. Water will not be released to the receiving environment unless water licence criteria are met. No effects on fish (i.e., fish and incubating eggs) would occur from pressure changes and

vibrations from blasting and excavation, as the closest fish-bearing lakes will be at sufficient setback distance from any blasting area (i.e., beyond the setback distances recommended in the guidelines).

The Transport of Dangerous Goods act sets regulations for the safe transport of explosives and AN. Best practices detailed in Section 6. Safe Handling Procedures and mitigation, and adaptive management measures outlined in Section 8 will help reduce the risk of spills during storage, transport and use of explosives.

Proper blast design and execution will help minimize NOx emissions and nitrate losses in blasts. Blast areas must be cleared of smoke, dust and gases before anyone is permitted to re-enter them. A designated employee will be assigned to monitor the air quality, at each working location, to ensure appropriate air quality is met. This information will be collected after each blast, or as required per Health and Safety Regulations. The records of monitoring will be submitted to the site Safety Supervisor.

In the event that wildlife enter the mining area during blasting activities, blasting will be suspended until wildlife have either moved to safe zones or been deterred from the area.

8. Mitigation and Adaptive Management

Mitigation measures for Project activities will be applied to all phases of the Project (Table 8-1).

Table 8-1. Mitigation and Adaptive Management Measures

Topic / Activity	Phase	Mitigation and Adaptive Management Measures
Transport	Construction Operation Closure	• Suppliers will provide AN, mixing equipment; the mine operator shall provide FO, explosives magazines and delivery trucks. • Certified and authorized Sabina employees or contractors will mix AN with FO at the on-site AN Facility or on a bulk ANFO truck at the blast hole. • All explosives will be transported to site in dedicated containers; secondary containment will be used as required. • Only qualified personnel holding valid blasting certificates shall handle these materials. • Spills will be contained, cleaned up, and placed in suitable containers for use or disposal. All reportable spills will be reported to the spill response coordinator. • Containers and equipment shall be inspected prior to use transporting explosives products on or between Project sites
Storage	Construction Operation Closure	• All explosives will be stored only at safe distances from facilities or personnel. • Explosives will be stored in a designated location within the explosives storage area and away from the explosive caps / detonator storage magazines. • The magazines will be dedicated to storing high energy explosives and blasting caps. • Explosives will be handled and managed only by suitably qualified employees trained in safe handling procedures and applicable legislation and regulations. • Mine personnel involved in explosives spill response will have explosives training.

(continued)

Table 8-1. Mitigation and Adaptive Management Measures (completed)

Topic / Activity	Phase	Mitigation and Adaptive Management Measures
Storage *(cont'd)*	Construction Operation Closure *(cont'd)*	• Only qualified personnel holding valid blasting certificates will handle these materials. • Inventory will be used on a first-in, first-out basis to ensure quality control and prevent degradation due to cold weather storage. • Explosives stored in magazines will be clearly labelled. • Spills shall be contained and placed in suitable containers for use or disposal. All reportable spills will be reported to a spill response coordinator. • Access will be controlled to the AN Facility and explosives storage locations. • Access to the explosives plant will be restricted to authorized personnel and log books shall be kept in each magazine for tracking purposes.
Blasting	Construction Operation	• Only certified and authorized mine employees or contractors will charge the holes, place the detonators and boosters, and tie-in the patterns. • All blasting will follow applicable legislation such as DFO Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (DFO 1998). • The Air Quality Monitoring and Management Plan will be followed to reduce or eliminate impacts from air. • Wet blast holes will be lined with plastic liners prior to being loaded with ANFO. Packaged explosives will used as a backup to ANFO for situations when blast holes cannot be lined. • Sleep time in loaded blastholes will be limited to minimize contact between ANFO and water • Spills shall be contained, cleaned up, and placed in suitable containers for use or disposal. All spills will be reported to a spill response coordinator. • The mine shall record daily use of explosives. Records will be checked and reconciled on a regular basis. • Explosives identified as deteriorated or damaged will be destroyed or disposed of; the supplier shall be consulted on the appropriate handling and disposal. • Contact water will be managed in accordance with the Site Water Monitoring and Management Plan.
Disposal	Construction Operation Closure	• All explosives will be removed from site or disposed of at closure. • Explosives will be secured and stored safely or disposed of in case of temporary closure. • All explosives will be disposed of according to the SDS or manufacture. • Spills will be contained, cleaned up, and placed in suitable containers for use or disposal. All spills will be reported to the spill response coordinator.

9. Checking and Corrective Action

9.1 INTERNAL INSPECTIONS AND AUDITS

Internal audits and inspections will be conducted as required by the regulations on all components related to the ExMP. Inspections will be completed by qualified personnel on a regular basis for physical condition and serviceability, and the results recorded according to quality and safety standard operating procedures. In addition, qualified personnel will perform regular inspections of the storage

area, such as ISO containers, storage of the boosters, caps and explosives to ensure that inventory is documented.

Inspections will be required for and reported for:

- Magazines.
- Transportation containers;
- Equipment; and
- Broken or contaminated bags.

9.2 EXTERNAL INSPECTIONS AND AUDITS

On occasion external inspections and audits may be required by regulatory authorities. All recommendations and orders made by Natural Resources Canada (NRC) Explosives Branch Inspectors, Fire Marshals, and Insurance Inspectors will be responded to and acted upon accordingly.

10. Record Keeping

Record keeping and inspections is an import way to document the effectiveness of this ExMP, as well as being mandatory by Sabina. Four forms of record keeping proposed include: explosives use tracking; monitoring records; inspections and audits; and incident reporting.

10.1 EXPLOSIVE USE TRACKING

Documentation will reconcile incoming and outgoing quantities of explosives. The documentation will also track the authority of employees to remove and receive explosives. Further details on these procedures will be included in subsequent updates of the Explosives Management Plan.

10.2 MONITORING RECORDS

Records of the post-blast air quality at each of the blasting working location will be submitted to the Safety Supervisor.

10.3 INSPECTIONS AND AUDITS

Copies of all internal and external inspections and audits will be stored on site for review during annual ExMP reviews.

10.4 EXPLOSIVE INCIDENTS

All explosives-related incidents will be reported to the Safety Superintendent. If the incident cannot be resolved internally, the Safety Superintendent will report any unexplained loss, theft, attempted theft, or any other security incident to authorities.

If an explosives incident were to occur, an explosive incident report will be completed as required. Form 34 Federal Explosives Incident Report can be found at: http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca.minerals-metals/files/pdf/mms-smm/expl-expl/pdf/fm34-eng.pdf.

11. Environmental Reporting

Any spills or releases of explosives material or diesel fuel will be reported and will follow the incident response procedures of Sabina's Spill Contingency Plan and the Fuel Management Plan. All information about the spill or release will be documented according to the requirements of Spill Contingency Plan and the Fuel Management Plan.

12. Plan Effectiveness

The ExMP will be reviewed and updated periodically. Relevant associated documents such as use logs, and spill records will be incorporated into the annual review. Completion of the review of the ExMP will be documented through signatures of the personnel responsible for reviewing, updating and approving the ExMP.

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

References

Bureau de normalisation du Quebec (BNQ) and the Standards Council of Canada (SCC). 2015. *National Standard of Canada CAN/BNQ 2910-500/2015 – Explosives – Magazines for Industrial Explosives*. ISBN 978-2-551-25699-0 (PDF). Copyright: BNQ 2015.

Explosives Act (Canada)

Explosive Regulations and the Industry: Tables of Quantity Distances (QD) http://www.nrcan.gc.ca/minerals-metals/explosives/3045

Wright and Hopky. 1998. Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters. Retrieved from: http://www.dfo-mpo.gc.ca/Library/232046.pdf.

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NRCan. 2013. Quantity Distance Principles User's Manual. Retrieved from: http://www.nrcan.gc.ca/explosives/publications/standards/9961.

NRCan. 2014. *Guidelines for Bulk Explosives Facilities Minimum Requirements*. Prepared by the Explosives Regulatory Division Explosives Safety and Security Branch Minerals and Metals Sector, February 2014. Revision # 6. Retrieved from: http://www.nrcan.gc.ca/explosives/publications/9925.NWT Mine Health and Safety Act and Regulations (NWT MHSAR), specifically Part XIV http://www.canlii.org/en/nt/laws/regu/nwt-reg-125-95/latest/nwt-reg-125-95.html

Transportation of Dangerous Goods (TDG)

Transport Canada and the U.S. Department of Transportation. 2012. *2012 Emergency Response Guidebook: A Guidebook for First Responders During the Initial Phase of a Dangerous Goods / Hazardous Materials Transportation Incident*.

Workplace Hazardous Materials Information System (WHMIS)

Appendix A

Material Safety Data Sheets (MSDS)

MSDS Sheets will be provided in future iterations of the Plan

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Appendix B
Sample ERAP Table of Contents

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Transport Canada Emergency Response Guides for ANFO and AN

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POTENTIAL HAZARDS

FIRE OR EXPLOSION

- **MAY EXPLODE AND THROW FRAGMENTS 1600 meters (1 MILE) OR MORE IF FIRE REACHES CARGO.**
- **For information on "Compatibility Group" letters, refer to Glossary section.**

HEALTH

- Fire may produce irritating, corrosive and/or toxic gases.

PUBLIC SAFETY

- **CALL EMERGENCY RESPONSE Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- Isolate spill or leak area immediately for at least 500 meters (1/3 mile) in all directions.
- Move people out of line of sight of the scene and away from windows.
- Keep unauthorized personnel away.
- Stay upwind.
- Ventilate closed spaces before entering.

PROTECTIVE CLOTHING

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.

EVACUATION

Large Spill

- **Consider initial EVACUATION for 800 meters (1/2 mile) in all directions.**

Fire

- If rail car or trailer is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, initiate evacuation including emergency responders for 1600 meters (1 mile) in all directions.

*** FOR INFORMATION ON "COMPATIBILITY GROUP" LETTERS, REFER TO THE GLOSSARY SECTION.**

EMERGENCY RESPONSE

FIRE

CARGO Fire

- **DO NOT fight fire when fire reaches cargo! Cargo may EXPLODE!**
- Stop all traffic and clear the area for at least 1600 meters (1 mile) in all directions and let burn.
- **Do not move cargo or vehicle if cargo has been exposed to heat.**

TIRE or VEHICLE Fire

- **Use plenty of water - FLOOD it! If water is not available, use CO_2, dry chemical or dirt.**
- If possible, and WITHOUT RISK, use unmanned hose holders or monitor nozzles from maximum distance to prevent fire from spreading to cargo area.
- Pay special attention to tire fires as re-ignition may occur. Stand by with extinguisher ready.

SPILL OR LEAK

- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Do not touch or walk through spilled material.
- DO NOT OPERATE RADIO TRANSMITTERS WITHIN 100 meters (330 feet) OF ELECTRIC DETONATORS.
- **DO NOT CLEAN-UP OR DISPOSE OF, EXCEPT UNDER SUPERVISION OF A SPECIALIST.**

FIRST AID

- Move victim to fresh air.
- Call 911 or emergency medical service.
- Give artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

* FOR INFORMATION ON "COMPATIBILITY GROUP" LETTERS, REFER TO THE GLOSSARY SECTION.

POTENTIAL HAZARDS

FIRE OR EXPLOSION

- These substances will accelerate burning when involved in a fire.
- Some may decompose explosively when heated or involved in a fire.
- May explode from heat or contamination.
- Some will react explosively with hydrocarbons (fuels).
- May ignite combustibles (wood, paper, oil, clothing, etc.).
- Containers may explode when heated.
- Runoff may create fire or explosion hazard.

HEALTH

- Inhalation, ingestion or contact (skin, eyes) with vapors or substance may cause severe injury, burns or death.
- Fire may produce irritating, corrosive and/or toxic gases.
- Runoff from fire control or dilution water may cause pollution.

PUBLIC SAFETY

- **CALL EMERGENCY RESPONSE Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate closed spaces before entering.

PROTECTIVE CLOTHING

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.
- Structural firefighters' protective clothing will only provide limited protection.

EVACUATION

Large Spill

- Consider initial downwind evacuation for at least 100 meters (330 feet).

Fire

- If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

EMERGENCY RESPONSE

FIRE

Small Fire

- Use water. Do not use dry chemicals or foams. CO_2 or Halon® may provide limited control.

Large Fire

- Flood fire area with water from a distance.
- Do not move cargo or vehicle if cargo has been exposed to heat.
- Move containers from fire area if you can do it without risk.

Fire involving Tanks or Car/Trailer Loads

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- ALWAYS stay away from tanks engulfed in fire.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

SPILL OR LEAK

- Keep combustibles (wood, paper, oil, etc.) away from spilled material.
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.
- Do not get water inside containers.

Small Dry Spill

- With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.

Small Liquid Spill

- Use a non-combustible material like vermiculite or sand to soak up the product and place into a container for later disposal.

Large Spill

- Dike far ahead of liquid spill for later disposal.
- **Following product recovery, flush area with water.**

FIRST AID

- Move victim to fresh air.
- Call 911 or emergency medical service.
- Give artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- Contaminated clothing may be a fire risk when dry.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- Keep victim warm and quiet.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

14. Road Management Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Road Management Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 14	All	Various	Various minor clarifications, updates, and changes made.
	All	George	Remove George as a source of ore. Remove George from logistics references (delivering supplies, etc.).
	All	Commitments	Included updates to Sections as required in the Sabina commitments list.

Preface

General Information

Sabina Gold & Silver Corp. (Sabina) is proposing two main areas of development as part of the Back River Project (the Project). These two areas, as well as an existing exploration camp, will be interconnected with winter ice roads: the Goose Property, a Marine Laydown Area (MLA) situated along the western shore of southern Bathurst Inlet, and the George Exploration Camp.

The Road Management Plan will be executed within the scope of normal operations.

Annual Review

The Road Management Plan will be reviewed and updated at least annually. Completion of the annual review of the Road Management Plan will be documented through signatures of the personnel responsible for reviewing, updating, and approving the Road Management Plan.

Record of Changes and Revisions to Plan

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

Distribution List

Sabina will maintain a distribution list for the Road Management Plan providing information about all parties that receive the plan including personnel, departments, and outside agencies.

BACK RIVER PROJECT
ROAD MANAGEMENT PLAN

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Appendix A. Applicable Legislation

1. Introduction

Winter ice roads, all-weather haul and service roads are needed in the operation of the Back River Project (the Project). All Project roads will be private for the exclusive use of Sabina's operations. The road network required for the Project is presented on the following Figures:

- Figure 1-1: Back River Project Road Winter Ice Road Overview.
- Figure 1-2: Potential Development Area and Site Layout - Marine Laydown Area.
- Figure 1-3: Potential Development Area and Site Layout – Goose Property.

1.1 ALL-WEATHER ROADS

The two main sites of the Back River Project will contain all-weather roads. All-weather roads consist of haul roads and service roads. Goose Property will have 4 km of service roads and 9 km of haul roads. The Marine Laydown Area (MLA) will have 1.35 km of service roads and no haul roads.

1.2 WINTER ICE ROADS

The winter ice road between the MLA and Goose Property will be approximately 157 km long, travelling over 58% water and 42% land. The George Exploration Camp could connect to this winter ice road by a winter spur road approximately 13 km in length.

1.2.1 Public Use of Winter Ice Road Corridors

Sabina acknowledges that once the winter ice roads are constructed, local hunters may use these roads for ease of access to hunting grounds inland. While Sabina's community communication effort will emphasize the safety aspects of using these winter ice roads, the Company cannot prevent local inhabitants from using the corridor. Non-Project individuals will use the winter ice roads at their own risks.

1.2.2 Expected Traffic on Winter Ice Roads

These winter ice roads will be used for the life of the Project. It is expected that vehicle traffic will begin in January to end of April annually. The expected number of vehicles on each road is presented in Table 1.2-1. Freight hauling is expected to average 25 tonnes per load including double and triple-axle flat deck trailers. Fuel hauling will utilize standard B-train tankers with an estimated 50,000 litres per load capacity. Vehicles types are currently projected at

Table 1.2-1. Estimated Annual Vehicle* Traffic on Winter Ice Roads

	Construction Cargo/Freight/Fuel	Operation Cargo/Freight/Fuel
MLA to Goose	Up to 16 trucks making a return trip every 1 to 1.5 days (up to 1,100 transits)	Up to 27 trucks making a return trip every 1 to 1.5 days (up to 2,300 transits)

**includes trips by vehicles moving cargo, freight, and fuel over the winter ice road season; this does not include any personnel movement, or equipment movement of the winter ice road*

1.3 RELATED MANAGEMENT PLANS

The construction, upgrade, and maintenance of roads can affect site water quality and fish habitat. Therefore, this plan must be viewed in concert with:

- Environmental Protection Plan.
- Site Water Monitoring and Management Plan.
- Borrow Pits and Quarry Management Plan.
- Mine Closure and Reclamation Plan.
- Aquatic Effects Management Plan.
- Risk Management and Emergency Response Plan.
- Spill Contingency Plan.
- Air Quality Monitoring and Management Plan.
- Wildlife Mitigation and Monitoring Plan.

2. Targeted VECs and VSECs

The targeted valued ecosystem components (VECs) and valued socio-economic components (VSECs) are:

- Water quality.
- Fish habitat.
- Terrestrial wildlife.
- Health and safety of employees.
- Cultural resources and heritage.

In addition to the VECs and VSECs, this plan considers occasional use of the roads by residents of the neighbouring communities.

3. Scope and Objectives

This Road Management Plan has been written to meet requirements under the NWB Review Process and applies to all Sabina projects in the Kitikmeot region. Subject to annual internal review and revision, it will remain applicable throughout the duration of the Project.

This Road Management Plan outlines construction, operation, and management of access and transportation for the Back River Project including construction, operation, and closure of an all-weather airstrip, connecting winter ice roads, and associated rock quarries.

GIS # BR_FEIS_NA_tab_WinterIceRoadCorridor_v1b

October 31 2015

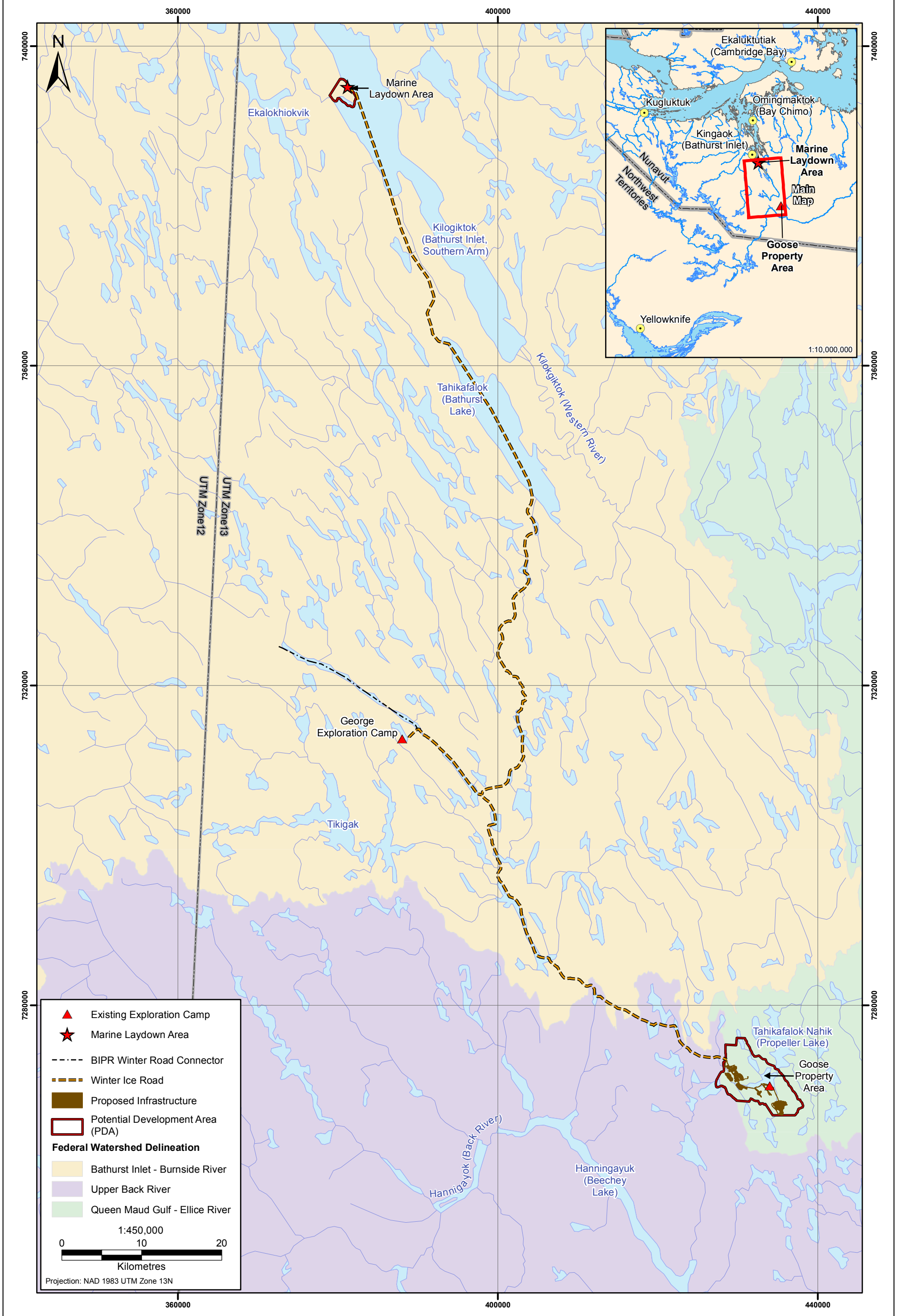

Figure 1.1

Winter Ice Road Corridor Overview

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GIS # BR_FEIS_NA_tab_MLASiteLayout_v1

October 26 2015

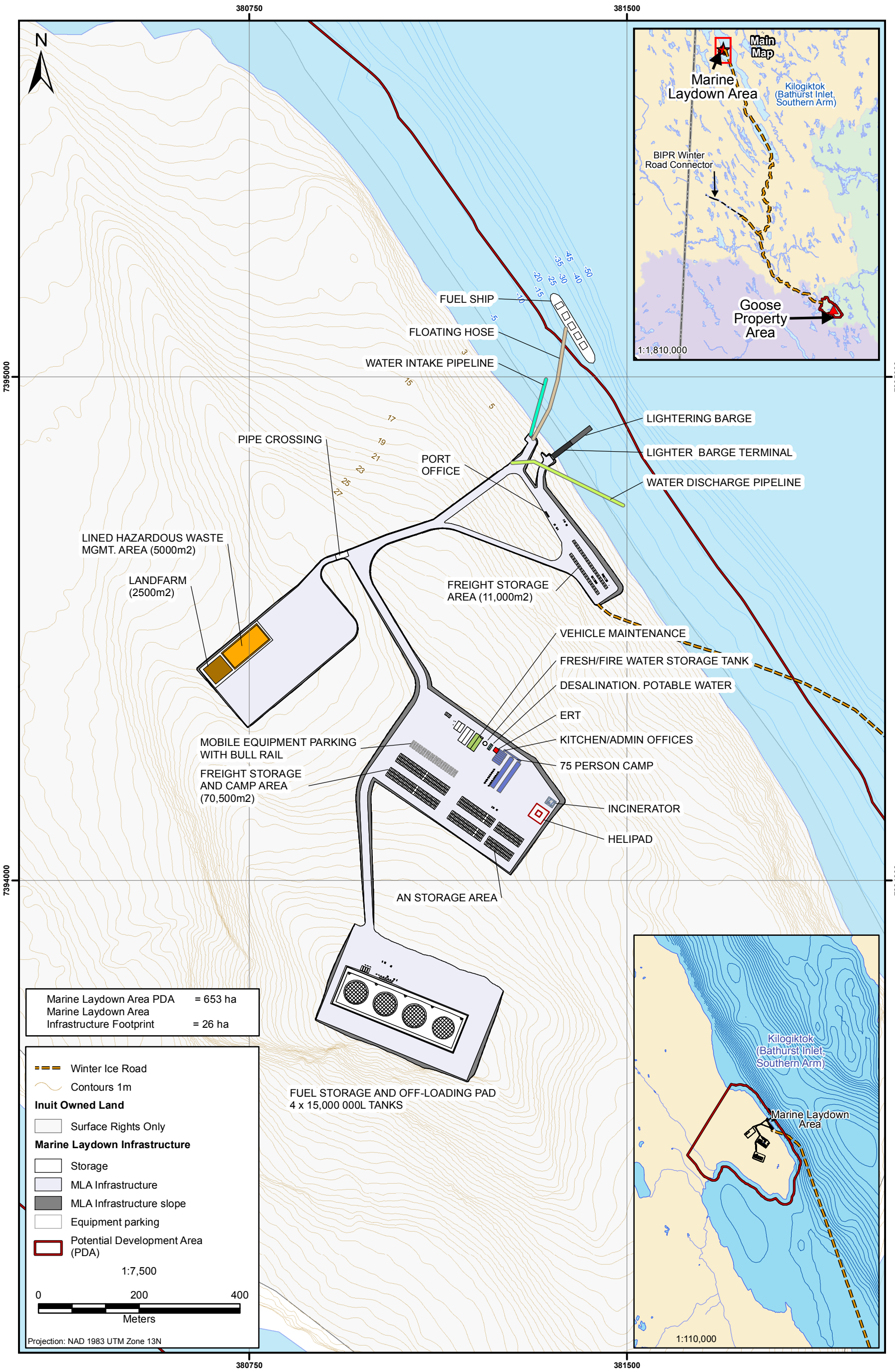

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Figure 1.2

Marine Laydown Area
Layout and Potential Development Area

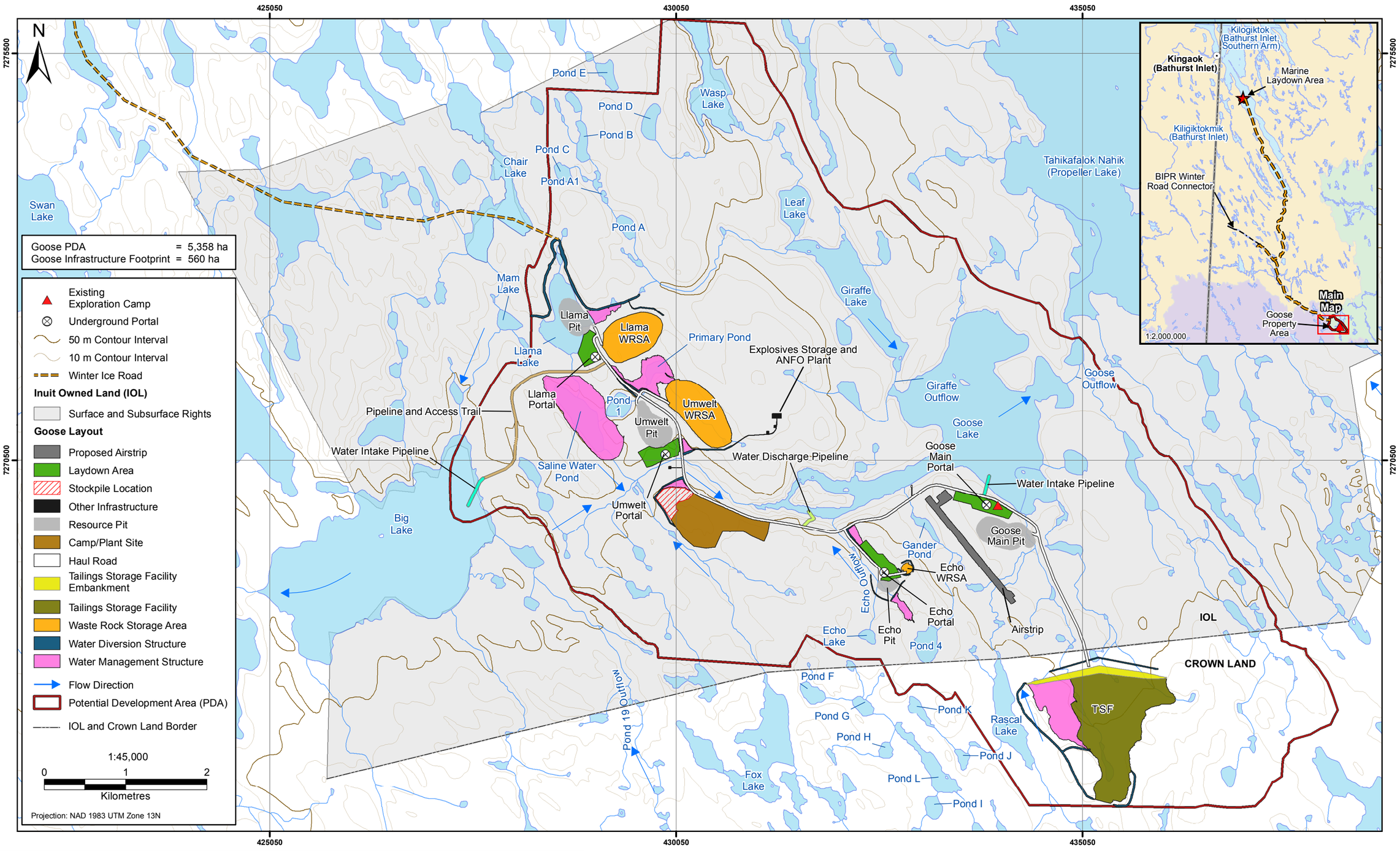

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Figure 1.3

Potential Development Area and Layout
Goose Property Area

This Plan provides construction and operating maintenance methods and best management practices that will be used for the Back River Project. The purpose of this Plan is to ensure sound management of water and waste deposited to water to minimize the impacts to the local environment during construction, operation, and closure of the transportation corridors.

Implementing best management practices and working responsibly will ensure the protection of the environment and personnel safety. The goal of any management plan is to reduce and prevent impacts to the environment while ensuring personnel safety and appropriate fiscal considerations during mineral exploration activities.

4. Planning and Implementation

4.1 WINTER ICE ROAD INFRASTRUCTURE

Environmental conditions determine the route selected for winter ice road corridors including:

- Ice of a sufficient thickness to support equipment so that pumping and using water to build up ice will be limited.
- Snow/ice thickness on land will be sufficient to prevent damage to soil and vegetation.
- Weather conditions permit safe transport of equipment and materials.

The "Field Guide for Ice Construction Safety" published by the Northwest Territories Department of Transportation (2007) will guide the planning and construction of the winter ice roads.

The winter ice road will be constructed yearly in December and January. The road will be open to traffic from late January to the end of April each year. The roads will be designed to be capable of carrying legal highway loads.

All-weather roads will be constructed at Goose Property and the MLA. The all-weather roads will consist of haul roads and service roads. The all-weather roads will allow operations at the Goose Property to continue year-round. The roads will be designed to protect the permafrost regime.

The effective use and duration of a winter ice road depends on a number of variables, the most important of which are the climatic conditions (air temperatures and snowfall), surface conditions, and the amount and type of traffic that will be using it.

The winter ice roads will be constructed over land and over ice. Overland crossings rely on a frozen subgrade to support the vehicle loads and a prepared surface layer to provide a level driving surface. Surface layers usually consist of compacted snow and/or ice where available. Ice-capped snow roads will be constructed for highway legal loads (e.g., B-trains). A discontinuous pad of granular fill may be required over rough terrain or where there is insufficient snow cover to create a smooth surface. If this is insufficient to provide an acceptable surface and gradient, additional grading effort may be required to create a road that meets the design criteria.

Roads that will be built over floating ice covers on lakes and rivers for B-trains will be built to a minimum 30 m cleared width. This width is necessary to provide a 5 m buffer along the edges to separate the vehicle traffic from the thinner ice found under snow banks. It also provides additional lane width when roads are blown with drifted snow. Snow banks need to be managed carefully as they are an additional

load on the ice, and the thinner ice underneath is prone to cracking and flooding. The final cleared width to account for floating ice covers will be determined during the next stages of the Project.

In high wind locations, it is often desirable to initially open the road to widths greater than the normal 30 m, which will provide space for the operational width to narrow throughout the season to a minimum width of 30 m. The final cleared width to account for high wind locations will be determined during the next stages of the Project.

4.1.1 Design Criteria for Winter Ice Roads

The following design criteria were used for the winter ice roads:

- Road widths:
  - On Ice - minimum 30 m.
  - On land – minimum 10 m, with maximum 5% grade.
- Operating speeds:
  - Loaded Trucks (>50% of maximum load limit):
    - 25 km/h on ice.
    - 30 km/h on land.
    - 10 km/h on and off portages (i.e., shoreline-lake transition points).
  - Empty Trucks (<50% of maximum load limit):
    - 35 km/h on ice.
    - 55 km/h on land.
- Load limits:
  - Table 1.2-2 below provides minimum ice thickness and total allowable weight fo4r various vehicle configurations.

Table 1.2-2. Load Limit at 100% of Highway Legal Gross Vehicle Weight

Vehicle Configuration	Minimum Ice Thickness (cm)	Total Allowable Weight (kg)
2-Axle Hotshot	66	14,600
3-Axle Hotshot	73	22,500
6-Axle Tractor Trailer	89	46,500
7-Axle B-Train	96	56,500

4.1.2 Winter Ice Road Construction

The winter ice road is anticipated to be constructed in early December when the subgrade is frozen to a sufficient depth and the ice can support light tracked vehicles. Construction of the winter ice road will take approximately two months utilizing two work fronts from Goose Camp and the MLA Camp.

Maintenance will be required over the operating season from late January to the end of April, with crews accommodated at the MLA and Goose camps.

The “Field Guide for Ice Construction Safety” published by the Northwest Territories Department of Transportation (2007) will guide the construction and maintenance requirements of the winter ice roads.

4.2 ALL-WEATHER ROAD INFRASTRUCTURE

The MLA and Goose Property will require all-weather roads in order to operate year-round. These roads will be constructed in a permafrost environment. In non-permafrost areas, it is common for road designs to incorporate both cuts and fills to establish the final grade along the alignment. However, in permafrost areas, disturbing sensitive overburden soils and surface vegetation can result in thaw degradation and the creation of unstable ground. Consequently, the design for the Project calls for embankment construction only, wherever the road passes over overburden soils. The embankment material will come from rock quarry sources near to the existing road alignment.

The roads will cross a number of ephemeral streams. While the streams will be dry most of the year, there will be considerable flow during freshet. All culverts and bridges will be designed to handle a 1-in-100-year event. Surface gravel will be used on all service roads. Where there is combined haul and service traffic on a road, surfacing gravel will be used.

Due to site constraints, a portion of the haul roads at Goose will share the road with service vehicles. These portions of the road will require strict traffic controls to ensure safe operating conditions.

4.2.1 Design Criteria for Haul Roads

The design criteria have been determined using the *Mine Health and Safety Act* (Northwest Territories and Nunavut), and the appropriate Transportation Association of Canada Geometric Guidelines. The following design criteria were used for the haul roads:

- Design vehicle: Cat 775G or equivalent.
- Minimum width of travelling surface: 20 m.
- Design speed: 50 km/h.
- Side slopes: 2H:1V.
- Maximum grade: 10%.
- Safety berms for fills greater than 3 m in height: 1.6 m.
- Drainage: major culverts and bridges to be designed to a 1-in-100 year return period.

4.2.2 Design Criteria for Service Roads

Service roads are used for smaller vehicles (i.e., light trucks) to access ancillary infrastructure such as water supply sources, Goose Airstrip, and explosives storage facility. The following design criteria were used for the service roads:

- Design vehicle: light/medium truck.
- Minimum width of travelling surface: 8 m.
- Design speed: 50 km/h.
- Side slopes: 2H:1V.
- Maximum grade: 8%.
- Safety berms for fills greater than 3 m in height: 0.5 m.
- Drainage: major culverts and bridges to be designed to a 1-in-100-year return period.

4.2.3 Construction of All-weather Roads

Disposal of excavated material will be in a location above the high water mark to ensure that this material does not enter the watercourse. Efforts shall be made to minimize the duration of any in-stream works and minimize disturbance at stream crossings. This practice will prevent the release of sediment or sediment-laden water into water frequented by fish. Exposed landscape surfaces will be protected, where possible, by the installation of covering material like riprap, aggregate, or rolled erosion control products. All in-stream works for waterbodies frequented by fish shall be completed in accordance with the relevant Department of Fisheries and Oceans (DFO) Guidelines. Additional details are outlined in Section 7.1.2.

Sediment loading in runoff will be minimized by the application of measures to intercept Total Suspended Solids (TSS) before it reaches the freshwater environment. Sediment control measures could include:

- Buffer zones to trap sediment and to reduce flow velocities.
- Installation of synthetic permeable barriers, fibre rolls, and/or silt fences as required.
- Installation of check dams, gabions, and sediment basins to reduce flow velocities and encourage sediment deposition.
- Stockpiles will be located well away from watercourses.

4.3 GOOSE AIRSTRIP

The proposed all-weather Goose Airstrip and connecting all-weather road will be privately-owned infrastructure built entirely on Inuit-Owned Lands currently permitted by Sabina from the Kitikmeot Inuit Association (KIA). This infrastructure will be constructed, inspected, and maintained by Sabina to support activity at the Back River Project.

The Goose Airstrip will be classified as a “registered aerodrome” and the design will be in accordance with Transport Canada’s Aerodrome Standards and Recommended Practices (Transport Canada, 2005). The construction of the road follows generally accepted good engineering practices for building roads in permafrost areas of the Northwest Territories and Nunavut.

Environmental considerations are incorporated into design and routing. Wind direction and speeds, in addition to existing terrain and ground conditions, determine the optimal airstrip orientation. Road alignment, connecting the airstrip to the camp and the airstrip to the quarries, considered the existing terrain and topography to determine the optimal route for equipment movement. The design aimed to minimize the project footprint. Additional fieldwork determined that the airstrip and road alignments did not include any archaeological sites or vegetation/wildlife species under the *Species at Risk Act*.

Establishing fish and fish habitat included water quality and quantity, fish population, and fish habitat studies. These data have been incorporated to determine the optimal alignment for the airstrip, the connecting road, and the associated water crossings.

5. Applicable Legislation and Guidelines

5.1 LAND TENURE

The majority of all-weather roads are to be located on Inuit Owned Lands (IOL) administered by the Kitikmeot Inuit Association (KIA). The surface ownership of the land encompassing the roads right-of-ways was transferred to the KIA when the Nunavut Land Claims Agreement (NLCA) came into effect. Land and environmental management in this area are generally governed by the provisions of the NLCA.

5.2 PERMITTING REGIME

Federal, territorial, and municipal laws and regulations that apply to the construction, operation and closure of all haul and service roads are itemized in Appendix A.

Table 5.2-1 outlines the current licences and permits held by Sabina in relation to the Exploration Phase of the Project.

Table 5.2-1. Current Authorizations and Permits (as of June 2, 2015)

Permit	Expiry (mm/dd/yyyy)	Agency	Description
KTL204C012 - Amended	12/13/2015	KIA	Boulder: Staking/prospecting, exploration (ground/air geophysics), geophysical survey, gridding and drilling
KTL204C020 - Amended	12/13/2015	KIA	Boot: Exploration (air/ground geophysics), staking, prospecting, fly/survival camp and drilling
KTL304C017 - Amended	12/13/2015	KIA	Goose: Staking/prospecting, exploration (ground/air geophysics), drilling, bulk sampling, bulk fuel storage, camp, winter road
KTL304C018 - Amended	12/13/2015	KIA	George: Staking/prospecting, exploration (ground/air geophysics), drilling, bulk sampling, bulk fuel storage, camp, winter road
KTL304F049 - Amended	12/13/2015	KIA	Winter road Bathurst Inlet to Goose and George
KTP11Q001	12/13/2015	KIA	Goose rock quarry
KTP12Q001	12/13/2015	KIA	Goose airstrip borrow area
KTP12Q002	12/13/2015	KIA	George borrow quarry
N2011F0029	12/13/2015	AANDC	Winter road connecting George-Goose
N2010F0017	9/16/2015	AANDC	Winter road connecting Bathurst Inlet - Back River Project
N2010C0016	10/31/2015	AANDC	Exploration activities
2BEGOO1520	02/18/2020	NWB	Goose water licence
2BEGEO1520	05/29/2020	NWB	George water licence

6. Roles and Responsibilities

The General Manager is ultimately responsible for the success of the plan and approves all relevant policies and documents, auditing, action planning, and the verification process.

The Mine Manager, along with his/her direct reports, is responsible for the implementation of this plan including safety, traffic management, and maintenance.

The Environmental Superintendent, along with his/her direct reports, is responsible for monitoring the effective implementation of this plan.

7. Inspection and Maintenance of Roads

Sabina has sole responsibility for the ongoing inspection and maintenance of all of the components of roads and the airstrip, including the road bed, airstrip foundation, culverts, water crossings, and quarry sites. Sabina will have the Site Supervisor, or their designate, responsible for ongoing inspection and maintenance. The following is a summary of the procedures that will be applied.

7.1 ALL-WEATHER ROADS INSPECTION AND MAINTENANCE

Sabina recognizes that a good inspection program will lead to the early identification of areas of the airstrip and road where improvements are necessary. The early resolution of any deficiencies will result in less ongoing maintenance and repair of the infrastructure.

The all-weather roads and its shoulders will be inspected regularly during the summer period for evidence of seasonal freeze and thaw adjacent to the toe of the road embankment. Such movements are expected and may lead to longitudinal cracking and thaw settlement especially for portions of the road founded on thaw-susceptible (ice-rich) soil. When such areas are discovered, the affected area will be repaired using geochemically and geotechnically suitable granular material and/or crushed rock. Sabina will maintain stockpiles of such material for this purpose.

The roads and airstrip will be inspected for signs of accumulation of ponded water, either on the surface or along the sides. Where noticed, the Site Supervisor will evaluate and monitor the accumulation to determine why water is accumulating in these areas. Based on these evaluations, the Site Supervisor will take remedial action where and when necessary to correct the cause of such ponding, such as grading of the surface to remove areas of ponding or installation of additional culverts if the road is causing excessive water ponding.

The all-weather road surfaces will be maintained with gravel being spread as required and regular grading of the road. Granular surfacing required for yearly maintenance of the all-weather roads will be sourced and stockpiled from local quarries. Refer to the Borrow Pits and Quarry Management Plan (Volume 10, Chapter 16), as it develops, for each quarry site.

In fall, winter, and spring, maintenance will be adjusted according to the weather conditions. Snow clearing along the roads will be completed to ensure that the roads can be operated safely. The manner in which the snow is cleared will also take into account the road configuration to ensure that snow accumulation will not cause any complications during the freshet.

Inspection frequency will be increased during the following critical time periods:

- Just prior to spring freshet to ensure that the culverts and stream crossings are in good state to accommodate the rapid spring thaw.
- During the spring freshet to ensure that the culverts and stream crossings are not impeding spring freshet and to initiate action when and where required to prevent wash outs.
- Just after heavy rainfall events to monitor water accumulation, to ensure that culverts and diversion/collection channels and ponds are passing precipitation as planned and to initiate action when and where required to prevent erosion and wash outs.

7.1.1 Dust Suppression

The amount of dust generated along the road and airstrip is dependent on the dryness of the surface, the number of vehicles, weight and speed, and maintenance of the driving surface. Regular grading of the road and airstrip combined with the addition of granular material to the surface will be needed. This will improve road safety and also reduce dust. In areas or times identified by the Site Supervisor as being prone to high dust levels or areas where safe road visibility is impaired or in areas where dust deposition is impacting fish habitat and/or water quality, the Site Supervisor will arrange mitigation measures as appropriate. This could involve actions such as grading of the road surface, placement of new coarser topping, and/or watering of the road surface. Use of chemical dust suppressants may be used and only in accordance with the Environmental Guidance for Dust Suppression on Unpaved Roads prepared by the Government of Nunavut Department of Environment's Environmental Protection Division (April 2014), available online at the following web site: http://env.gov.nu.ca/sites/default/files/guideline_-_dust_suppression_on_unpaved_roads_2014.pdf f

All Sabina employees and contractors are instructed to report any road and airstrip maintenance problem or hazardous condition to Project Management. Regular scheduled safety meetings will incorporate discussion and reminders related to all-weather airstrip and road use, operation, and maintenance.

7.1.2 Watercourse Crossings Inspection and Maintenance

The watercourse crossing inspection and maintenance program has these main components:

- A regular inspection program to identify issues relating to watercourse crossings such a structural integrity and hydraulic function.
- All necessary repairs and adjustments will be conducted in a timely manner.
- An event inspection program to track the impacts of large storm events on watercourse crossings, such as structural integrity and hydraulic function.
- A culvert location inspection program to ensure that culverts have been installed in the right location with respect to the watercourse and that culvert capacity is adequate to ensure that the culvert(s) pass the water under all hydraulic conditions.

Culverts will be sized for each stream crossing to accommodate normal summer flows as well as spring freshet and heavy rainfall flows.

Visual monitoring will be conducted on a regular basis to ensure drainage and erosion controls are effective per the following guidelines:

- Culvert maintenance will be conducted following the DFO's advice, "Measures to Avoid Causing Harm to Fish and Fish Habitat" (Fisheries and Oceans Canada 2013).

- Instream work will be conducted during approved timing windows presented in the DFO's advice, "Measures to Avoid Causing Harm to Fish and Fish Habitat" (Fisheries and Oceans Canada 2013).
- Winter ice road construction will follow the DFO advice, "Measures to Avoid Harm to Fish and Fish Habitat" (Fisheries and Oceans Canada 2013).
- Water withdrawal will follow DFO's Protocol for Winter Water Withdrawal from Ice covered Waterbodies in the Northwest Territories and Nunavut (Fisheries and Oceans Canada 2010) and DFO's advice "Measures to Avoid Harm to Fish and Fish Habitat" (Fisheries and Oceans Canada 2013).

7.1.3 Regular Crossing Inspection and Maintenance

Starting during the freshet period (mid-May through June), crossing inspections will be performed during the ice-free period prior to fall freeze-up which typically occurs in October of each year. These activities for each watercourse crossing will consist of visual inspection to:

- Identify defects, cracks, or any other risks to structural integrity of the infrastructure. Particular attention will be paid to the inlet and outlet structures of culverts.
- Identify sediment or other debris accumulation impeding the free flow of water through the crossings. Maintenance operations will consist of hand removal of accumulated debris and repairing damage as soon as possible.
- Identify bed erosion or scour around the watercourse crossing of the upstream and downstream channel. Any erosion concerns will be addressed as soon as possible.

Particular attention will also be paid to potential sources of sediment transport at the crossing. Inspection results will be recorded to help track change in conditions over time. Maintenance operations will consist of undertaking remediation of any detected problems and repairing damage as soon as possible.

7.2 SNOW CLEARING

The Project is expected to experience snow drifts due to strong winds over the winter season. Routine spring snow management will include the removal of any snow that accumulates at culverts so that water at freshet can move freely through the culverts and waterway. In the case of culverts, snow is removed from both ends but not from the inside.

7.3 WINTER ICE ROADS INSPECTION AND MAINTENANCE

During winter ice road operations, the roads will be inspected and maintained in accordance with the "Field Guide for Ice Construction Safety" published by the Northwest Territories Department of Transportation in 2007. These regulations state that inspections should be done once a week on snow roads, twice a week on ice roads, and daily on ice bridges.

8. Traffic Management and Road Safety

Sabina's traffic management and road safety regulations will be inspired from the Tibbit to Contwoyto Winter Road Joint Venture, Winter Road Regulations and Rules of the Roads. This comprehensive document on winter ice road regulation will be developed once the Project is approved. This document will address:

- General Regulations for Use of the Winter Ice Roads:
  - General regulations.
  - Enforcement.
  - Signage.
  - Dispatching.
- Rules of the Road:
  - Speed restrictions.
  - Truck and convoy spacing.
  - Right of way.
  - Portage traffic.
  - Dangerous driving and unsafe practices.
  - Interference with security.
  - Drug, alcohol, and firearms.
  - Littering and refuse disposal.
  - Safety restrictions and equipment.
  - Hours of works/log book.
  - Designated refuge and rest areas.
  - Dispatching.
  - Communications.
  - Spills and dangerous/emergency situations.
  - Stopping on lakes/water crossings.
  - Wildlife.
  - Wildlife reporting.

Key concepts of the traffic and road safety plan are discussed below.

8.1 ROAD SAFETY AND COMMUNICATION

Sabina security personnel along with Sabina's road supervisor will monitor activity on all roads through radio contact with both staff and drivers on the roads, and through periodic patrols of the roads. All Sabina vehicles that routinely travel on the roads will be equipped with a radio set to the requisite road frequency. Similarly contractor's vehicles that routinely travel on the roads will be equipped with a radio set to the requisite road frequency. Consequently, Sabina's traffic on the roads will always have radio contact.

This system will be used to report any unusual conditions along the roads such as:

- Location of other Sabina vehicles.
- Presence of wildlife on the roadway.
- Presence of non-Sabina vehicles such as ATVs, snowmobiles, or other.

- Presence and location of any non-Sabina vehicles broken down on the roads.
- Unsafe practices noticed.
- Special road conditions.
- Special weather conditions, etc.

The safety rules that will apply to all users of the roads, including Sabina's employees and contractor employees of the roads are as follows:

- Maximum speed limits will be enforced. Signs will be posted.
- Use of seat belts by all drivers and passengers is mandatory.
- Driving under the influence of alcohol or intoxicating drugs is prohibited.
- Wildlife has right-of-way on the roads, and no harassment of wildlife is allowed.
- No public traffic is allowed within mining areas; these are industrial work sites and, thus, non-Project related vehicles will be stopped and escorted to the camp. Signs will be posted.

Sabina may temporarily place emergency shelters approximately every 60 km along the winter ice road. These shelters will have the necessary safety supplies to allow stranded travelers to wait out an event such as a prolonged blizzard.

All roads associated with the Project, including all winter ice roads and all-weather roads, are private roads. Due to the remote location, traditional community pursuits are not anticipated.

8.2 ROAD SIGNAGE

Sabina will post appropriate road signs along the roads. Typically, signs will advise drivers of the posted speed limit, of approaching bridges, of approaching curves, and/or areas of lower visibility (e.g., blind hills or obstructed curves).

Speed limit signs will be posted at intervals of approximately every 5 km along the roads. Reflective flags will be installed along one side of the road to help drivers identify the road shoulder during a blizzard, white out conditions, or dense fog. Typically, these flags will be black in colour to help them stand out in white-out conditions, and will be nominally placed at intervals of 100 to 200 m apart. Kilometre markers will also be posted along the roads and 1 km increments.

8.3 POLICING

Responsibility for all road operation and maintenance activities will rest solely with Sabina. Sabina will concentrate on raising public awareness and commitment to road safety, and improving communication, cooperation, and collaboration among all stakeholders on the safe use of the roads. Sabina employees and its contractors who will use the roads will be required to take road safety training before being allowed to drive on the roads.

Sabina will use its road supervisor and site security to monitor activity on the roads. This will be achieved through radio contact with the staff at the gatehouse, through periodic patrols of the roads, and in conversation with drivers on the roads. Sabina will monitor speed limit infractions by direct observation of active road users. Sabina will also rely on radio contact with its employees and contractor vehicles on the roads to monitor unsafe conditions or activity.

8.3.1 Emergency Response

As a private road, the responsibility for response to any emergency or accident lies solely with Sabina. It will be Sabina personnel that respond and address any emergencies that occur on the road and airstrip. Sabina will have staff on site trained in emergency response including firefighting, first aid, and spill response. Sabina does not anticipate that emergency response will result in any demand on local public service providers in Cambridge Bay (fire, police, ambulance, medical, maintenance).

In most circumstances the emergency response will be met by Sabina personnel. Sabina's emphasis will be on prevention with ongoing awareness, training, and ongoing safety measures while at the same time keeping resources close at hand to respond to emergencies at the Project in a timely manner.

8.4 ACCIDENTS AND MALFUNCTIONS

Sabina's emphasis will be on prevention, while at the same time keeping resources close at hand to respond to emergencies on the roads in a timely manner.

Three possible causes of road emergencies are the road itself, vehicles, and people. It is the interplay of these three elements that lead to either safe use of the roads or potential emergency response. Sabina is fully responsible for the design, construction, and maintenance of the roads on the Project site. This will include regular inspection and maintenance of transportation infrastructure, including service roads, haul roads, road crossings, water crossings, signage, and any refuge stations located along the winter ice roads.

Sabina will ensure its vehicles are in good working order before road use it allowed. As well, Sabina will train its employees on road safety and emergency response (first aid, firefighting, spill response, etc.). By educating and protecting its workers, Sabina will lead by example in road safety.

Some accidents and malfunctions may have an indirect effect on local fauna. For example, fish spawning success appears to be strongly affected by stream blockages. Thus, improper decommissioning of ice bridges and snow fills may cause stream channels to become blocked to fish during the spring migration, which could in turn lead to fish failing to spawn. Sabina will ensure that streams along the road alignments are appropriately monitored, and that any issues will be addressed as soon as feasible.

A Sabina trained emergency response and spill response team will be available on site with appropriate equipment to respond to all spills and road accidents. The Emergency Response Team will be trained in emergency response (firefighting, first aid, mine rescue, spill response, vehicle accidents, etc.). In addition, emergency response equipment is to be carried in all Sabina vehicles. This equipment will include survival gear, emergency first aid equipment, and initial spill response equipment. Spill response will be implemented by environmental staff who will advise, document, and report on initial response and clean-up actions. The Spill Contingency Plan (Volume 10, Chapter 5) will be activated in response to a spill.

8.4.1 Incident Response

Despite the preventative and mitigation measures taken, should any incident arise as a result of human error or unforeseen circumstances, the response procedures outlined in the Spill Contingency Plan (Volume 10, Chapter 5) will be implemented. The types of accidents and malfunctions that may occur are as follows:

- Vehicle collisions that may result in personal injury and spillage of potential harmful materials such as fuel, lubricating fluids, or antifreeze.

- Contact between vehicles and wildlife that may result in harm to wildlife, personal injury, and spillage of potentially harmful materials.
- Single vehicle accidents that may result in personal injury and spillage of potentially harmful materials.
- Risk of people getting stuck on the roads in bad weather such as in blizzard, white out or dense fog conditions, or due to mechanical breakdown.
- Risk of accident due to an intoxicated or impaired driver on the roads.
- Spills of harmful materials onto the land or into water through a vehicle rollover or tipping during bad weather.

Sabina will report all reportable-scale incidents to the appropriate authority; this may include the Kitikmeot Inuit Association, Mines Inspector, RCMP, Nunavut Water Board (NWB), Nunavut Spill Line, Environment Canada, Government of Nunavut (GN) Department of Environment, and Fisheries and Oceans Canada (DFO).

The following actions are to be taken in the event of an accident on the roads involving other vehicles (including ATVs), or in the event of an accident involving contact with wildlife such as caribou, muskox, bear, wolf, etc.:

- Check the condition of people involved in the accident and provide immediate first aid if appropriate.
- Call the Sabina road dispatch by radio and report the location and nature of the accident and indicate the type of assistance required (e.g., medical help, environmental cleanup, fire and/or mechanical help).
- Secure the accident site so that any vehicles do not continue to present a hazard to others. This may involve moving the vehicles to the nearest pull off in the event of a minor accident, or blocking off the road in both directions in the event of a more serious accident.
- If safe to do so, secure the site to prevent continued spill or leakage of contaminants into the surrounding environment.

Upon receiving the accident call, the road dispatch will initiate the emergency response procedure passing along the information to the emergency response coordinator. The emergency response coordinator will then call out the required emergency response personnel to assist at the accident site.

Once the accident site is secured and all people requiring assistance have been relocated to receive appropriate medical care, the emergency coordinator will turn the accident scene over to the mine's safety personnel so that an appropriate accident investigation can be initiated.

In the event of an incident involving contact with wildlife, the road dispatch will notify the site security personnel and the environmental representatives. Security and the site environmental team will then initiate an appropriate accident investigation. The Environmental Department will ensure that appropriate reporting of such incidents is made on a timely basis to the KIA, the Hunters and Trappers Organization (HTO), and the GN Wildlife Officers.

In the event of a serious accident, the RCMP will be contacted and advised of the incident. The RCMP will then decide on whether they will become involved or take the lead on any subsequent accident investigation.

9. Wildlife Protection Measures

Wildlife may occasionally be observed on or immediately along the side of the all-weather airstrip and connecting road. Caribou and other wildlife will have the right-of-way at all times. In case of operational challenges (e.g., groups of caribou), the project management and environmental personnel on site will manage the situation. The Project personnel will be notified by radio if any wildlife is observed on the road according to current communication procedures.

The following protocol will be implemented on the road and airstrip for the protection of wildlife:

- Vehicular traffic speeds on the all-weather roads will be limited to 50 km/hr.
- It will be strictly forbidden for any individual to feed wildlife while operating or travelling on the roads. This restriction also extends to any personnel at the Project.
- Prior to aircraft landing on the airstrip, a visual inspection will be conducted to identify the presence of any wildlife. If possible, the wildlife will be escorted off the airstrip; the flight crew will be notified by radio that such action is taking place and aircraft will not be approved to land until the airstrip is clear. If the wildlife cannot be escorted from the airstrip within a reasonable length of time, the flight crew will be instructed to divert to the George Airstrip or to return to Yellowknife at the pilot's discretion.
- Where small to moderate aggregations of caribou (i.e., 1-50 animals) are observed within 100 m of the road, travel speeds will be reduced to 30 km/hr.
- Where large aggregations of caribou (i.e., 50 or more) are observed within 100 m of the road, at the discretion of the Site Supervisor, vehicle movements may be suspended until the animals have moved away from the road.
- Caribou and all wildlife will be given right-of-way on the road. Vehicles must stop until the animals are off the road.
- Locations of large aggregations of animals must be reported to the Site Supervisor who will inform all potentially affected employees and the environmental representative.
- All incidents between vehicles and wildlife must be reported to the Project Management/ Environmental Department whether they are:
  - Near miss incidents.
  - Collision with injury to the wildlife.
  - Accidental death.
- Each incident will be investigated by the Site Supervisor and environment personnel with measures taken to avoid reoccurrence. Disciplinary measures will be taken against any employee if the investigation concludes that the accident is the result of negligence.
- Road embankments will include reduced sides slopes (e.g., 3H:1V slopes) in key locations to facilitate ungulate passage.
- In the case of the accidental death of an animal, environment personnel will contact the GN Wildlife Officer, KIA Senior Lands Manager, and the HTO office in Kugluktuk and Cambridge Bay. The carcass will be removed from the road and incinerated to avoid attracting scavengers such as wolves, grizzly bear, Arctic fox and/or wolverine.

More information on wildlife protection measures can be found in the Wildlife Mitigation and Monitoring Plan.

10. Monitoring Program

10.1 WILDLIFE

Wildlife monitoring will be incorporated into current wildlife tracking according to the terms and conditions of current land use permits. This includes a log of sightings that detail wildlife observed, estimate of numbers, and nearest kilometre marking along the road. The data will be aggregated and made available on-site during inspections. Additional details can be found in the Wildlife Mitigation and Monitoring Plan (Volume 10, Chapter 20).

11. Adaptive Management

The Road Management Plan will be reviewed internally on an annual basis to confirm the effectiveness of the management measures outlined above, and corrective action will be implemented as appropriate. The Plan may also be updated to be reflective of adjusted Project operational needs or the long-term exploration strategy for the Property.

12. Reclamation

Reclamation of the haul and service roads will follow the completion of mining. In some instances, progressive reclamation will lead to roads being reclaimed after they are no longer needed. As described in the Mine Closure and Reclamation Plan (Volume 10, Chapter 29), the service roads should be the last mining component to be reclaimed.

Decommissioning of the roads will involve restoring natural drainage, which will be accomplished by removing all culverts, bridges, and other potential obstructions to drainage paths. Any slopes where there is potential for erosion will be stabilized. Stabilization measures may require pulling back of side-cast fills on locally steep slopes or buttressing and/or re-contouring of steepened slopes using non-acid generating material.

References

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Fisheries and Oceans Canada. 2013. Advice, “Measures to Avoid Causing Harm to Fish and Fish Habitat”.

Government of Nunavut Department of Environment. 2014. Available online at the following web site: http://env.gov.nu.ca/sites/default/files/guideline_-_dust_suppression_on_unpaved_roads_2014.pdf. (April 2014)

Sabina. 2015. Final Environmental Impact Statement for the Back River Project, November 2015.

Tibbitt to Contwoyto Winter Road Joint Venture, Winter Road Regulations and Rules of the Road, current version.

Appendix A
Applicable Legislation

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Appendix A. Applicable Legislation

Acts	Regulations	Guidelines
Federal		
Canadian Environmental Protection Act (1999 c.33)	Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations (SOR/2008-197) Environmental Emergency Regulations (SOR/2003-307) Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149) Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2002-301) Federal Registration of Storage Tank Systems for Petroleum Products and Allied Petroleum Products on Federal Lands or Aboriginal Lands Regulations (SOR/97-10) Fuels Information Regulations, No. 1 (SOR/C.R.C., c. 407) Sulphur in Diesel Fuel Regulations (SOR/2002-254) Sulphur in Gasoline Regulations (SOR/99-236)	Canadian Council of the Ministers of Environment - Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products Notice with respect to substances in the National Pollutant Release Inventory Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil
Canada Water Act (1985 c.11)		
Canada Wildlife Act (1985 w9)	Wildlife Area Regulations (C.R.C., c. 1609)	
Species at Risk Act (2002 c.29)		(Eskimo Curlew – endangered)
Migratory Birds Convention Act (1994 c.22)	Migratory Birds Regulations (C.R.C., c. 1035) Migratory Bird Sanctuary Regulations, [C.R.C., c.1036]	Avoidance Guidelines: • Reducing Risk to Migratory Birds • Technical Information • Guidelines to Avoid Disturbance to Seabird and Waterbird Colonies in Canada • Birds at Sea • General Nesting Periods of Migratory Birds in Canada

Acts	Regulations	Guidelines
Fisheries Act (1985, c. F-14)	Metal Mining Effluent Regulations (SOR/2002-2222) Applications for Authorization Under Paragraph 35(2)(B) of the Fisheries Act Regulations Aquatic Invasive Species Regulations (SOR/2015-121) Regulations Establishing Conditions for Making Regulations Under Subsection 36(5.2) of the Fisheries Act (SOR/2014-91)	Fisheries Protection Policy Statement Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada DFO Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut Implementing the New Fisheries Protection Provisions under the *Fisheries Act* - Discussion Paper General Fish-out Protocol for Lakes and Impoundments in the Northwest Territories and Nunavut Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters Freshwater Intake End-of-Pipe Fish Screen Guideline Standard Operating Procedure – Clear Span Bridges
Explosives Act (1985 c.E-17)	Ammonium Nitrate and Fuel Oil Order (C.R.C., c. 598) Explosives Regulations (C.R.C., c. 599)	
Navigation Protection Act (R.S. 1985 c. N-22, s. 1; 2012, c.31, . 316)	Navigable Waters Bridges Regulations (C.R.C., c. 1231) Navigable Waters Works Regulations (C.R.C., c. 1232)	List of Scheduled Waters (Schedule in the Act)
Transport of Dangerous Goods Act (1992, c. 34)	Transportation of Dangerous Goods Regulations (SOR/2001-286)	
Territorial Lands Act (R.S. *1985, c. T-7)*	Northwest Territories and Nunavut Mining Regulations (C.R.C., c. 1516) Territorial Lands Regulations (CRC, c 1525) Territorial Land Use Regulations (CRC, c 1524) Territorial Quarrying Operations, [C.R.C., c. 1527] Northwest Territories Mining District and Nunavut Mining District Order	Northern Land Use Guidelines: Administrative Process
Nunavut Waters and Nunavut Surface Rights Tribunal Act (2002, c.10)	Nunavut Waters Regulations (SOR/2013-69)	
Nunavut Act (1993 c.28)	Nunavut Archaeological and Paleontological Sites Regulations (SOR/2001-220)	
Nunavut Land Claims Agreement Act (1993, c.29)		

Acts	Regulations	Guidelines
Territorial		
Environmental Protection Act (RSNWT (nu) 1988, c E-7)	*Spill Contingency Planning and Reporting Regulations* (NWT Reg (Nu) 068-93) The removal of hazardous materials will require the registration with the Government of Nunavut, Department of Environment as a waste generator as well as carrier (if applicable) prior to transport. Asphalt Paving Industry Emission Regulations, R.R.N.W.T. 1990 c. E-23	Guideline on Dust Suppression Guideline for the General Management of Hazardous Waste in Nunavut Guideline for Industrial Waste Discharges in Nunavut Guideline for Air Quality – Sulphur Dioxide and Suspended Particulates Guideline for the Management of Waste Antifreeze Guideline for the Management of Waste Batteries Guideline for the Management of Waste Paint Guideline for the Management of Waste Solvents Guideline for Industrial Projects on Commissioner's land Canada-Wide Standards for Particulate Matter (PM) and Ozone Canada-Wide Standards for Petroleum Hydrocarbons (PHC) In Soil
Historical Resources Act RSNWT (Nu) 1988, c. H-3)		
Wildlife Act (RSNWT (Nu) 1988, c W-4)	*Wildlife General Regulations* (NWT Reg (Nu) 026-92) *Wildlife Licences And Permits Regulations* (NWT Reg (Nu) 027-92) *Wildlife Management Barren-Ground Caribou Areas Regulations* (NWT Reg (Nu) 099-98) *Wildlife Management Grizzly Bear Areas Regulations* (NWT Reg (Nu) 155-96) *Wildlife Management Zones Regulations* (RRNWT (Nu) 1990 c W-17) *Wildlife Regions Regulations* (NWT Reg (Nu) 108-98) Critical Wildlife Areas Regulations, R.R.N.W.T. 1990 c. W-3 Polar Bear Defence Kill Regulations, N.W.T. Reg. 037-93 Wildlife Management Muskox Areas Regulations, R.R.N.W.T. 1990 c. W-11 Wildlife Management Polar Bear Areas Regulations, R.R.N.W.T. 1990 c. W-13 Wildlife Sanctuaries Regulations, R.R.N.W.T. 1990 c. W-20 Wildlife Preserves Regulations, R.R.N.W.T. 1990 c. W-18	

Acts	Regulations	Guidelines
Territorial Parks Act (RSNWT (Nu) 1988, c T-4)	*Territorial Parks Regulations* (RRNWT (Nu) 1990 c T-13)	
Scientists Act (RSNWT (Nu) 1988 c S-4)	*Scientists Act Administration Regulations* (NWT Reg (Nu) 174-96)	
Commissioner's Land Act (RSNWT 1988, c C-11)	*Commissioner's Airport Lands Regulations* (NWT Reg (Nu) 067-97) *Commissioner's Land Regulations* (RRNWT 1990, c C-13)	
Mine Health And Safety Act (SNWT (Nu) 1994, c 25)	*Mine Health And Safety Regulations* (NWT Reg (Nu) 125-95) Mine Health and Safety Regulations, amendment, Nu. Reg. 016-2003	
Workers' Compensation Act (RSNWT, 1988, c. W-6)	*Workers' Compensation General Regulations* (Nu Reg 017-2010)	
All-Terrain Vehicles Act (RSNWT (Nu) 1988, c A-3)	*All-Terrain Vehicles Regulations* (RRNWT (Nu) 1990 c A-1)	
Apprenticeship, Trade And Occupations Certification Act (RSNWT (Nu) 1988, c A-4)	Apprenticeship, Trade And Occupations Certification Regulations (RRNWT (Nu) 1990 c A-8) Occupation Designation Order, N.W.T. Reg. 026-96 Trade Advisory Committees Order, R.R.N.W.T. 1990 c. A-9 Trade Designation Order, R.R.N.W.T. 1990 c. A-10	
Electrical Protection Act (RSNWT (Nu) 1988, c E-3)	*Electrical Protection Regulations* (RRNWT 1990 c. E-21)	
Explosives Use Act (RSNWT (Nu) 1988, c E-10)	*Explosives Regulations* (RRNWT (Nu) 1990 c E-27)	
Fire Prevention Act (RSNWT (Nu) 1988, c F-6)	Fire Prevention Regulations (RRNWT (Nu) 1990 c F-12) Propane Cylinder Storage Regulations, N.W.T. Reg. 094-91	
Hospital Insurance And Health And Social Services Administration Act (RSNWT 1988, c T-3)	Territorial Hospital Insurance Services Regulations (RRNWT (Nu) 1990 c T-12) Baffin Regional Health and Social Services Board Order, N.W.T. Reg. 059-98 Hospital Standards Regulations, R.R.N.W.T. 1990 c. T-6	
Labour Standards Act (RSNWT (Nu) 1988, c L-1)	*Various*	
Motor Vehicles Act (RSNWT (Nu) 1988, c M-16)	*Large Vehicle Control Regulations* (RRNWT (Nu) 1990 c M-30) *Motor Vehicle Registration And Licence Plate Regulations* (RWT Reg (Nu) 054-94)	

Acts	Regulations	Guidelines
Petroleum Products Tax Act (RSNWT (Nu) 1988, c P-5)	*Petroleum Products Tax Regulations* (RRNWT (Nu) 1990 c P-3)	
Public Health Act (RSNWT (Nu) 1988, c P-12)	*Camp Sanitation Regulations* (RRNWT (Nu) 1990 c P-12) *General Sanitation Regulations* (RRNWT (Nu) 1990 c P-16) *Public Water Supply Regulations, R.R.N.W.T. 1990 c. P-23* *Public Sewerage Systems Regulations, R.R.N.W.T. 1990 c. P-22*	
Public Highways Act (RSNWT (Nu) 1988, c P-13)	*Highway Designation And Classification Regulations* NWT Reg (Nu) 047-92)	
Safety Act (RSNWT 1988, c.S-1)	*General Safety Regulations, Amendment NU Reg 021-2000* (RRNWT (Nu) 1990 c S-1) Asbestos Safety Regulations, N.W.T. Reg. 016-92 General Safety Regulations, R.R.N.W.T. 1990 c. S-1 Safety Forms Regulations, N.W.T. Reg. 102-91 Silica Sandblasting Safety Regulations, N.W.T. Reg. 015-92 Work Site Hazardous Materials Information System Regulations, R.R.N.W.T. 1990 c. S-2	
Transportation Of Dangerous Goods Act (1990. RSNWT (Nu) 1988, c 81 (Supp))	*Transportation Of Dangerous Goods Regulations* (1991, NWT Reg (Nu) 095-91)	Emergency Response Assistance Plans (ERAPs)

Applicable Legislation and Guidelines for the Back River Project

15. Shipping Management Plan

Sabina
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BACK RIVER PROJECT
Shipping Management Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 15	4.3.2	Diesel Fuel	Storage capacity updated to 60 ML
	1.1, 4.3	MLA Design	Updates to MLA design and lightering procedure
	1.2	Shipping Routes	Added Western Route
	4.1.1	Open Water season	Updated to include western route
	4.3	Dry Cargo	Added explanation for contingency if over wintering vessels is required
	4.3.2	Diesel Fuel	OHF level 2 classification for life of MLA
	4.3.3	Explosives and hazardous materials	Clarified that TDG and other applicable regulations will be followed
	5	Legislation and Guidelines	Detail added to capture applicable legislation and guidelines
	12	Marine Liability Insurance	Details added to explain marine liability insurance requirements

BACK RIVER PROJECT
SHIPPING MANAGEMENT PLAN

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Appendix A. Shipping Regulatory Framework

Preface

GENERAL INFORMATION

Sabina Gold & Silver Corp. (Sabina) is actively exploring the Back River property mineral rights encompassing the primary exploration camp at Goose Lake, as well as a satellite camp at George Lake and unoccupied claim groups at Boot Lake, Boulder Pond, Wishbone and Del Lake.

This chapter describes the Shipping Management Plan (the Plan) that Sabina Gold & Silver Corp. (Sabina) will follow in the development and operation of the Project. The Plan and other management plans are intended to describe the ways in which Sabina will address or mitigate issues identified in the Final Environmental Impact Statement (EIS). The Shipping Management Plan will be executed within the scope of normal operations.

The information presented herein is current as of August 2015. This is a living document and will be updated based on engineering design, management reviews, incident investigations, regulatory changes, or other Project-specific protocols. The Plan will be included in Sabina's future Type A Water Licence Application and may be updated prior to submitting the application pending comments from review of the FEIS. The plan may be updated again prior to construction if instructed to do so by the NWB during the licensing process. The plan will be reviewed on a regular basis to incorporate any lessons learned, major changes to facility operation or maintenance, and environmental monitoring results. Any updates to the Plan will be filed with the Annual Report submitted under the Type A Water Licence.

The Plan has been prepared in accordance with Section 9.4.11 of the EIS Guidelines issued by the Nunavut Impact Review Board (NIRB) to Sabina (NIRB 2013). This Plan was prepared in conformance with current Federal and Territorial statutory requirements

ANNUAL REVIEW

The Shipping Management Plan will be reviewed and updated at least annually. Completion of the annual review of the Shipping Management Plan will be documented through signatures of the personnel responsible for reviewing, updating and approving the Shipping Management Plan.

RECORD OF CHANGES AND REVISIONS TO PLAN

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

DISTRIBUTION LIST

Sabina will maintain a distribution list for the Shipping Management Plan providing information about all parties that receive the plan including personnel, departments, and outside agencies.

Preamble

All shipping companies operating in Canadian territorial waters must abide by the Canadian regulatory framework. The Shipping Management Plan was developed in accordance with federal legislation. Shipping in Canada is regulated by the following:

- *Canada Shipping Act, 2001* (http://www.tc.gc.ca/eng/acts-regulations/acts-2001c26.htm).
- *Arctic Waters Pollution Prevention Act* (http://www.tc.gc.ca/eng/acts-regulations/acts-1985ca-12.htm).
- *Marine Liability Act* (http://www.tc.gc.ca/eng/acts-regulations/acts-2001c6.htm).
- *Coasting Trade Act* (http://laws-lois.justice.gc.ca/eng/acts/C-33.3/).
- *Navigable Waters Protection Act* (http://laws-lois.justice.gc.ca/eng/acts/N-22/).
- *Marine Transportation Security Act* (http://www.tc.gc.ca/eng/acts-regulations/acts-1994c40.htm).

In the Arctic, three of these Acts combine to provide Canada's operational regulatory regime governing marine safety and environmental protection issues: the *Canada Shipping Act*, 2001, the *Marine Liability Act*, and the *Arctic Waters Pollution Prevention Act* (AWPPA).

These federal laws and regulations aim to promote marine safety, prevent pollution, provide a framework to respond to incidents, and address related liabilities and compensation issues. Transport Canada is the lead agency regulating shipping. Other federal agencies and departments, such as Fisheries and Oceans Canada, the Canadian Coast Guard and Environment Canada, have distinct but interrelated responsibilities for the management of marine transportation safety and environmental protection in the Arctic. Transport Canada works with these federal agencies and departments to establish the regulatory framework and mechanisms that provide a coherent and consistent approach to aspects of marine transportation safety and environmental protection.

The *Canada Shipping Act* provides an overall mechanism to protect safety and the environment for vessels operating in Canadian jurisdiction – waters out to the 200 nautical mile limit. Its regulations include requirements for a vessel's construction, how it manages ballast water, its pollution control equipment, arrangements for emergency response, and its crew qualifications. The AWPPA provides enhanced protection for vessels operating in Canadian jurisdiction north of 60°North latitude. It provides specific construction standards for vessels engaged in Arctic shipping, a system of shipping safety control zones, a ban on discharges of oil, hazardous chemicals, and garbage, and requirements for vessels to carry insurance to cover damages from any of these discharges. The *Marine Liability Act* sets out a regime that requires vessels operating in Canadian jurisdiction to carry insurance to pay for damages from oil spills. In the event of a conflict between the AWPPA and the *Marine Liability Act*, the latter applies. All three of these Acts are implemented based on the "polluter pays" principle. An overview of the shipping regulatory framework, shipping provider's obligations, and Transport Canada's role in enforcement these regulations is presented in Appendix A.

Sabina Gold & Silver Corp. is not a shipping company and does not own any vessels. Sabina intends to contract all its shipping and resupply requirements to Canadian shipping providers. Sabina does not possess the expertise to impose navigational requirements in terms of safety at sea, emergency responses on ships, crew qualifications, or other specialized requirements on shipping providers. This expertise lies with Transport Canada and the Canadian Coast Guard.

1. Introduction

The Project includes a Marine Laydown Area (MLA) located at Bathurst Inlet, approximately 130 km north-northwest of the Goose site. The MLA will be connected via winter ice roads to both the Goose Property and the George exploration camp. It will be used to receive fuel, cargo, and consumables through all phases of the Project.

Fuel and cargo will be received and staged at the MLA during the ice-free period, typically from August to September, and will be transported to the Project by freight truck via the winter road from January to March. Outside of the aforementioned periods, MLA activities will be limited to on-site storage and monitoring for loss prevention.

During periods MLA activity, crew transport to the MLA will be facilitated by an ice airstrip in the winter months (January to March) and by float planes in the summer months (August to September). Between operational seasons, occasional personnel transport will be supported by helicopter service.

1.1 MLA FUNCTIONAL AND DESIGN CRITERIA

The MLA has been designed to be capable of off-loading and storing 60 ML of diesel fuel and 30,000 t of consumables during operations and off-loading and storing 15 ML of diesel fuel and 20,000 t of materials during construction. A laydown area is required for 1,200 containers (20-ft long, 1 Twenty-foot Equivalent Unit (TEU)), as well as a fuel farm with four 15-ML tanks. Initially one 15 ML fuel tank is erected in Year -3, two more 15 ML fuel tanks are erected in year -2, and the fourth 15 ML tank is installed in Year -1.

The MLA comprises the marine infrastructure, the laydown area, and the upland infrastructure. Upland infrastructure includes:

- Four 15 ML diesel fuel storage tanks with a fuel truck loading/unloading facility.
- Lubricant oil storage.
- Secure container storage for 1,200 containers (20 ft, 1 TEU).
- Secure outdoor cold storage.
- Cold and heated warehouses.
- Diesel generator sets.
- A vehicle maintenance building.
- Desalination plant.
- Fresh/fire water storage and distribution.
- A 75-person camp with offices.
- A staging area for shipping containers.
- Hazardous waste containment and landfarm.

The marine infrastructure comprises a single grounded terminal barge that will accept lighter barges. Lightering barges will shuttle freight from the ocean-going vessels that are moored at a water depth of approximately 12 m, to the terminal barge. A foreshore ramp provides access from the terminal barge to the laydown area. The terminal barge will be secured in place by mooring it to onshore bollards.

The terminal barge will be removed from the water at the end of each sealift season and re-installed for the next year's sealift. Other components of the MLA include an onshore fuel manifold for offloading fuel from tankers. The MLA layout is shown in Figure 1.1-1.

1.2 SHIPPING ROUTES

The MLA is located on a peninsula approximately 30 km south of the settlement of Kingaok (Bathurst Inlet) with the following NAD 83 Zone 13 N UTM coordinates: 7394976N 381254E. This site allows the MLA to be constructed on relatively flat terrain while providing sufficient water depth for ships at a reasonable distance from the shore. The bathymetric information for marine access to the MLA was obtained from Canadian Hydrographic Services.

The Project will ship goods, equipment, material, supplies, and fuel from the St. Lawrence River and Vancouver, BC to Bathurst Inlet. Ships from international ports may also be used. An existing shipping route exists through the Northwest Passage from Bathurst Inlet toward the west through Coronation Gulf or toward the east through Queen Maud Gulf, Victoria Strait, Franklin Strait, Peel Sound, Barrow Strait, and out through Lancaster Sound during the open-water season. The shipping traffic through the Northwest Passage to the east through Nunavut is estimated to be at least 30 to 40 transits between September 1 and October 31 (approximately 60 days). The shipping routes are presented in Figure 1.2-1.

Subject to vessel safety, Sabina will request its shipping providers avoid Prince Leopold Island, specifically the 30 km radius offshore that has been identified as a key marine habitat site for seabird species.

Sabina will obtain copies of logs and map of ship tracks from its shipping providers and will include this information in annual monitoring reports to assess shipping volume and routes. All vessels will be equipped with appropriate navigations aids as per Transport Canada requirements.

It is expected that all shipping activities will originate from Canadian ports. Should it become necessary to utilize vessels which originate outside of Canada, all regulatory requirements will be met.

1.3 SHIPPING MANAGEMENT

The aspects of shipping which are under Sabina's control include:

- Shipping schedule for freight and fuel deliveries.
- Ship to shore transfer of freight and fuel.
- Oil handling facility at the Marine Laydown Area.
- Security at the Marine Laydown Area.

The Shipping Management Plan addresses shipping activities on which Sabina can exert influence or control through contractual agreements with shipping providers or direct management of the Marine Laydown Area sealift activities.

Once the Project approval is granted, Sabina will proceed with the development of a marine security plan will be developed for the MLA as required by the *Marine Transportation Safety Act*.

GIS # BAC-15-082_S

October 02 2015

380750

381500

7395000

7394000

N

31m

FUEL SHIP

FLOATING HOSE

WATER INTAKE PIPELINE

PIPE CROSSING

PORT OFFICE

LIGHTERING BARGE

LIGHTER BARGE TERMINAL

WATER DISCHARGE PIPELINE

LINED HAZARDOUS WASTE MGMT. AREA (5000m2)

LANDFARM (2500m2)

FREIGHT STORAGE AREA (11,000m2)

VEHICLE MAINTENANCE

FRESH/FIRE WATER STORAGE TANK

DESALINATION. POTABLE WATER

ERT

KITCHEN/ADMIN OFFICES

75 PERSON CAMP

INCINERATOR

HELIPAD

MOBILE EQUIPMENT PARKING WITH BULL RAIL

FREIGHT STORAGE AND CAMP AREA (70,500m2)

AN STORAGE AREA

FUEL STORAGE AND OFF-LOADING PAD
4 x 15,000 000L TANKS

Kilogiktok (Bathurst Inlet, Southern Arm)

Main Map

Marine Laydown Area

BIPR Winter Road Connector

Goose Property Area

1:1,810,000

Marine Laydown Area PDA = 653 ha
Marine Laydown Area Infrastructure Footprint = 26 ha

Winter Ice Road

Marine Laydown Infrastructure

Storage

MLA Infrastructure

MLA Infrastructure slope

Equipment parking

Shoreline Buffer (31 metres)

Contours 1m

Inuit Owned Land

Surface Rights Only

Potential Development Area (PDA)

1:7,500

0 200 400

Meters

Projection: NAD 1983 UTM Zone 13N

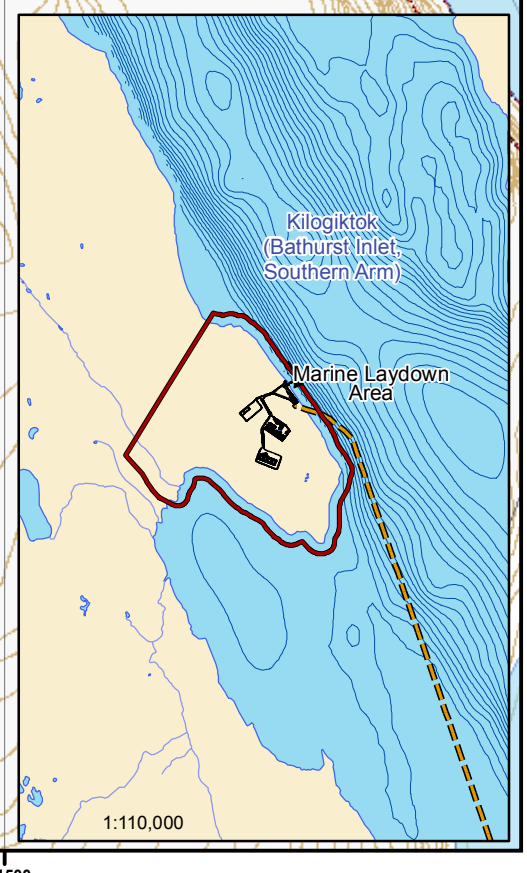

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Figure 1.1-1

Marine Laydown Area Site Layout

PROJECT # 0194096-0033 GIS # BAC-50-001_S November 02, 2015

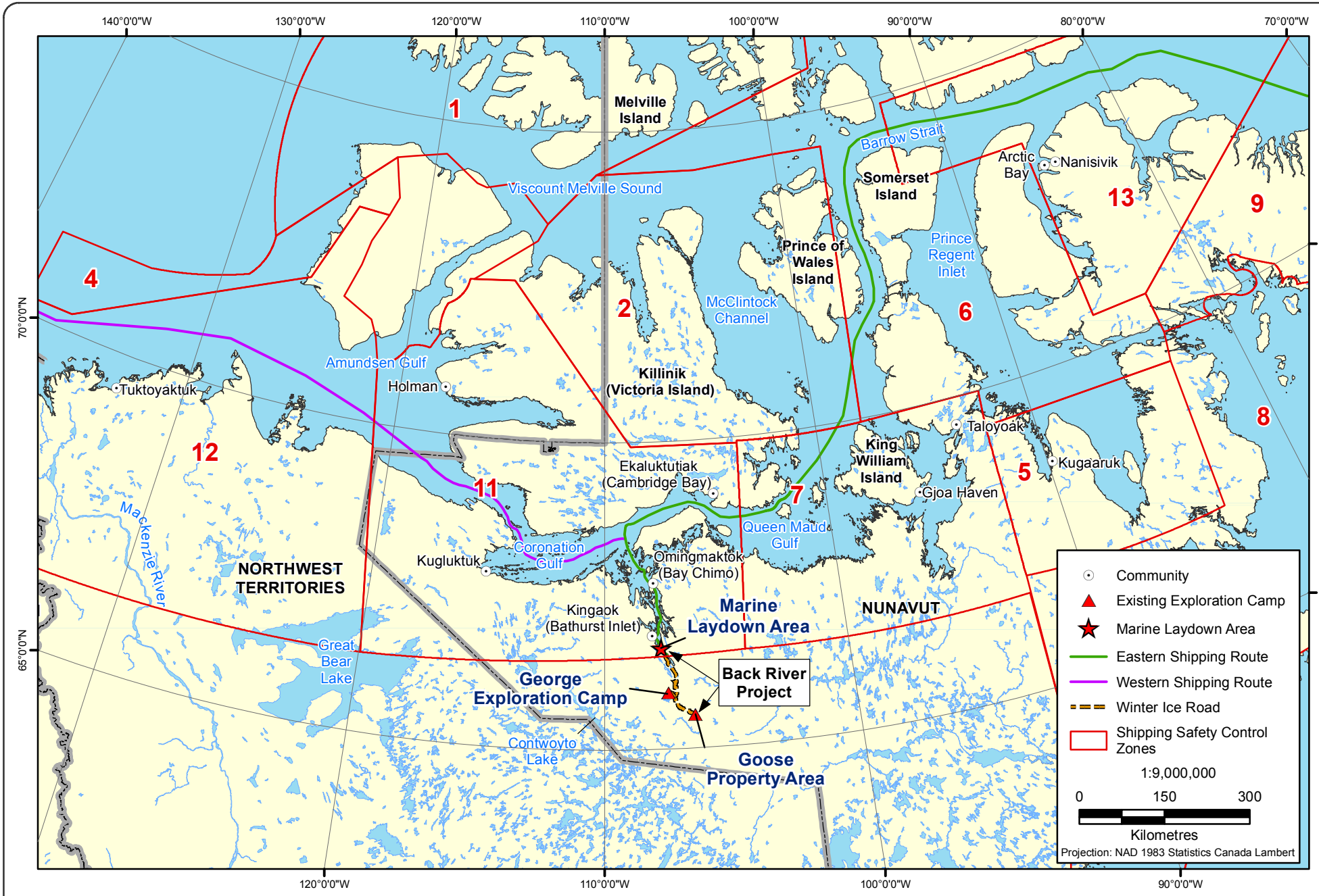

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Figure 1.2-1

Shipping Routes

2. Related Management Plans

The Shipping Management Plan must be viewed in concert with:

- Shipboard Oil Pollution Emergency Plan (shipping companies).
- Risk Management and Emergency Response Plan.
- Spill Contingency Plan.
- Oil Pollution Emergency Plan.
- Occupational Health and Safety Plan.

2.1 SHIPBOARD OIL POLLUTION EMERGENCY PLAN

Section 27 of the Vessel Pollution and Dangerous Chemicals Regulations requires the owner of every Canadian oil tanker of 150 tonnes gross tonnage or more, and every other Canadian ship of 400 tonnes gross tonnage or more that carries oil as fuel or cargo, to submit four copies of the vessel's Shipboard Oil Pollution Emergency Plan (SOPEP) to Transport Canada for review. All SOPEPs are ship-specific.

The SOPEP provides guidance to help the ship master deal with shipboard emergency situations, including discharge of fuel, should one occur. The required SOPEP(s) will be in place prior to the commencement of shipping.

2.2 OIL POLLUTION EMERGENCY PLAN (OPEP)

As the owner and operator of an Oil Handling Facility (OHF), the CSA 2001 and its regulations require Sabina to maintain a minimum level of spill prevention and response preparedness at all times. OHFs must each have onsite emergency and prevention plans, equipment, personnel, and training that allow deployment of an immediate response in the event of a fuel spill. Transport Canada's regional Pollution Prevention Officers enforce the OHF regulations by reviewing the facility's OPEP, and inspecting the facilities and response resources to ensure compliance with the OHF regulation.

Sabina's conceptual Oil Pollution Emergency Plan (OPEP) is presented in Volume 10, Chapter 6 of the FEIS. As per regulations, the MLA OPEP will be updated and submitted to Transport Canada for review on an annual basis.

3. Targeted VECs and VSECs

The targeted valued ecosystem components (VECs) and valued socio-economic components (VSECs) are:

- Marine water quality.
- Marine mammals.
- Sea birds and ducks.

4. Shipping Schedule

4.1 OPEN WATER SEASON

All shipping activities will take place during the open water season, ending on October, 15 each year unless emergency or unforeseen circumstances occur.

4.1.1 Determining the Open Water Season

Vessels entering Canadian Arctic waters must comply with Canadian shipping regulations. The Arctic Shipping Pollution Prevention Regulations (ASPPR) governs the navigation through what is commonly known as the Zone / Date System. In the Zone / Date System, the Arctic waters are divided into sixteen Shipping Safety Control Zones, with a schedule of earliest and latest entry dates for each zone corresponding to specific categories of vessels. Zone 1 has the most severe ice conditions and Zone 16 the least.

The ships transporting cargo and fuel to Bathurst Inlet will be Arctic Class 1A or Type B. According to ASPPR, vessels of these types travelling the eastern route from Becancour, QC will pass through Zone 6 and are only permitted to navigate in this zone from August 25th to September 30th. Whereas a similar vessel travelling the western route from Vancouver, BC will pass through Zone 11 which allows for navigation from July 15th to October 20th.

In response to the fact that the Zone / Date System does not fluctuate with ice conditions, Transport Canada introduced the Arctic Ice Regime Shipping System to allow ships to navigate in the Arctic when the ice conditions permit. Operators have increased flexibility with their operations through the introduction of the Arctic Ice Regime Shipping System (AIRSS) Standards, TP 12259. This system permits ships to navigate outside of the current Zone / Date System when ice conditions are suitable.

4.2 GOODS AND MATERIALS RECEIVED

The quantities and volumes of goods and material received will vary depending on the phase of the Project. Deliveries will begin during the construction phase and continue throughout operations as shown in Table 4.1-1.

Table 4.1-1. Estimated Goods and Material Received at the Marine Laydown Area

Year	Y-3	Y-2	Y-1	Y1	Y2	Y3 onward
Dry Freight (tonnes)	6,000	15,800	17,300	19,100	23,500	< 30,000
Number of vessels	2 to 4 annual	3 to 4	3 to 4	3 to 4	3 to 4	3 to 4 annual
Fuel (x1000 litres)	3,656	12,699	22,430	46,768	53,064	< 60,000
Number of tankers	1 annually	1	1	1	1	1 annually

4.3 LIGHTERING PROCEDURES

4.3.1 Dry Cargo

During the operations and construction phases, cargo will be transported by barges and ships. The design cargo barge has a Dead Weight Tonnage (DWT) of 16,500 t with maximum draft of 5.9 m. The design cargo ships have a DWT of 17,000 t with draft of 9.7 m. The ships and barges will be self-sufficient for offloading cargo by using their own equipment.

The port marine infrastructure comprises a single grounded terminal barge that will accept lightering barges. Lightering barges will be used to transfer cargo from the vessel to the Lightering Barge Terminal. A foreshore ramp provides access from the terminal barge to the laydown area. The terminal barge will be secured in place by mooring it to onshore bollards which will be secured to the ground by using rock anchors. Freight will then be hauled to a laydown area where is will be stored until the annual winter ice road is open.

Most dry cargo will be transported in marine shipping containers (Twenty-foot Equivalent Units) stacked on the deck of general cargo vessels fitted with cranes. Shipping containers will be offloaded and stacked in the MLA laydown yard prior to transport to the Goose Property over the winter ice road. The use of shipping containers serves to provide protection for cargo, secondary containment against spills, and facilitates rapid transfer from ship to shore.

Navigation of tugs and other vessels at the MLA will proceed at a slow speed in periods of low visibility. Traffic will be coordinated through communication between tugs, vessels, and MLA personnel.

Masters of tugs, large and small tankers, and dry cargo ships are responsible for their vessels at all times and for the safe navigation of their vessels from the port of departure to the MLA. For tugs this also includes responsibility for the barge they are towing or pushing. When a barge is laid alongside a dry cargo vessel for lightering containers or equipment to the barge, a loading supervisor on the ship will take charge of the barge. When a cargo barge is secured to the lightering barge, a shore supervisor will take charge of the cargo barge.

At the end of the shipping season or when all the dry cargo has been received by Sabina for the year, outgoing cargo will be loaded on the barges for the return trip to southern ports. Outgoing cargo could include construction equipment being demobilized following the completion of construction and/or hazardous or other waste being sent to a certified waste management facility for treatment, recycling and/or disposal in another provincial or territorial jurisdiction.

The Lightering Barge Terminal is designed to be removed at the end of each sea-lift season and re-installed prior to the arrival of the first sea-lift vessel the following year. Currently there is no plan for barges, fuel vessels or tugs to remain at Bathurst Inlet over the winter. Should it become necessary, all regulations for overwintering will be met.

4.3.2 Diesel Fuel

Fuel will be transported to the MLA using double-hull tankers with the following specifications:

- Fuel capacity of 15,000 to 60,000 m^3.
- Dead weight tonnage (DWT) of 20,000 to 60,000 t.
- Draft of 8 to 12 m.
- Offload transfer rate of 450 m^3/h via 200 mm floating hoses.

The fuel tankers will use anchors to secure the ship offshore during off-loading. During the initial construction season in year -3, and for the remainder of the mine life, the MLA will have a Level 2 OHF classification which will permit transfer rates to a maximum of 750 m^3/h. The fuel supplier shall connect supplied floating 200 mm discharge hoses to a shore installed connection that will allow the fuel to be pumped to the fuel storage facility.

4.3.3 Explosives and Hazardous Materials

All hazardous and dangerous material will be packaged, handled, stored and transported in accordance with the Canadian Transportation of Dangerous Goods Regulation (TDGR).

Part of the dry cargo received each year will be ammonium nitrate, which will be used on site to manufacture explosives. Bulk ammonium nitrate will be shipped as prill, which is inert and will not require special handling during transit. The ammonium nitrate will remain in sea containers at the MLA until it can be transported to the mine sites over the winter ice road. The design of all storage facilities will meet government regulations and will be located according to required separation distances as regulated by the Explosives Regulatory Division (ERD) of Natural Resources Canada (NRCan). During the construction of the MLA, there will be temporary storage and use of packaged explosives. Explosives will be stored using the magazines that will be permanently installed at Goose. During operations packaged explosives will be not be stored at the MLA.

All handling, transport, storage, manufacture and use of explosives will be subject to federal approval under the *Explosives Act*, and the *Nunavut Mine Health and Safety Act*.

Hazardous waste and contaminated soil will be stored at the MLA until it can be shipped off site. Hazardous waste will be appropriately packaged for transport in sea cans and sent via a dry cargo vessel to a certified hazardous waste management facility for treatment, recycling and/or disposal in another jurisdiction.

5. Applicable Legislation and Guidelines

5.1 LEGISLATIONS

The *Fisheries Act* is the main environmental legislation addressing environmental protection of the marine environment. The transportation of all cargoes between Canadian ports is regulated by the Government of Canada through a variety of legislation, including:

- *Canada Shipping Act*.
- IMO Code for the Safe Handling of Bulk Cargoes.
- Canada Labour Code.
- IMDG Code for the Safe Handling of Dangerous Goods.
- *Canadian Transportation Accident Investigation and Safety Board Act*.
- *Canadian Transportation Act*.
- *Canadian Transportation of Dangerous Goods Act*.
- *Department of Transport Act*.
- *Marine Transportation Security Act*.
- *Navigation Waters Protection Act*.
- *Oceans Act*.
- *Arctic Waters Pollution Prevention Act* and Regulation.
- *Safe Containers Convention Act*.

- Ballast Water Control and Management Regulations.

The following regulations issued under the *Canada Shipping Act* regulate Canadian vessel operations and foreign vessels while operating in Canadian waters:

- Aids to Navigation Protection Regulations.
- Air Pollution Regulations.
- Boat and Fire Drill Regulations.
- Charts and Nautical Publications Regulations.
- Dangerous Chemicals and Noxious Liquid Substances Regulations.
- Classed Ships Inspection Regulations.
- Collision Regulations.
- Crew Accommodation Regulations.
- Dangerous Bulk Materials Regulations.
- Dangerous Goods Shipping Regulations.
- Eastern Canada Vessel Traffic Services Zone Regulations.
- Fire Detection and Extinguishing Equipment Regulations.
- Garbage Pollution Prevention Regulations.
- Home-Trade, Inland and Minor Waters Voyages Regulations.
- Hull Inspection Regulations.
- Marine Transportation Security Regulations.
- Life Saving Equipment Regulations.
- Marine Certification Regulations.
- Marine Crewing Regulations.
- Marine Machinery Regulations.
- Navigating Appliances and Equipment Regulations.
- Non-Canadian Ship Safety Order.
- Oil Pollution Prevention Regulations.
- Pilot Ladder Regulations.
- Pollutant Discharge Reporting Regulations.
- Pollutant Substances Regulations.
- Response Organizations and Oil Handling Facilities Regulations.
- Safe Working Practices Regulations.
- Safety Management Regulations.
- Ship Station Radio Regulations.
- Ship Station Technical Regulations.

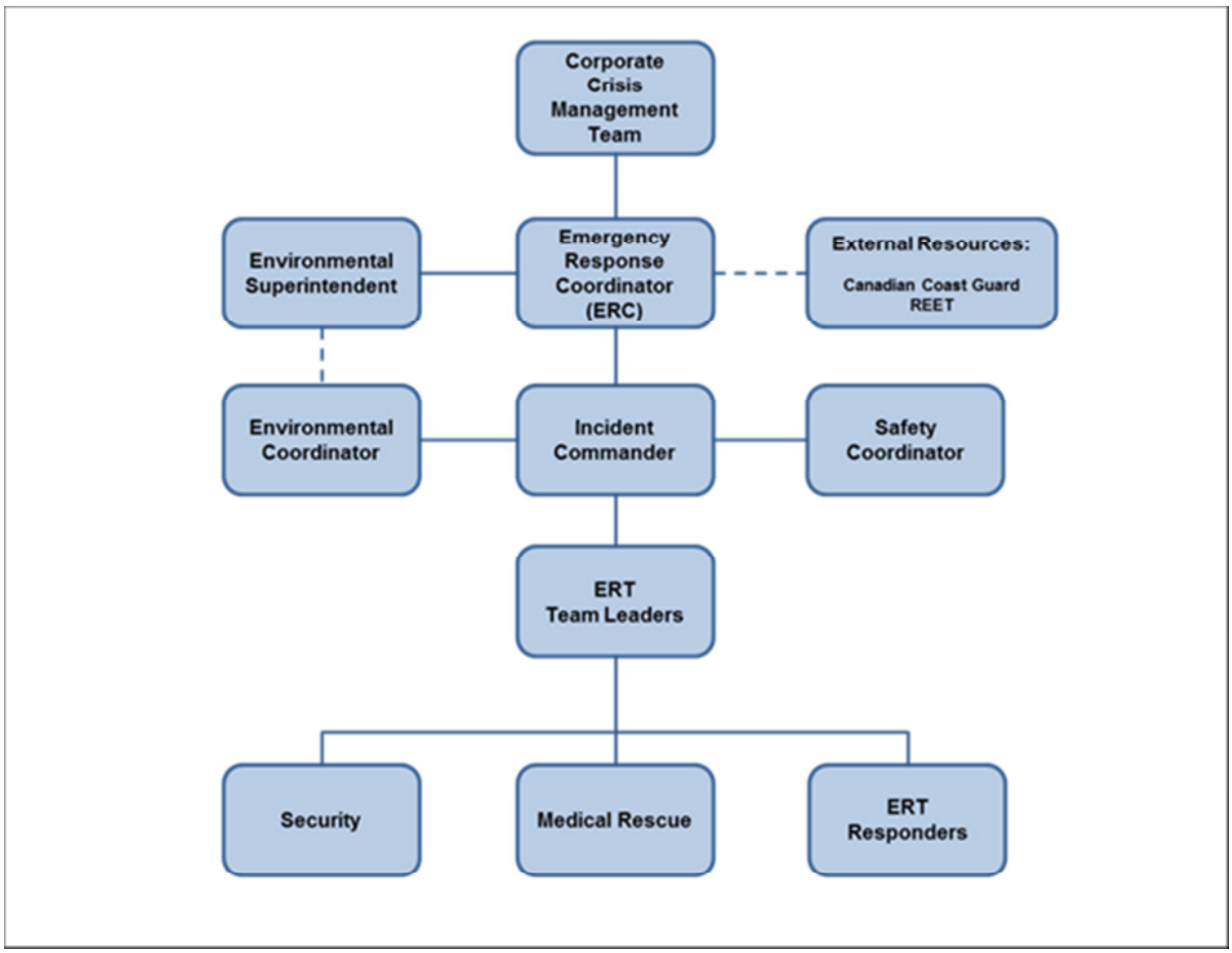
- Ships' Tonnage Survey and Measurement Fees Regulations.
- Shipping Casualties Reporting Regulations.
- Shipping Inquiries and Investigations Rules.
- Ships' Crews Food and Catering Regulations.
- Ships' Elevator Regulations.
- Steering Appliances and Equipment Regulations.
- Tackle Regulations.
- Vessel Traffic Services Zones Regulations.
- VHF Radiotelephone Practices and Procedures Regulations.

Refer to Appendix A for an overview of Canadian shipping regulations.

6. Roles and Responsibilities

For the duration of the shipping season, Sabina will appoint a lead supervisor to oversee the MLA activities. This lead supervisor will act as the designated "Marine Facility Security Officer" for the period of activities at the MLA. He will also fill the role of "Emergency Response Coordinator" for the MLA.

The figure below illustrates the organizational chart for emergency response.



7. Pollution Prevention

7.1 PREVENTING POLLUTION AND REGULATING VESSEL DISCHARGES

The *Canada Shipping Act* (2001) and the *Arctic Waters Pollution Prevention Act* (AWPPA) and their associated regulations incorporate pollution prevention as set out in international standards of the International Convention for the Prevention of Pollution from Ships, known as MARPOL. This convention sets out detailed technical standards for:

- Carrying and handling oil.
- Carrying and handling noxious liquid substances in bulk.
- Carrying packaged dangerous goods.
- Managing vessel sewage discharges.
- Managing vessel garbage.
- Managing vessel air emissions.

Canadian regulations also prohibits the use of hull coatings containing tributyl tin, which has been found harmful to marine life, under International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001.

Transport Canada applies these standards through the Vessel Pollution and Dangerous Chemical Regulations under the CSA 2001. These standards are continuously subject to review. Under the Regulations, vessels operating in Canadian waters are subject to the following requirements.

7.2 PREVENTING OIL POLLUTION

Canadian shipping regulations set out requirements to prevent oil pollution and implement Annex I of MARPOL. Oil tankers (vessels carrying oil in bulk) must:

- Have their plans and specifications approved by their Administration—in the case of a Canadian tanker, by Transport Canada—and by 2015 be double-hulled.
- Have contained areas where fuel or product is pumped on or off the vessel and tanks for oily residue and sludge oil.
- Use standardized connections and piping systems and use equipment for cleaning holds that meet international standards.

All ships of 400 tonnes gross tonnage or more and oil tankers of 150 tonnes gross tonnage or more, must:

- Meet cargo standards for oil even if they carry oil with other cargo.
- Be able to remotely stop discharge pumps.
- Have oil filtering equipment to remove oil from discharges down to 15 parts per million (note, in Canadian jurisdiction, north of 60°N, the AWPPA zero discharge regime applies).
- Have alarms that both alert crew when the filtered product exceeds the standard and automatically shut discharge.
- Be inspected regularly, with simple inspections carried out annually, more detailed inspections about every three years, and a comprehensive inspection every five years.
- Carry on board:
    - An onboard Emergency Plan that includes contacts for response organizations.
    - Certificates, namely the International Oil Pollution Prevention Certificate, attesting that the inspections were carried out and that the vessel meets standards.
    - An oil record book that is kept up to date (this includes a record of all discharges of waste oil or of unloading waste oil in port to a reception facility).
    - Procedures and arrangement manual that sets out operating instructions for all equipment used onboard the oil tanker.

The regulations also set out requirements for transfer operations, the loading or unloading of oil or oil products either between an oil tanker and shore facility or between two oil tankers at sea:

- The operations must be supervised by a person certified to do so and clear communications between all personnel involved must be arranged.

- The supervisor is responsible for ensuring:
  - Personnel understand all signals, controlling flow rates during the transfer.
  - No hazardous conditions place the transfer operation at risk.
  - Response preparations are in place.
  - Valves and equipment are secure once operations are complete.
- Only fittings and conduits that meet performance standards for pressure resistance may be used.
- The facility and vessel are equipped with proper lighting.

7.3 PREVENTING POLLUTION FROM CHEMICALS CARRIED IN BULK

Division 2 of Part 2 of the Vessel Pollution and Dangerous Chemicals Regulations set out requirements to prevent pollution from chemicals known as noxious liquid substances when carried in bulk and implement Annex II of MARPOL.

The regulations also set out requirements for transfer operations: the loading or unloading of chemical products either between a chemical tanker and shore facility or between two such tankers at sea. These requirements are similar to requirements for oil noted above. Discharge requirements of this Division do not apply in Arctic waters, as the AWPPA applies and prohibits these discharges.

7.4 CARRYING PACKAGED DANGEROUS GOODS

Division 3 of Part 2 of the Vessel Pollution and Dangerous Chemicals Regulations prohibits the discharge of any substance that is listed as a marine pollutant.

In Canada, carrying packaged dangerous goods is subject to a comprehensive control regime under the *Transportation of Dangerous Goods Act* 1992. The regime includes standards for classifying different types of dangerous goods to ensure proper containment, packaging, handling, control documents, operator training, and emergency response.

7.5 MANAGING VESSEL SEWAGE DISCHARGES

Division 4 of Part 2 of the Vessel Pollution and Dangerous Chemicals Regulations sets out requirements that all ships of 400 tonnes gross tonnage or more must follow to manage sewage generated on board and implement Annex IV of MARPOL. The provisions setting limits on the discharge of sewage do not apply in Arctic waters as the AWPPA allows for the discharge of untreated sewage.

7.5.1 On-vessel Sewage Treatment

Vessels are to have an approved sewage treatment plant meeting Canadian standards. Holding tanks with the capacity for all grey and treated sewage while in port are expected to be part of the ship's infrastructure. Sewage sludge from the sewage treatment plant can be incinerated in the on-board incinerator.

7.6 MANAGING VESSEL GARBAGE

Division 5 of Part 2 of the Vessel Pollution and Dangerous Chemicals Regulations sets out requirements for vessels to manage the garbage generated on board and implements Annex V of MARPOL. Garbage can include:

- Waste from the vessel's crew.

- Operational waste such as galley or maintenance shop waste.
- Cargo associated waste such as dunnage or packing material or residues of dry cargoes carried in bulk (such as ore or grain).

The provisions setting limits on the discharge of garbage do not apply in Arctic waters as the AWPPA prohibits the discharge of garbage.

7.6.1 On-vessel Solid waste

Solid waste materials are to be incinerated, not disposed of in the marine environment. Modern incinerators operating at very high combustion temperatures are expected on all vessels. These will be capable of incinerating food and other domestic waste, residual oil separated from bilge water, waste oil and in most cases, sewage. Ash from incineration will remain on board and be taken south for treatment, recycling and/or disposal in a certified waste management facility.

The design and operation of shipboard incinerators in Canada are specified under the International Marine Organization, Marine Environmental Pollution Committee 76 (40), Annex V. Standard specification for shipboard incinerators allow for the incineration of solid wastes approximating in composition to household waste and liquid wastes arising from the operation of the ship, e.g., domestic waste, cargo-associated waste, maintenance waste, operational waste, cargo residues, and fishing gear. Ash from the incinerator is stored on-board. The ash is transported south to a certified waste management facility for treatment, recycling and/or disposal in another provincial or territorial jurisdiction.

Sabina will require all of its shipping providers to dispose of waste at the port of origin. No solid or liquid waste will be accepted for treatment at the Marine Laydown Area.

7.7 MANAGING VESSEL AIR EMISSIONS

Division 6 of Part 2 of the Vessel Pollution and Dangerous Chemicals Regulations sets out requirements for vessels to manage air emissions and implements Annex VI of MARPOL. The requirements:

- Prohibit emissions of ozone depleting substances.
- Set controls for emissions of nitrogen oxides (combustion products from nitrogen in the air), sulphur oxides (combustion products from sulphur in the fuel), and volatile organic compounds.
- Set performance standards for incinerators.

For example, the regulations set a maximum limit for the sulphur content of any fuel oil used on a vessel to 4.5%. In addition, tankers using a vapour collection system for volatile organic compounds are required to meet international standards for the collection system. These criteria will become even more stringent once the new air emissions requirements come into force.

7.8 ANTIFOULING SYSTEMS

Division 7 of Part 2 of the Vessel Pollution and Dangerous Chemicals Regulations requires vessels not to have any tributyl tin compounds present in hull coatings. This applies a global ban on such compounds under the International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001.

7.9 REPORTING POLLUTION

In the event of an incident involving harmful substances, responsibilities are set out in the AWPPA, Part 3 of the Vessel Pollution and Dangerous Chemicals Regulations. In the event of a polluting incident

that requires Environment Canada's involvement, the National Environmental Emergencies Centre (NEEC) is Environment Canada's focal point for the provision of scientific advice, such as weather forecast, contaminant dispersion and trajectory modeling, fate and behaviour of hazardous substances, the establishment of clean-up priorities and techniques, as well as the protection of sensitive ecosystems and wildlife such as migratory birds and fish. These instruments outline when and how a vessel's master or an owner or operator of an oil handling facility must report any discharge of a pollutant that occurs or the probability that such a discharge will occur. Reports are to be made according to either the:

- Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants, TP 9834 (http://www.tc.gc.ca/eng/marinesafety/tp-tp9834-menu-1684.htm).
- General Principles for Ships Reporting Systems and Ship Reporting Requirements, including Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants, IMO Resolution A.851(20).

Vessels are also required to report the presence of any pollutant in the water under the CSA 2001's Vessel Traffic Services Zones Regulations.

Vessels in Arctic waters are subject to the AWPPA. The Arctic Shipping Pollution Prevention Regulations, which set requirements for how vessels operating in Arctic waters must be built and details conditions on the no-discharge regime, and the Arctic Waters Pollution Prevention Regulations, which include a civil liability regime for vessels to ensure there is insurance to cover damages should deposits of wastes occur, both regulate pollution.

8. Ballast Water Management

Discharge of ballast water will not be an issue since all ships will arrive to Bathurst Inlet fully loaded. The vessel will take ballast water on board when departing Bathurst Inlet. Canadian regulatory requirements on management of ballast water are described in Appendix A.

9. Accidents and Malfunctions

9.1 FUEL SPILLS ALONG THE SHIPPING ROUTE

The navigation route from the Eastern seaboard of Canada to Cambridge Bay is well known and has been in use for several decades. In addition, Canadian regulations required that fuel tankers navigating in Arctic waters be double-hull vessels.

The following spill prevention measures are essential and must be respected by all shipping providers:

- The Ship Master's responsibility is to navigate with caution. He is ultimately responsible for the safety of his crew and of the ship.
- All fuel tankers built after 1993 to be double-hulled to operate in Canadian waters.
- Vessels have anti-collision devices with alarms and radar to ensure that collisions are avoided.

- Vessels are equipped with several dual/redundant back-up systems such as twin engines, radar, and have redundancy for navigational systems and communication systems.
- Shipping route bathymetry is known.

Furthermore, the "rules of the road" for shipping are:

1. Shipping operators must abide by the established regulatory framework.
2. Ships must sail within the established shipping corridor.
3. Ships must have a Shipboard Oil Emergency Response Plan (SOPEP).

The likely scenarios considered that could lead to a spill event are:

1. Ship engine failure at sea (possible; moderate risk) – many ships have dual engines.
2. Ship grounding (unlikely, low risk) – bathymetry along shipping corridor is known.
3. Collision with other vessels (rare, low risk) – radar very low incidence of collision.

Because of the tanker ship double-hull design, systems redundancy on vessels, and the focus placed on prevention of accidents and malfunctions the recorded frequency of such accidents and malfunctions is very low. This is supported by the recent "Tanker Safety Expert Panel" report available for consultation on Transport Canada's website (http://www.tc.gc.ca/eng/marinesafety/menu-4100.htm#g).

9.2 FUEL SPILLS DURING SHIP-TO-SHORE TRANSFER OF FUEL AT THE MLA

The Transportation Safety Board of Canada marine statistics for recent years (www.tsb.gc.ca/eng/stats/marine/2014/ssem-ssmo-2014.asp) as well as the worldwide Oil Tanker Spills Statistics for 2011, prepared by the International Tankers Owners Pollution Federation Limited (ITOFP) confirms that the vast majority of spills occurred at dock while loading or unloading fuel and that the vast majority of fuel spills are generally less than 7 tonnes in size. Furthermore, the vast majority of these spills occur at port.

Sabina's emphasis for marine spill preparedness will focus on the MLA. The OPEP details the emergency response procedures to deal with small fuel spill during the ship-to-shore fuel transfer operation.

9.3 ACCIDENTS AND MALFUNCTIONS INVOLVING FREIGHT

At the anchor point, cargo will be lightered from the ships onto barges and be delivered to the spud barge via the access passage. The tugs-barges will be highly manoeuvrable. Navigation will be during daylight hours and will proceed at a slow speed in periods of low visibility. Shipping traffic will be coordinated to avoid shipping conflicts and to ensure safety.

Accidents and malfunctions could increase the level of hazard and necessitate associated mitigation measures:

- Mechanical failure occurring on the ship or tug thereby placing it in jeopardy in the shipping route.
- Tug-barge or ship running aground due to a navigational error or mechanical failure.
- Loss or damage to sea cans in heavy seas.
- Barge tow line breaking in heavy seas.
- Collision of tug-barge or ship carrying dry cargo and fuel.

- Tug-barge or ship sinking upon hitting ice.
- Tug-barge or ship colliding with a small boat.

Mitigation reduces the probability of occurrence and increases safety. The following mitigation/safety measures are proposed:

- Where available, electronic navigation aids be used in all instances.
- Ship speeds in open water remain less than 14 knots.
- Shipping is only carried out during the ice free season. Should ice be encountered, the vessel will either sail around it at a reduced speed or proceed slowly through the ice.
- Tug-barge or ship will remain within defined sea route.
- Tug-barge operations will proceed when there is good visibility from the anchor point of the ships to the spud barge and/or adjust their speed according to the conditions.
- Traffic at the MLA will be coordinated to avoid conflicts and ensure safety.
- Communication between tugs will coordinate movement at the MLA.
- Sabina will provide emergency response equipment and materials as outlined in the OPEP for use by the tug or ship in dealing with spills.
- Crews will follow standard operating procedures and adherence to these will be monitored.
- Tug-barge or ship crews will be trained for responses to hazards that can normally be expected in northern waters.

10. Safety of Persons Using Small Boats

The most likely areas where interactions may occur between small boats and barges-tugs and/or ships/vessels are in Bathurst Inlet, in proximity of the MLA.

Mitigation measures to safeguard the safety of those in small boats will include the following:

- Sabina will inform communities on the shipping activities that can be expected over the ice free shipping season and consults with organizations/individuals mooring or beaching their boats in proximity of the MLA.
- Protocols will be developed to minimize the interaction between barge-tug or ship and small boats.
- Barge-tug or ship will travel at a slow speed when transiting near shore to reduce the wake and not compromise the safety of people travelling in small boats along the shipping route. The slower speed will reduce the wake of the ship while also providing an opportunity for the small boats to move to the side.
- Barge-tug or ship would only travel through the near shore islands and reefs when there is good visibility or adjust their speed according to the conditions. This would allow the ship and the small boats to see one another.
- Barge-tug or ship will restrict themselves to the shipping route thereby not surprising any small boat travelling outside the shipping route.

- The ship will sound its horn if a small boat seems unaware of its presence.
- Sabina, through the Community Liaison Committee, will recommend that all those in small boats wear personal floatation devices.

11. Wildlife Protection Measures

The reaction of marine wildlife to vessel traffic is predicted to not be significant and should not lead to any residual effects (refer to Volume 7, Marine Environment and Impact Assessment).

11.1 INTERACTIONS AND POTENTIAL EFFECTS

Possible interactions between shipping and marine wildlife can have the following potential effects:

- Marine mammals may retreat to the water should a vessel pass too close to an island or reef where they have pulled themselves out of the water.
- The foraging of marine birds and mammals may be interrupted when vessels approach and pass them in the shipping lanes.
- Mammal mortalities may result from collisions with the ship.
- Fuel and/or oil spills could result in mortalities and for marine birds, could lead to the loss of foraging and brood rearing habitat.

11.2 MITIGATION MEASURES

Mitigation measures are outlined in Section 9.1.

As a general mitigation measure and subject to ship safety, Sabina will request that its shipping operators reduce navigation speed when approach areas of high marine wildlife and sea birds concentrations.

Sabina will provide relevant mitigation measures to the shipping companies related to marine birds and marine mammals. This information may be included into the ships SOPEP or other relevant operation procedures.

11.3 MONITORING AND REPORTING

Sabina will discuss with contracted vessel operators the monitoring of marine wildlife. Shipping providers will be encouraged to collect incidental monitoring data during their voyage and to report it to Sabina.

As part of usual bridge-deck procedures, ship personnel could conduct incidental monitoring for marine mammals concurrent with visual observations for other shipping/marine hazards. Wildlife observations can be recorded using a data sheet that include information such as time of sighting, species, distance to animal, as well as photos if possible. Incidental monitoring for seabirds concurrent with visual observations for shipping/marine hazards will be recorded by ship personnel. Significant interactions with seabirds will be recorded.

12. Marine Liability Insurance

Sabina's shipping contractors will carry third party liability insurance as required by Canadian regulations and outlined in Appendix A.

12.1 INSURANCE

The ship owner is responsible for insuring the ship hull and machinery. Sabina will require each ship owner to have in place cargo insurance to satisfy the carrier's responsibilities under the *Canadian Carriage of Goods by Water Act*. In addition there is a requirement for the vessels to have standard Protection and Indemnity insurance covering third party claims, including pollution cover, to satisfy the requirements for clean-up, civil liberty and compensation for pollution as required under Part XVI of the *Canada Shipping Act*.

12.2 COMPENSATION

The *Canada Shipping Act*, under Part XVI provides the authority and the legislative process for addressing Civil Liability and Compensation for Pollution. This section is in compliance with the *International Convention on Civil Liability for Oil Pollution Damage*, concluded in Brussels on November 29, 1669 and as amended by any protocol that is in force for Canada.

The Civil Liability and Compensation section of the *Canada Shipping Act* establishes the responsibility and procedures for polluters to compensate affected parties for liabilities. It further provides for and requires the ship owner to provide a guarantor under a contract of liability insurance or other similar security relating to a ship owner's liability under the *Canada Shipping Act*.

Section 702 of the Act provides the authority to establish the Canadian Ship-source Oil Pollution Fund. In addition, Canada supports the *"Fund Convention"* meaning the *International Convention on the Establishment of an International Fund for Compensation for Oil* concluded in Brussels on December 18, 1971, and the Protocol concluded in London on November 19, 1976.

The Canada Shipping Act through Part XVI establishes the liability of the ship owner for pollution. Section 677 (1) states that the Owner of the ship is liable for the following:

- For oil pollution damage from the ship.
- For costs and expenses incurred by:
  - The Minister of Fisheries and Oceans.
  - A response organization to whom a certificate of designation has been issued pursuant to subsection 660.4(1).
  - Any other person in Canada.
  - Any person in a state, other than Canada, that is a party to the Civil Liability Convention. In respect of measures taken to prevent, repair, remedy or reduce oil pollution damage from the ship, including measures taken in anticipation of a discharge of oil from the ship, to; or
  - The extent that the measures taken and the costs and expenses are responsible, and for any loss or damage caused by such measures; and

- For costs and expenses incurred:
  - By the Minister of Fisheries and Oceans in respect of Measures taken to pursuant to paragraph 678(1) (a) in respect of an monitoring, or in relation to the direction of the taking measures or their prohibition, pursuant to paragraph 678 (1) (b) or (c), or
  - By any other person in respect of measures the person was directed to take, or prohibited from taking, pursuant to paragraph 678 (1) (b) or (c), to the extent that the measures taken and the costs and expenses are reasonable, and for any loss or damage caused by such measures.

Under the Act, the Minister is provided with the authority to take necessary measures, as the Minister deems appropriate. Section 678 (1) states that where the Minister believes on reasonable grounds that a ship has discharged, is discharging or is likely to discharge a pollutant, the Minister may:

- Take such measures as the Minister deems necessary to repair, remedy, reduce or prevent pollution damage from that ship, including the removal or destruction of the ship and its contents, and may sell or otherwise dispose of the ship and its contents.
- Monitor the measures taken by any person to repair, remedy, reduce or prevent pollution damage from the ship; or
- Where the Minister considers it necessary to do so, direct any person to take measures referred to in paragraph (b), or prohibit any person from taking such measures.

Baffinland will continue to develop policies that will provide safe operations and all events will be planned with the intent of reducing, to the greatest degree possible, accidental discharges.

12.3 IDENTIFICATION OF THIRD-PARTY LIABILITIES

Section 712 of Part XVI of the *Canada Shipping Act* provides the instrument for claims for loss of income due to a pollution event for:

- An individual who derives income from:
  - Fishing
  - The production, breeding, holding or rearing of fish; or
  - The culture or harvesting or marine plants.
- The owner of a fishing vessel who derives income from the rental of fishing vessels to holders of commercial fishing licenses issued in Canada.
- An individual who derives income from the handling of fish on shore in Canada directly after the landing thereof from fishing vessels.
- A person who fishes or hunts for food or animal skins for his own consumption or use.
- A person who rents or charters boats in Canada for sport fishing; or
- A worker in a fish plant in Canada.

A person affected as a result of a discharge of oil from a ship and whose losses are not recoverable otherwise under any other law, may, within a prescribed time limit, file a claim with the Administrator for past or future loss.

Identifiable third party liabilities related to shipping include:

- The Hamlets of Cambridge Bay and Kugluktuk in the event of spill in Bathurst Inlet that adversely impact the marine environment.
- The hunters and trappers should a ship or tanker run aground and adversely impact the marine environment in spilling fuel or other chemicals into the marine environment.

13. Marine Security

13.1 MARINE SECURITY PLAN

Once Project Approval is granted, Sabina will develop a Marine Security Plan per the requirements of the *Marine Transportation Security Act*. Refer to Appendix A, Section 2.2.1 for the requirements of this Plan.

13.2 SMUGGLING PREVENTION AND POLICING

Smuggling, particularly alcohol and prohibited substances, could have negative socio-economic effects on the community. Measures to prevent smuggling will include:

- The crew of the ship will not be allowed to take any tobacco or alcohol ashore.
- Any crew member under the influence of alcohol or attempting to take alcohol ashore will be disciplined by the ship's Master.
- Sabina MLA security will send any crew member having alcohol back to the ship for disciplinary action or refer the matter to the Royal Canadian Mounted Police (RCMP) if prohibited substances are involved.

While it is anticipated that the RCMP will not be involved in security matters, all criminal activities or matters of a grave nature will be referred to the RCMP in Cambridge Bay.

14. Adaptive Management

The Shipping Management Plans will be reviewed on an annual basis and revised/updated as required.

References

Sabina, *Draft Environmental Impact Statement for the Back River Project*, January 10, 2014

Transport Canada, Transport Canada's Written Submission to The Nunavut Impact Review Board Respecting: Baffinland Iron Mines Corporation's Mary River Project, Final Environmental Impact Statement, NIRB File #08MN053, June 11, 2012

AEM, Meliadine Gold Project, *Shipping Management Plan* (SD 8-1), March 2013

Appendix A

Shipping Regulatory Framework

Sabina
GOLD & SILVER CORP.

Appendix A. Shipping Regulatory Framework

The following Appendix presents selected extracts from Transport Canada's presentation at the Nunavut Impact Review Board (NIRB) Final Hearing for Baffinland Iron Mines Corporation's Mary River Project.

This presentation provides an overview of the regulatory framework with respect to shipping activities in Canada, the responsibilities of the shipping companies and the role of Transport Canada as the lead agency for enforcement of the regulatory regime.

The original document can be consulted in its entirety on the NIRB's public registry.

Transport Canada's written submission to the Nunavut Impact Review Board respecting:

Baffinland Iron Mines Corporation's Mary River Project
Final Environmental Impact Statement
NIRB File #08MN053
June 11, 2012

EXECUTIVE SUMMARY

This submission summarizes Transport Canada's mandate, roles and responsibilities, including those defined by relevant conventions, legislation, regulations and policies. Specific detail is provided related to marine transportation safety and security, rail transportation safety, transportation of dangerous goods and aviation safety. Although the transportation safety regime described is broader than the scope of the Final Environmental Impact Statement, this information provides important context for the consideration of the potential environmental impacts of the proposed project.

Transport Canada's submission responds to the Nunavut Impact Review Board (NIRB) letter of May 10, 2012 requesting information with respect to areas falling within Transport Canada's mandate, notably relating to the regulatory and enforcement regime for marine shipping, ballast water management and the overwintering of fuel barges/vessels. The Department will be providing its discussion paper on the practice of overwintering of fuel barges/vessels in Arctic waters to the NIRB in an addendum to this submission by the end of June 2012.

2.1 MARINE TRANSPORTATION SAFETY

The *Constitution Act,* 1867 grants the federal government exclusive legislative jurisdiction over navigation and shipping, coastal fisheries, and aids to navigation such as beacons, buoys, and lighthouses.

The following is an overview of the laws that govern marine shipping activities in Canada and Transport Canada's responsibilities, highlighting those laws that govern marine safety and environmental protection in the North.

These federal laws and regulations aim to promote marine safety, prevent pollution, provide a framework to respond to incidents, and address related liabilities and compensation issues. Transport Canada has the federal lead in regulating shipping. However it recognizes that other federal agencies

and departments, such as Fisheries and Oceans Canada, the Canadian Coast Guard and Environment Canada, have distinct but interrelated responsibilities for the management of marine transportation safety and environmental protection in the Arctic. Transport Canada works with these federal agencies and department to establish the regulatory framework and mechanisms which provide a coherent and consistent approach to aspects of marine transportation safety and environmental protection.

The list below names the principal statutes, relevant to the Project, which Transport Canada enforces to help ensure that marine transportation is safe, secure and environmentally responsible. They will be discussed further in this section to provide context for later sections of this submission.

- *Canada Shipping Act, 2001* (http://www.tc.gc.ca/eng/acts-regulations/acts-2001c26.htm).
- *Arctic Waters Pollution Prevention Act* (http://www.tc.gc.ca/eng/acts-regulations/acts-1985ca-12.htm).
- *Marine Liability Act* (http://www.tc.gc.ca/eng/acts-regulations/acts-2001c6.htm).
- *Coasting Trade Act* (http://laws-lois.justice.gc.ca/eng/acts/C-33.3/).
- *Navigable Waters Protection Act* (http://laws-lois.justice.gc.ca/eng/acts/N-22/).
- *Marine Transportation Security Act* (http://www.tc.gc.ca/eng/acts-regulations/acts-1994c40.htm).

In the Arctic, three of these Acts combine to provide Canada's operational regulatory regime governing marine safety and environmental protection issues: the Canada Shipping Act, 2001, the *Marine Liability Act*, and the *Arctic Waters Pollution Prevention Act*.

The CSA 2001 provides an overall regime to protect safety and the environment for vessels operating in Canadian jurisdiction – waters out to the 200 nautical mile limit. Its regulations include requirements for a vessel's construction, how it manages ballast water, its pollution control equipment, arrangements for emergency response, and its crew qualifications. The AWPPA provides enhanced protection for vessels operating in Canadian jurisdiction north of 60° north latitude. It provides specific construction standards for vessels engaged in Arctic shipping, a system of shipping safety control zones, a ban on discharges of oil, hazardous chemicals, and garbage, and requirements for vessels to carry insurance to cover damages from any these discharges. The *Marine Liability Act* sets out a regime that requires vessels operating in Canadian jurisdiction to carry insurance to pay for damages from oil spills. In the event of a conflict between the AWPPA and the *Marine Liability Act*, the latter applies. All three of these Acts are implemented based on the —polluter pay principle.

The *Coasting Trade Act* (CTA) supports domestic marine interests by reserving the coasting trade of Canada to Canadian registered ships, with limited exemptions. The *Navigable Waters Protection Act* sets out a regime to approve works built in, on, over, under, through or across navigable water in Canada.

The *Marine Transportation Security Act* sets out a regime to protect and preserve the efficiency of Canada's marine transportation system against unlawful interference, terrorist attacks or use as a means to attack our allies.

2.1.1 *Canada Shipping Act, 2001*

The CSA 2001 is the principal statute that governs safety in marine transportation and protects the marine environment. The CSA 2001 seeks to balance shipping safety and marine environment protection while encouraging maritime commerce. The CSA 2001 applies to all vessels operating in

Canadian waters and Canadian vessels worldwide. No special permission or authority is required for transporting goods by vessels that comply with the CSA 2001.

The objectives of the CSA 2001 are to:

- Protect the health and well-being of people, including crews of vessels who participate in marine transportation and commerce.
- Promote safety in marine transportation and recreational boating.
- Protect the marine environment from damage caused by navigation and shipping activities.
- Develop regulations that encourage viable, effective and economical marine transportation and commerce.
- Promote an efficient marine transportation system.
- Develop regulations that encourage the viable, effective and economical use of Canadian waters by recreational boaters.
- Ensure that Canada can meet its international obligations under bilateral and multilateral agreements related to navigation and shipping.
- Encourage harmonized marine practices.
- Establish an effective inspection and enforcement program.
- Establish and maintain an oil spill preparedness and response regime.

In addition to national requirements, the CSA 2001 and its regulations implement in whole or in parts many international conventions enforced on Canadian vessels trading internationally and on foreign vessels in Canadian waters.

Shipping is an international activity. At any given time, many vessels in Canadian waters are foreign-flagged. That is why we have tools for regulating foreign vessels to protect our marine environment and to ensure the safe and efficient operation of our ports and waterways. International organizations such as the International Maritime Organization (IMO) and the International Labour Organization (ILO) play a central role in setting the highest maritime standards possible for shipping safety and security as well as protecting the environment and seafarers. Canada works closely with these organizations so we can adopt these international standards into our marine safety regulations.

The IMO is a specialized agency of the United Nations that focuses on improving safety and security at sea and preventing pollution from vessels. The IMO also deals with international aspects of liability and compensation and promotes maritime commerce. To achieve these objectives, the 169 IMO Member States develop and promote the adoption of conventions, protocols, codes and recommendations concerned with these issues. Canada has ratified or agreed to IMO conventions on safety, collision prevention, pollution prevention, crewing and oil spill response, and is enforcing them through safety and environmental standards set out in the CSA 2001.

Canada also contributed to the safety of seafarers by ratifying the ILO's Maritime Labour Convention, 2006. The Convention sets out seafarers' rights to decent work conditions and helps to create conditions of fair competition for shipowners. Marine safety and pollution prevention measures set out in the CSA 2001 and its regulations include:

- Establishing vessel traffic services (VTS) zones.

- Reporting vessel movements.
- Establishing vessel routing measures where warranted.
- Setting vessel design and construction requirements, including double-hull requirements for tankers.
- Setting crew qualifications and training requirements.
- Adopting the International Safety Management Code.
- Setting controls to prevent pollution and manage ballast water.

The Canadian Coast Guard's Marine Communications and Traffic Services (MCTS) monitor coastal vessel traffic. The Canadian Coast Guard works with Transport Canada on notification. The Northern Canada Vessel Traffic Services Zones Regulation (NORDREG) is one reporting system for vessels in the Arctic. All vessels of 300 tons gross tonnage or more, vessels towing or pushing with combined gross tonnage of 500 tons or more, and all vessels carrying pollutants or dangerous goods as cargo, or towing or pushing a vessel carrying pollutants or dangerous goods must report their identity, destination, route, information on pollutants on board, and any defects 24 hours before entering the VTS zone that extends along Canada's coastal waters. This information helps promote safe and efficient navigation and environmental protection and allows any safety or environmental concerns to be addressed before the vessel enters Canadian waters.

Transport Canada is the lead federal regulatory agency responsible for the National Marine Oil Spill Preparedness and Response Regime. Part 8 of the CSA 2001 and its regulations and standards govern the regime, which is built upon the polluter-pay principle that makes the polluter liable for reasonable response costs associated with an oil spill. Canada, as an active member of the IMO, has acceded to a number of international conventions that support the regime, such as the International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC Convention) – the regime reflects this convention. Transport Canada sets the guidelines and regulatory structure for the preparedness and response to marine oil spills incidents.

Part 8 of the CSA 2001 sets out the preparedness and response regime. Part 8 and its regulations require oil handling facilities (OHFs), such as the Proponent's proposed port facilities for the Project, to have emergency plans and prevention plans. OHFs south of 60° are required to have arrangements with a Transport Canada certified oil spill response organization prior to commencement of operations. Currently, there is no response organization present in the Arctic. Response services north of 60° north are the responsibility vessel and OHF owners and operators and fall under the mandate of the Canadian Coast Guard.

Transport Canada works with stakeholders through a network of six Regional Advisory Councils (RACs) to monitor and continually improve the administration of Part 8 of the CSA 2001. The RAC for the Prairie and Northern Region is the Arctic Regional Advisory Council. Each council has seven members, who provide a cross-representation of people, groups and companies whose interests could be affected by spills. The role of each RAC is to address areas of mutual concern and to advise the Minister of Transport on issues related to the Regime in Part 8.

There is a designated lead agency for every type of environmental emergency. The Canadian Coast Guard is the lead agency for the Government of Canada response to ship-source and mystery marine spills; and other federal agencies assist. For example, Environment Canada will provide the Canadian Coast Guard with expert environmental advice to ensure an appropriate response to the incident. When the polluter is unknown, unwilling or unable to respond, the Canadian Coast Guard will manage the response.

When the polluter is known, willing and able to respond, the Canadian Coast Guard will advise the polluter of the latter's responsibilities. Once satisfied with the polluter's intentions and plans, the Canadian Coast Guard will monitor the polluter's response and provide advice and guidance as required.

Part 9 of the CSA 2001 sets controls to prevent pollution and to manage ballast water. Under this Part, the Vessel Pollution and Dangerous Chemicals Regulations set standards for vessel construction and onboard management to prevent pollution from oil, hazardous chemicals, sewage, garbage, and air emissions. For details see http://laws-lois.justice.gc.ca/eng/regulations/SOR-2012-69/index.html

These Regulations also require pollution incidents, or threats that pollution may be released, to be reported when observed by vessels or oil handling facilities. The provisions of these Regulations related to discharges of oil, chemicals, sewage and garbage do not apply in Arctic waters, as they are governed by the AWPPA.

As well, the Ballast Water Control and Management Regulations apply to all vessels entering Canadian waters, including the Arctic. These Regulations require vessels to manage their ballast water by either:

- Exchange at sea 200 nautical miles off shore in waters at least 2,000 m deep.
- Treatment on board to standards specified in the Regulations.
- Offloading ballast water to port for treatment.
- Retention on board and not discharging ballast water in Canada.

These Regulations also require ships to report on the ballast water management in advance of entering Canadian waters and keep a ballast water management plan and record book. For details see http://laws-lois.justice.gc.ca/eng/regulations/SOR-2011-237/index.html.

Monitoring Compliance under the CSA 2001

Transport Canada monitors compliance with the CSA 2001 and enforces its requirements. Transport Canada has three main programs for monitoring compliance: Flag State Control (FSC), Port State Control (PSC), and the National Aerial Surveillance Program (NASP).

Flag State Control ensures that Canadian-flagged vessels are inspected to Canadian regulations and, for vessels on international voyages, the appropriate international memoranda, conventions and protocols that are integrated into Canadian regulations. It is also responsible for taking all other steps necessary to fully enforce these regulations and ensure that a Canadian vessel is fit for its intended service.

Port State Control is a vessel inspection program whereby foreign vessels entering a sovereign state's waters are boarded and inspected to ensure compliance with various major international maritime conventions. The IMO and the ILO provide the regulatory framework for the PSC program.

Canada works with the global PSC community to verify that foreign vessels entering their waters comply with strict international safety, security and anti-pollution standards. Vessels that are found to be in serious violation of standards are detained in port until their deficiencies are addressed. The objective of PSC is to detect and inspect sub-standard vessels and help eliminate the threat that they pose to life, property and the marine environment.

Transport Canada monitors vessels transiting waters under Canadian jurisdiction through its National Aerial Surveillance Program. NASP regular aerial surveillance has greatly reduced oil discharges nationally because potential polluters are aware that:

- Canada has increased its surveillance over all waters under Canadian jurisdiction.
- The NASP gathers evidence that can be used to help prosecute marine polluters.

Enforcement under the CSA 2001

Transport Canada has a compliance and enforcement program that works to achieve CSA 2001's objectives. Marine Safety Inspectors conduct both random and targeted inspections of Canadian and foreign vessels in Canadian waters on a risk-management basis to ensure they comply with the CSA 2001 and its regulations. When they detect a problem, Transport Canada can use a number of enforcement tools ranging from warnings, to Administrative Monetary Penalties, to prosecutions. The choice of enforcement tool depends on:

- How severe the violation is.
- If the violation was deliberate.
- If the alleged violator was a previous offender.

Transport Canada maintains a Policy on Compliance and Enforcement of the *Canada Shipping Act*, 2001 (TP 13585) that can be accessed at: http://www.tc.gc.ca/eng/marinesafety/tp-tp13585-policy-ce-csa2001-1356.htm

2.1.2 *Arctic Waters Pollution Prevention Act*

While the provisions of the CSA 2001 and its associated regulations apply in all Canadian waters, vessels in Arctic waters north of 60° north and out to the 200 nautical mile limit of Canada's Exclusive Economic Zone, are also subject to the provisions of the AWPPA. There is one notable exception to provisions in the Arctic compared to elsewhere in Canada: discharge limits. The AWPPA prohibits discharges of oil, chemicals, garbage and other wastes generated onboard vessels, except untreated sewage which may be discharged. The AWPPA is based on the polluter pays principle. The following key regulations support the AWPPA:

- The Arctic Shipping Pollution Prevention Regulations which set requirements for how vessels operating in Arctic waters must be built and details conditions of the no-discharge regime. These regulations also establish vessel control systems for preventing a vessel from operating in ice conditions which exceed its capability.
- The Arctic Waters Pollution Prevention Regulations which include a civil liability regime for vessels to ensure there is insurance to cover damages should deposits of wastes occur.

Vessel Control Systems

Two vessel control systems are established under the Arctic Shipping Pollution Prevention Regulations – the Zone/Date System and the Arctic Ice Regime Shipping System – provide for operational safety by taking into account the vessel's capability to operate safely in ice by virtue of ice strengthening, and the ice conditions it will encounter.

Zone/Date System

Under the Zone/Date System, Canadian Arctic waters are divided into 16 shipping safety control zones. A vessel is allowed to operate in a particular zone between the dates that correspond to its ice class. Zone boundaries were established using analysis by the National Research Council of ice conditions over many years. Zone numbering indicates the relative severity of ice conditions from Zone 1, the most severe, to Zone 16.

Arctic Ice Regime Shipping System (AIRSS)

The AIRSS System was developed as an alternative to the Zone/Date System and provides a more flexible framework for decision-making based on actual ice conditions. Vessels using AIRSS are required to have an experienced ice navigator on board. The ice navigator uses currently available ice information to plan a preliminary route. While underway, decisions on whether to proceed are made based on a calculation that takes into account both the vessel's ice strengthening and observations from the bridge of actual ice conditions.

A pictorial guide that explains AIRSS and its application in greater detail is available at http://www.tc.gc.ca/media/documents/marinesafety/tp14044e_airss_guide.pdf.

For details on the AWPPA and its regulations, see http://laws-lois.justice.gc.ca/eng/acts/A-12/.

For details on Marine Safety programs for the Arctic, see http://www.tc.gc.ca/eng/marinesafety/debs-arctic-menu-303.htm.

Enforcement

Pollution Prevention Officers (PPOs) designated under the AWPPA conduct risk-based inspections of Canadian and foreign vessels in Canadian waters as a means to monitor compliance with the Act and its regulations. When a designated PPO suspects that a vessel fails to comply with a standard prescribed by the regulations or that a vessel is about to or has entered a zone in contravention of the regulations, the Officer may direct the vessel to proceed outside of a zone, remain outside of a zone or proceed to anchor as justified in the interests of safety. In more serious situations, a PPO may, with the consent of the Governor in Council, seize the vessel, or may consider charging the vessel with an offence under the Act.

2.1.3 *Marine Liability Act*

The *Marine Liability Act* was adopted in 2001 and later amended in 2009. It is the principal legislation dealing with the liability of shipowners and vessel operators in relation to passengers, cargo, pollution and property damage. It establishes uniform rules on liability and compensation by balancing the interests of shipowners and other parties involved in maritime accidents.

Under the *Marine Liability Act*, all vessels over 1000 gross tonnage must have adequate insurance to pay for damages that would result from a bunker oil spill. This requirement stems from the IMO's International Convention on Civil Liability for Bunker Oil Pollution Damage, 2001 (Bunker Convention), which deals with bunker oil spills from vessels carrying oil as fuel for their propulsion or operation. In addition, ships that can carry more than 2000 tonnes of oil as cargo must also have adequate insurance under the IMO's International Convention on Civil Liability for Oil Pollution Damage, 1992 (Civil Liability Convention or CLC), which deals with oil spills from ships (i.e., tankers) carrying oil as cargo. A vessel over 1,000 gross tonnage and a tanker carrying more than 2,000 tons of oil must have its insurance coverage certified in order to operate in Canada.

For Canadian vessels, or vessels registered in countries that are not party to one of the two liability conventions, Transport Canada can issue certificates. Foreign vessels registered in countries that are party to these conventions would be certified by those countries. For details, see http://www.tc.gc.ca/eng/marinesafety/oep-environment-liability-menu-365.htm

2.1.4 *Coasting Trade Act*

The coasting trade refers to Canada's domestic marine trade. It includes the carriage of goods and passengers between Canadian points and other marine activities of a commercial nature. The CTA

supports domestic marine interests by reserving the coasting trade of Canada to Canadian registered ships, with limited exemptions. The legislation provides an administrative process to temporarily import a foreign vessel under a coasting trade license when a suitable Canadian registered vessel is not available.

The Proponent's submission indicates that the ore vessels will be foreign flagged, however, since these vessels will not be carrying passengers or cargo between ports in Canada they will not be engaged in the coasting trade. Conversely other vessels providing marine services to the mine will be subject to the CTA when carrying goods or passengers from places in Canada to the mine or when engaged in other marine activities of a commercial nature in Canadian waters.

2.1.5 *Navigable Waters Protection Act*

Transport Canada's Navigable Waters Protection Program (NWPP) administers the NWPA, the federal law designed to protect the 'public right to navigate'. The NWPA applies to all navigable waterways in Canada, both inland and coastal, extending out 12 nautical miles offshore.

The NWPP regulates works to ensure a balance between the public's right to navigate and the need to build works. Specifically, the NWPP:

- Regulates certain works built or placed in, on, over, under, through or across any navigable water in Canada.
- Removes obstructions to navigation, such as wrecks or sunken vessels, as well as unauthorized works.
- Imposes appropriate terms and conditions required for safe navigation during and/or on completion of the construction of works.

The NWPA defines a work as any man-made structure, device or thing, whether temporary or permanent, that may interfere with navigation and any dumping of fill in any navigable water, or any excavation of materials from the bed of any navigable water, that may interfere with navigation.

As a result, section 5 of the NWPA applies to all works that are proposed to be built or placed in, on, over, under, through, or across any navigable water. New works may require an approval under Section 5 of the NWPA before they can be built or placed.

Approvals issued under subsection 5(2) are for works that substantially interfere with navigation. Subsection 5(2) of the NWPA states,

> *"If the Minister considers that the work would substantially interfere with navigation, the Minister may impose any terms and conditions on the approval that the Minister considers appropriate, including requiring that construction of the work be started within six months and finished within three years of the day on which approval is granted or within any other period that the Minister may fix."*

Approvals issued under subsection 5(3) are for works that interfere with navigation other than substantially. Subsection 5(3) of the NWPA states,

> *"If the Minister considers that the work would interfere, other than substantially, with navigation, the Minister may impose any terms and conditions on the approval that the Minister considers appropriate, including requiring that construction of the work be started and finished within the period fixed by the Minister."*

Substantial interference means that the proposed work will significantly alter the way that vessels pass down a navigable waterway or may make passage dangerous to the public. As indicated above, Transport Canada can apply appropriate terms and conditions to both subsection 5(2) and subsection 5(3) approvals to protect and maintain the public's right to navigate.

The regulatory process for subsections 5(2) and 5(3) approvals differ. Before issuing a subsection 5(2) approval, the NWPP will direct the local authority, company or individual to provide notice of the proposed construction and the deposit of the plans by advertising in the Canada Gazette and in one or more newspapers published in or near the place where the work is to be constructed. This allows the public and stakeholders to provide input on the potential navigational concerns related to a proposed work. The NWPP will consider all navigational comments received when determining the appropriate terms and conditions to protect navigation.

For more information about Transport Canada's NWPP, and a link to the electronic application form, see http://www.tc.gc.ca/eng/marinesafety/oep-nwpp-menu-1978.htm.

2.1.6 Relevant Transport Canada Marine Transportation Programs and Proponent Obligations

The following section describes Transport Canada's marine transportation regulatory programs that are relevant and the Proponent's responsibilities to meet these regulatory requirements. These include programs related to vessel safety, security, pollution prevention, pollution response, marine liability and compensation, and navigable waters. This section also outlines the steps the Proponent will be required to take under Transport Canada's legislation prior to commencing operation if the project is approved.

Observations are provided where appropriate, based on the information made available to Transport Canada through the NIRB Review Process. It is understood that more detailed information will be brought forward by the Proponent as it develops its detailed project design.

Port State Control Program

According to the Proponent, some vessels calling on the Project will be foreign-flagged (e.g., any large equipment shipments will most likely come from Europe so they will be foreign flagged), and therefore will be subject to oversight by the PSC Program. For PSC inspections, Transport Canada applies a risk based inspection program when determining which vessels will require inspection services.

Additionally, all foreign tankers chartered by the Proponent will be subject to PSC inspections under the following terms:

- Vessels are targeted for inspections based on risks they may pose and intelligence received on deficiencies.
- Vessels more than 12 years old calling on the Project will undergo expanded inspections.

Foreign vessels that do not meet safety standards may be detained until their deficiencies have been rectified.

Transport Canada maintains an inspections database and a list of detained ships, which in turn feed into the two international databases. This will allow Transport Canada to apprise the Proponent of any substandard vessels, if they may be considering chartering or utilizing such vessels in support of this Project. See http://www.tc.gc.ca/eng/marinesafety/oep-inspection-psc-menu-1120.htm.

Flag State Control Program

Canadian flagged vessels will be inspected and certified under the FSC Program. For details see, http://www.tc.gc.ca/eng/marinesafety/dvro-fsc-menu-1741.htm.

Safety Management Systems

The Safety Management Regulations of the CSA 2001 provide the legal basis for Safety Management Systems (SMS). The Regulations incorporate the requirements of the International Safety Management Code, which provides an international standard for safely managing and operating vessels and for preventing pollution.

SMS are formal management systems that strengthen safety awareness and pollution prevention practices. SMS integrates formal rules and processes to enhance safety into daily operations and seeks to identify and manage any risks before they turn into accidents. In short, SMS allows vessel owners and operators to have a safety system that prepares them for the realities of day-to-day work and that meets safety management regulatory requirements.

SMS is an independent safety requirement. It does not replace safety requirements under other regulations. It also does not remove the requirement for a vessel to be inspected and carry Canadian Maritime Documents (CMDs).

Five Responsible Organizations authorized by the Minister of Transport perform the SMS certification of Canadian vessels and the companies that operate them, as the companies are legally required to comply with the regulations. Transport Canada monitors and oversees the audit and certification process for the International Safety Management Code as part of its responsibilities under international shipping treaties.

The Safety Management Regulations apply to Canadian convention vessels. A convention vessel is one to which international conventions apply. Transport Canada oversees and enforces compliance with these regulatory requirements.

Canadian convention vessels involved in the Project must comply with the Safety Management Regulations. For details on SMS, see: http://www.tc.gc.ca/eng/marinesafety/dvro-4067.htm.

Navigation Safety

There are several regulations under the CSA 2001 that help to ensure vessels can navigate safely in Canadian waters. Vessels must have the appropriate navigation equipment, follow navigational rules and procedures, and have effective means of communications for safety. For example, vessels must follow international regulations for preventing collisions at sea, which include a requirement to proceed at a safe speed at all times. Vessels must also have up-to-date nautical charts and, for each voyage, a passage plan that takes into account relevant information for safe navigation and protection of the environment and that will ensure the progress of the vessel can be closely monitored. There are vessel reporting requirements and vessel routing measures that also help ensure safe navigation.

Specific challenges regarding the Canadian Arctic include navigation in ice infested waters, limited charting information, and limited marine infrastructure.

Navigation and Radio Communications Equipment

Foreign cargo vessels in Canadian waters must be equipped with navigation and radio communications equipment as set out in international requirements. Each item of equipment must also meet detailed

international standards. To ensure compliance, vessels are subject to regular inspections and must have valid inspection certificates that show the vessel's navigation equipment (Cargo Ship Safety Equipment Certificate) and radio equipment (Cargo Ship Safety Radio Certificate) meet all requirements. For more details, see http://www.tc.gc.ca/eng/marinesafety/oep-navigation-safety-menu-724.htm.

Places of Refuge

Canada has a National and Regional Places of Refuge Contingency Plan (PORCP) that applies to all situations where a vessel needs assistance and requests a place of refuge within waters under Canadian jurisdiction. This includes Canada's internal waters, territorial sea and the Exclusive Economic Zone. Note that this is for when a vessel reports a malfunction or other defect. When life is at risk, established search and rescue procedures are followed. The PORCP is based on the IMO's Guidelines on Places of Refuge for Ships in Need of Assistance.

The PORCP involves cooperation between Transport Canada, which is the lead agency, and the Canadian Coast Guard, which is responsible to ensure an appropriate response to ship-source pollution spills. In cases where vessel damage has resulted in the discharge of a pollutant or there is an imminent threat of a discharge of a pollutant, the PORCP would be followed, along with current response procedures and contingency plans. In urgent situations, the PORCP is followed to the extent possible given the time available for making decisions.

Transport Canada's Prairie and Northern Region has developed a draft Place of Refuge Plan, and will be implementing it in the near future.

In the event of an incident, when a vessel requests assistance through the MCTS, regional officers would invoke the plan and work with all appropriate partners to resolve the issue as quickly and effectively as possible.

The vessels involved in the Project will be required to meet all appropriate navigational equipment, routing, collision and reporting regulatory requirements. Compliance will be monitored and enforced through existing compliance and enforcement programs.

<u>Seafarers Certification/Crewing</u>

To achieve the desired level of marine safety, it is essential that properly trained, qualified and competent ship officers and crew operate Canadian vessels. This requirement is addressed under both the CSA 2001 and the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers.

Transport Canada is responsible for developing and updating regulations, examinations, and training standards for the certification of seafarers, including medical fitness. Transport Canada also issues Certificates of Competency to seafarers after they have successfully completed a certificate's prerequisites and examinations. Transport Canada keeps complete records on all seafarers who are candidates or recipients of these certificates.

All vessels involved in the Project, if under the Canadian flag, must comply with the Marine Personnel Regulations Part 1 Certification and Part 2 Crewing.

Canadian seafarers must follow an approved training course or an approved training program, or enroll in an approved cadet training program in either navigation or marine engineering depending on the certificate sought.

Transport Canada Publication TP 2293 —Examination and Certification of Seafarers‖ provides details relevant to each certificate a Canadian seafarer must complete (http://www.tc.gc.ca/eng/marinesafety/tp-tp2293-menu-2254.htm). These training courses and programs are approved by Transport Canada.

Foreign vessels are required to meet the requirements of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers and the requirements specified in Part 2 of the Marine Personnel Regulations for foreign vessels.

National Marine Oil Spill Preparedness and Response Regime

As noted, Transport Canada is the lead federal regulatory agency responsible for the National Marine Oil Spill Preparedness and Response Regime. As such, Transport Canada:

- Provides regime management and oversight.
- Develops regulations and standards relative to Part 8 of the CSA 2001.
- Applies and enforces regulations relating to response organizations.
- Applies and enforces regulations relating to OHFs.
- Oversees an appropriate level of national preparedness.
- Monitors marine activity levels, and makes adjustments to the Regime, as required.
- Monitors and prevents marine oil spills through the NASP.
- Sets up the Regional and National Advisory Councils.
- Provides post-mortem reporting for oil spill response exercises and incidents, both nationally and internationally. This helps improve the Regime by ensuring that the recommendations and/or lessons learned are considered and adopted as appropriate.

Transport Canada has created a National Review Board made up of regional Transport Canada representatives to ensure that Part 8 of the CSA 2001 is adopted and applied consistently across Canada as well as to ensure all regions have appropriate response capability. A representative from Transport Canada's Prairie and Northern Region is part of the National Review Board and continually monitors the region's response capability.

Transport Canada has an Environmental Prevention and National Response Preparedness Plan that lays out the overall framework for the nation's preparedness capacity to combat marine oil pollution incidents in Canada. Similarly, the Canadian Coast Guard has a National Response Plan that identifies how it will manage the response to a marine oil spill, including deploying personnel and response resources.

Spill Response Procedures

Canada's Marine Oil Spill Preparedness and Response Regime and the AWPPA are based on the polluter-pays principle. The polluter is responsible for appointing an On-Scene Commander and managing the response to a spill. The Canadian Coast Guard monitors the overall response to ensure that it is effective, timely, and appropriate to the incident. The Regional Environmental Emergencies Team, chaired by Environment Canada, provides the On-Scene Commander with technical advice about environmental priorities and scientific or other regional concerns related to the incident. The Canadian Coast Guard becomes the On-Scene Commander during an incident if the polluter is unable to respond, unwilling to take action, or unknown.

For this Project, the Proponent will be required to ensure it adheres to all requirements under CSA 2001, AWPPA, and the Vessel Pollution and Dangerous Chemicals Regulations.

Oil Handling Facility Regulatory Inspection and Compliance

The CSA 2001 and its regulations and standards require potential polluters to maintain a minimum level of preparedness at all times. Prescribed OHFs must each have onsite emergency and prevention plans, equipment, personnel, and training that allow them to deploy an immediate response in the event of an oil spill. Transport Canada's regional Pollution Prevention Officers enforce the OHF regulations by reviewing their plans, inspecting the facilities and response resources to ensure compliance with the CSA, 2001.

Pollution Liability and Compensation

The AWPPA and its associated regulations establish liability limits and insurance requirements to cover damages caused by the deposits of waste in Arctic waters. However, in the event of any inconsistency between the AWPPA and the *Marine Liability Act*, the provisions of the *Marine Liability Act* prevail over provisions of the AWPPA, as detailed in section 2.1 of the AWPPA.

The *Marine Liability Act* is based on the polluter-pays principle. There are various regimes available to pay for cleanup and compensation costs, such as shipowners' insurance and domestic and international funds. A single oil pollution incident may draw compensation from multiple regimes. Table A-1 below describes the liability and compensation framework for ship-sourced oil spills in Canada.

Table A-1. Liability and Compensation for Ship-Sourced Oil Spills in Canada

Persistent Oil Spill (crude oil, fuel oil, etc. carried in tankers)	**Bunker Oil Spill (used to propel/operate non-tankers)**	**Spill of Other Pollutants (i.e., refined oil, etc.)**
Shipowner strictly liable under the 1992 *Civil Liability Convention* Compulsory insurance certified by states Separate and higher limits of liability	Shipowner strictly liable under the 2001 *Bunkers Convention* Compulsory insurance certified by states General limits of liability	Shipowner only liable under *Marine Liability Act* No compulsory insurance General limits of liability
Access to international compensation funds: • 1992 Fund • Supplementary Fund Access to domestic compensation fund: Ship-Source Oil Pollution Fund	Access to domestic compensation fund: Ship-Source Oil Pollution Fund	Access to domestic compensation fund only if the substance is oil: Ship-Source Oil Pollution Fund
Total amount of compensation available: **approx. $1.35 billion**	Total amount of compensation available: **approx. $250 million**	Total amount of compensation available for largest ships: **approx. $100 million**

For the Project, bunker oil would be used as fuel by the vessels carrying the ore to markets or bringing supplies to the mine. Persistent oil would include heavy fuel oil or heavy diesel oil. Should the diesel used as fuel for the operation of the mine be considered a non-persistent oil (i.e., a lighter fuel that distills like gasoline), the CLC would not apply to spills from tankers supplying the Project.

The Proponent's shipping service provider will be required to ensure compliance with the *Marine Liability Act* and all requirements pertaining to insurance and liability coverage for their vessels operating in support of this project.

Marine Liability Act

As indicated in Section 2.1.3 above, the *Marine Liability Act* is the principal act that governs all matters of civil liability for maritime claims and sets out the various regimes that provide compensation for pollution damage from ships. These are included in Parts 6 and 7 of the *Marine Liability Act*, which determine to what extent shipowners are liable for pollution damage and what other forms of compensation are available to claimants.

The *Marine Liability Act* incorporates both international and domestic law and provides for various levels of liability depending on the substance causing the pollution damage and the type of ship involved in an incident.

Shipowners' Liability

The liability of ships carrying persistent oils in bulk (such as tankers) is governed by the IMO's Civil Liability Convention. Canada ratified and adopted it in Part 6 of the *Marine Liability Act*. The CLC covers any persistent hydrocarbon mineral oil such as crude oil, fuel oil, heavy diesel oil and lubricating oil, whether it is carried onboard a ship as cargo or as bunker oil.

The CLC imposes strict liability on the shipowner for oil pollution from his ship, subject to a limited number of defenses. In exchange, shipowners are entitled to limit their liability to a maximum amount linked to the tonnage of the vessel. To ensure that victims are protected, the CLC requires that shipowners carry insurance to cover the full amount of their liability. This insurance provides for direct action by claimants against the insurer and is certified by state parties to the CLC, such as Canada. The insurance is usually provided by Protection and Indemnity Association (P&I Clubs), which are mutual associations of shipowners insuring third party risks. Transport Canada issues certificates of financial responsibility or insurance once it receives evidence of adequate insurance from the shipowner. These certificates are issued to Canadian-registered tankers and to those registered in a state not party to the CLC and must be carried onboard the tanker. The maximum liability for shipowners under the CLC for the largest tankers is 89.770 million Special Drawing Right (SDR)2 or approximately $145 million per incident.

Spills of bunker oil from ships other than tankers are covered by the Bunkers Convention. This is another IMO instrument that Canada has ratified and implemented in the *Marine Liability Act*. Bunker oil is used for propelling and operating most seagoing ships, such as bulk carriers, general cargo ships, container ships, barges, passenger ships, and tugs. The Bunkers Convention is similar to the CLC in that it imposes strict liability for shipowners up to a limit linked to the vessel's tonnage. Under the Bunkers Convention, all ships over 1,000 gross tonnage must have the appropriate insurance coverage and similarly to the CLC above, this is certified by state parties to the Bunkers Convention. Upon receipt of proof of adequate insurance, Transport Canada issues certificates of financial responsibility to Canadian-registered ships that carry bunker fuel, which must be carried onboard the ship in order for it to sail or operate legally. Transport Canada can also issue certificates to ships registered in states that not party to the Bunkers Convention. The limits of liability are set out in another international convention (the 1996 Protocol to the International Convention on the Limitation of Liability for Maritime Claims, 1976) that Canada ratified and adopted in Part 3 of the *Marine Liability Act*. The maximum liability for shipowners under the Bunkers Convention for the largest ships of all classes other than tankers is 55 million SDRs or approximately $88 million per incident.

Spills of other types of oils and other pollutants not covered by these two international conventions are governed by Division 2 of Part 6 of the *Marine Liability Act*. This includes non-persistent oils such as refined oil, gasoline, jet fuel, kerosene, etc. While section 77 of the *Marine Liability Act* makes the shipowner strictly liable for the pollution damages from such a spill, there are currently no compulsory

insurance requirements. The shipowners' liability would also be limited in accordance with the limits set out in Part 3 of the *Marine Liability Act*.

Please note that the IMO adopted the Protocol of 2010 to the International Convention on Liability and Compensation for Damage in connection with the Carriage of Hazardous and Noxious Substances by Sea, 1996 (2010 HNS Protocol) in April 2010. This protocol would put in place a liability and compensation regime for spills of HNS, including non-persistent oils currently covered by Division 2 of Part 6 of the *Marine Liability Act.* This includes strict liability for the shipowner, compulsory insurance, higher limits of liability and access to a new international compensation fund. Canada was a leader in developing the 2010 HNS Protocol at the IMO and showed its support for its eventual coming into force when it signed the Protocol, which was ratified on October 25, 2011.

International Oil Pollution Compensation Funds

The International Oil Pollution Compensation Funds (IOPC Funds) is an international organization of which Canada has been a member since 1989. This organization manages two compensation funds created through two IMO conventions that Canada ratified and adopted through Part 6 of the *Marine Liability Act*. The compensation available under the IOPC Funds supplements the shipowner's liability under the CLC (i.e., tanker spills).

The IOPC Funds covers a range of loss and damage, including reasonable costs for preventive measures (to minimize or prevent a spill), clean-up, property damage, environmental damage (reinstatement measures), quantifiable economic losses (such as in the fisheries or tourism sectors) and post-spill monitoring and studies. It covers actual losses and reasonable expenses that can be directly linked to the pollution incident.

Ship-Source Oil Pollution Fund

In addition to the international funds, Canada has a domestic fund, the Ship-Source Oil Pollution Fund (SOPF), which is set out in Part 7 of the *Marine Liability Act* and which can provide an additional tier of compensation to victims of oil spills. The SOPF was created from levies paid by receivers and importers of oil in Canada. The balance of the fund has grown with interest paid to it to approximately $392 million. The SOPF has also paid the contributions to the IOPC Funds on behalf of Canadian receivers of oil since Canada joined them in 1989.

There is no international compensation fund to cover damage from bunker oil spills; however, Canadian victims may be able to claim additional compensation from the SOPF.

The SOPF covers pollution damages from any type of oil and any type of ship, including mystery spills if it can be proven that the spill originated from a ship. The current maximum liability for the SOPF is approximately $159 million for a single incident. This amount is adjusted annually with the Consumer Price Index. With the SOPF and the CLC/IOPC Funds regime, the total amount of compensation for a tanker spill of persistent oil would be approximately $1.3 billion. This is one of the largest amounts of compensation available in the world.

2.2 MARINE TRANSPORTATION SECURITY

Transport Canada is responsible for increasing the level of protection of Canada's marine transportation system against unlawful interference, terrorism attack, and terrorist exploitation of it as a conduit to attack our allies. The Department helps industry achieve compliance with marine security legislation and regulations through awareness, certification, inspection, and enforcement, and helps ports, marine facilities and vessels implement the International Ship and Port Facility Security (ISPS) Code through the Marine Transportation Security Regulations (MTSRs). As a partner in the Government

of Canada's interdepartmental Marine Security Operations Centres, Transport Canada works to detect, assess, prevent, and respond to direct or indirect marine security threats.

2.2.1 *Marine Transportation Security Act*

The MTSA came into force in 1994 as the legislative framework for securing the Canadian marine transportation system. The MTSA applies to vessels and marine facilities in Canada, Canadian ships outside Canada and marine installations and structures. It does not apply to vessels and marine facilities under the authority of the Minister of National Defense or military vessels of a foreign country.

The MTSA provides the Minister of Transport with the authority to secure the marine transportation system by preventing unlawful interference with it and ensuring appropriate action is taken where that interference occurs.

The MTSA gives the Minister of Transport the authority to:

- Make regulations respecting the security of the marine transportation system.
- Direct a vessel to a certain place, to proceed out of Canadian waters (12 nautical miles from the coast), or to remain outside of Canadian waters when there are reasonable grounds to believe the vessel is a threat to the security of any person or thing.
- Formulate security measures for any vessel or port or facility where the security of persons or goods is not adequately protected. A measure may apply instead of, or in addition to, any provision of a regulation.
- Exempt any person, vessel or marine facility from any regulations, security measure or rule when the exemption is in the public interest and is not likely to affect marine security.
- Designate security inspectors who enforce compliance with the regulations.
- Issue administrative monetary penalties and other enforcement tools as required.

As a signatory to the International Convention for the Safety of Life at Sea (SOLAS3 Convention), Canada is party to this international treaty on safe commercial shipping. The SOLAS Convention, however, also sets out special measures for commercial shipping security, and as such, is the source of most, if not all, the rules and regulations that govern the security of the world's marine transportation system.

In 2002, the ISPS Code was adopted by the IMO. It sets out a detailed framework that further explains and builds on the security measures already in the SOLAS Convention to prevent acts of terrorism involving vessels, ports and marine facilities involved in international trade. In other words, the ISPS Code forms the internationally agreed upon legal framework for deterring, preventing and detecting acts that threaten marine transportation security.

All signatories to the SOLAS Convention were required to have the necessary national regulations in place to apply the ISPS Code by July 1, 2004. The MTSA authorized the Government to make the Marine Transportation Security Regulations (MTSR) in order to implement the ISPS Code in Canada starting July 1, 2004.

The MTSRs were designed to set out a risk-based approach to achieving Canada's international obligations. While the ISPS Code applies to vessels of 500 gross tonnage and upwards, in developing the MTSRs Canada decided to harmonize its requirements with that of the United States who extended their marine security regime beyond the ISPS Code requirements. As a result, the MTSRs applies to SOLAS vessels, defined as travelling from a port in one country to a port in another country that are

500 GRT or carrying more than 12 passengers; and vessels (other than SOLAS) travelling from a port in one country to a port in another country that: are more than 100 GRT (other than a towing vessel), or carrying more than 12 passengers, or are towing vessels engaged in towing a barge astern or alongside or pushing ahead, if the barge is carrying certain dangerous cargoes (as defined in section 1 of the MTSRs). The MTSRs also apply to those Canadian ports and facilities that serve all such vessels.

The marine facilities of the Mary River Project and the vessels that interface with these facilities will be subject to these legislative requirements. The MTSRs do not apply to pleasure craft, fishing vessels, government vessels or vessels without a crew that are in dry-dock, dismantled or laid-up. In general, the MTSRs set out a clear accountability structure for operators of those vessels, ports and marine facilities who are required to adopt marine security requirements.

SOLAS: 'Safety of Life at Sea' and is an International agreement for all vessels (cargo, tanker, passenger etc.) that sets standards for safety, emergency procedures and other such protocols.

A detailed summary of the main safety regulatory framework that applies is provided in Section 2.1, including the enforcement regimes detailed in Sections 2.1.1 (CSA 2001) and 2.1.2 (AWPPA). The following lists the key regulatory obligations relative to the proposed Project pursuant to this framework:

- Report their arrival to Canada under the Northern Canada Vessel Traffic Services Zone Regulations.
- Report on their ballast water management under the Ballast Water Control and Management Regulations.
- Manage ballast water before entering Canada's waters, under the Ballast Water Control and Management Regulations.
- Retain all oil, noxious liquids, and garbage onboard while in Arctic waters (north of 60°N) or offload to ports, under the *Arctic Waters Pollution Prevention Act*.
- Discharge only sewage that has no chemical residues, under the *Arctic Waters Pollution Prevention Act*.
- Carry shipboard oil pollution emergency plans or shipboard marine pollution emergency plans, under the Vessel Pollution and Dangerous Chemicals Regulations.
- Attain certifications required by international standards and under the Vessel Pollution and Dangerous Chemicals Regulations and other regulations under the *Canada Shipping Act*, 2001.
- Adhere to standards for vessel construction and equipment, under the Vessel Pollution and Dangerous Chemicals Regulations and other regulations under the *Canada Shipping Act*, 2001.
- Adhere to special standards for vessel construction and equipment for ships navigating in the Arctic, set out in the Arctic Shipping Pollution Prevention Regulations under the *Arctic Waters Pollution Prevention Act*. The construction and operational standards established under both the Vessel Pollution and Dangerous Chemicals Regulations and Arctic Shipping Pollution Prevention Regulations are based upon the principle that not carrying pollutants next to the hull provides a measure of pollution prevention in the event of damage to the vessel due to striking ice, a collision, or a grounding.
- Adhere to global standards for sulphur oxides and nitrogen oxides, under the Vessel Pollution and Dangerous Chemicals Regulations.

- Not use any organotin compounds for antifouling coatings on their hulls, as these substances are banned internationally, under the Vessel Pollution and Dangerous Chemicals Regulations.
- Report any release of pollution or pending release of pollution to the Canadian Coast Guard, under the Vessel Pollution and Dangerous Chemicals Regulations.
- Carry insurance to cover fuel spills, oil spills if carrying oil as cargo, under the *Marine Liability Act.*
- Carry insurance to cover deposits of wastes, under the *Arctic Waters Pollution Prevention Act*.

The AWPPA, the CSA 2001 and their associated regulations set out comprehensive regimes for the regulation of marine shipping in Canada, including the enforcement regime. Transport Canada enforces the above requirements through a risk-based inspection regime and takes action in accordance with Marine Safety's Compliance and Enforcement Policy.

The broader regulatory regimes are constantly monitored and updated in response to international and domestic developments. Section 3.3 outlines some forthcoming pan-Canadian regulatory initiatives that could be relevant to NIRB's assessment of the shipping aspects of the Mary River project. At this point, Transport Canada does not anticipate implementing any regulatory changes (including relating to enforcement) in direct response to the Mary River project to address issues that are specific to that project.

3.2 BALLAST WATER MANAGEMENT AND POLLUTION PREVENTION

The NIRB requested the following of Transport Canada (NIRB request i):

> *A summary of the existing regulatory requirements associated with ballast water management, including ballast water exchange, pollution prevention, preventing the release of potentially invasive species, and the related jurisdiction of the agencies responsible for this type of regulation.*

As noted in Section 2.1, the *Canada Shipping Act*, 2001 is the primary act that sets out operational requirements for shipping. The *Arctic Waters Pollution Prevention Act* provides a special regime to control discharges of wastes in the Arctic.

Ballast water is brought on board a vessel to increase the draft and change the trim so as to regulate the stability or maintain stress loads within acceptable limits. Under the CSA 2001, Transport Canada administers and enforces the Ballast Water Control and Management Regulations to address the growing problem of aquatic species that may be carried in vessels' ballast water. These include bacteria and other microbes, micro-algae, and various life stages of aquatic plant and animal species. Vessels travelling in Canadian waters carry thousands of tonnes of ballast water annually, making Canada vulnerable to new species entering our waters from discharged ballast water.

Canada's regulations apply, as much as possible, to the IMO's International Convention for the Control and Management of Ships' Ballast Water and Sediments. Canada ratified this convention on April 8, 2010, which should come into force internationally between 2013 and 2014. As well, Canada's ballast water requirements are harmonized, as much as possible, with US Coast Guard requirements.

Under the regulations, all vessel operators need a ballast water management plan for each vessel that complies with the regulations. This plan must outline the operator's measures and procedures that ensure ballast water is being managed safely and effectively.

The vessels involved in the Project will be required to meet international standards and Canadian regulations that control how they manage pollutants such as sewage, garbage, anti-fouling coatings, ballast water, onboard chemicals, and air emissions, and how they report any pollutant discharges. Compliance will be monitored and enforced through existing compliance and enforcement programs.

A summary of the existing regulatory requirements associated with ballast water management, pollution prevention, and the responsible agencies is set out below. Additional requirements related to safety and security, such as the Northern Canada Vessel Traffic Services Zone Regulations under the CSA 2001, also support pollution prevention goals.

3.2.1 Ballast Water & Preventing Release of Potentially Invasive Species

As detailed in section 2.1.1 above, vessels entering Canadian waters, including the Arctic, are subject to the Ballast Water Control and Management Regulations made under the CSA 2001. Vessels are required to manage their ballast water by:

- Exchange at sea 200 nautical miles off shore in waters at least 2000 m deep.
- Treatment on board to standards specified in the Regulations.
- Offloading ballast water to port for treatment.
- Retention on board and not discharging ballast water in Canada.

The existing Regulations also require that ships report on their ballast water management in advance of entering Canadian waters and keep a ballast water management plan and record book.

For details on the Ballast Water Control and Management Regulations, see http://laws-lois.justice.gc.ca/eng/regulations/SOR-2011-237/index.html.

3.2.2 Pollution Prevention

Preventing Pollution and Regulating Vessel Discharges

Transport Canada regulates vessels to prevent pollution as set out in international standards of the International Convention for the Prevention of Pollution from Ships, known as MARPOL. This convention sets out detailed technical standards for:

- Carrying and handling oil.
- Carrying and handling noxious liquid substances in bulk.
- Carrying packaged dangerous goods.
- Managing vessel sewage discharges.
- Managing vessel garbage.
- Managing vessel air emissions.

Transport Canada also prohibits the use of hull coatings containing tributyl tin, which has been found harmful to marine life, under International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001.

Transport Canada applies these standards through the Vessel Pollution and Dangerous Chemical Regulations under the CSA 2001. These standards are continuously subject to review. Under the Regulations, vessels operating in Canadian waters are subject to the following requirements.

Preventing Oil Pollution

Division 1 of Part 2 of the Regulations set out requirements to prevent oil pollution and implement Annex I of MARPOL. Oil tankers (vessels carrying oil in bulk) must:

- Have their plans and specifications approved by their Administration—in the case of a Canadian tanker, by Transport Canada—and by 2015 be double-hulled.
- Have contained areas where fuel or product is pumped on or off the vessel and tanks for oily residue and sludge oil.
- Use standardized connections and piping systems and use equipment for cleaning holds that meet international standards.

Transport Canada requires any tanker built after 1993 to be double-hulled to operate in Canadian waters. Tankers that are not double hulled are being gradually phased out by 2015, depending on their age, size, construction, and cargoes. These regulations align with U.S. and amended international regulations. This means that all tankers calling on the Project will be required to be double-hulled as of January 2015. The Proponent has stated that they intend to only use double-hulled tankers as part of the proposed Project.

The IMO phase-in period for double-hulled tankers worldwide will be complete in 2015. An accelerated phase-out program was adopted following the MV Erika incident off France in 1999. The new stricter timetable has different schedules for different classes of vessels:

- For large crude-oil tankers, the phase-out date for single hulled vessels was brought forward from 2015 to 2010.
- For smaller tankers, the phase-in period for double hulled vessels ranges up to the end of 2014, depending on the size and age of the vessel.

During the phase-in period, all single-hull tankers are subject to an enhanced inspection program using IMO guidelines.

All ships of 400 tons gross tonnage or more and oil tankers of 150 tons gross tonnage or more, must:

- Meet cargo standards for oil even if they carry oil with other cargo.
- Be able to remotely stop discharge pumps.
- Have oil filtering equipment to remove oil from discharges down to 15 parts per million (note, in Canadian jurisdiction, north of 60°N, the AWPPA zero discharge regime applies).
- Have alarms that both alert crew when the filtered product exceeds the standard and automatically shut discharge.
- Be inspected regularly, with simple inspections carried out annually, more detailed inspections about every three years, and a comprehensive inspection every five years.
- Carry on board:
  - An onboard Emergency Plan that includes contacts for response organizations.

  - Certificates, namely the International Oil Pollution Prevention Certificate, attesting that the inspections were carried out and that the vessel meets standards.
  - An oil record book that is kept up to date (this includes a record of all discharges of waste oil or of unloading waste oil in port to a reception facility).
  - A procedures and arrangement manual that sets out operating instructions for all equipment used onboard the oil tanker.

The regulations also set out requirements for transfer operations, the loading or unloading of oil or oil products either between an oil tanker and shore facility or between two oil tankers at sea:

- The operations must be supervised by a person certified to do so and clear communications between all personnel involved must be arranged.
- The supervisor is responsible for ensuring:
  - Personnel understand all signals, controlling flow rates during the transfer.
  - No hazardous conditions place the transfer operation at risk.
  - Response preparations are in place.
  - Valves and equipment are secure once operations are complete.
- Only fittings and conduits that meet performance standards for pressure resistance may be used.
- The facility and vessel are equipped with proper lighting.

Shipboard Oil Pollution Emergency Plans

Section 27 of the Vessel Pollution and Dangerous Chemicals Regulations requires the owner of every Canadian oil tanker of 150 tons gross tonnage or more, and every other Canadian ship of 400 tons gross tonnage or more that carries oil as fuel or cargo, to submit four copies of the vessel's Shipboard Oil Pollution Emergency Plan (OPEP) to Transport Canada. All Plans must be ship-specific. Transport Canada pollution prevention officers who have also been appointed as marine vessel safety inspectors will examine Shipboard OPEPs for Canadian vessels.

Plans for foreign vessels will be approved by their flag State or an organization recognized by them. These Plans help shipboard personnel deal with an unexpected discharge of oil. Their main purpose is to set in motion the necessary actions to stop or minimize the discharge and to reduce its effects. Effective planning ensures that the necessary actions are taken in a structured, logical and timely manner.

Plans must go beyond providing for operational spills. They must include guidance to help the master meet the demands of a catastrophic discharge, should one occur.

Preventing Pollution from Chemicals Carried in Bulk

Division 2 of Part 2 of the Vessel Pollution and Dangerous Chemicals Regulations set out requirements to prevent pollution from chemicals known as noxious liquid substances when carried in bulk and implement Annex II of MARPOL.

The regulations also set out requirements for transfer operations: the loading or unloading of chemical products either between a chemical tanker and shore facility or between two such tankers at sea. These requirements are similar to requirements for oil noted above. Discharge requirements of this Division do not apply in Arctic waters, as the AWPPA applies and prohibits these discharges.

Carrying Packaged Dangerous Goods

Division 3 of Part 2 of the Vessel Pollution and Dangerous Chemicals Regulations prohibits the discharge of any substance that is listed as a marine pollutant.

International standards under Annex III of MARPOL set out requirements for vessels carrying packaged dangerous goods, which are set out in detail under the International Maritime Dangerous Goods Code.

In Canada, carrying packaged dangerous goods is subject to a separate comprehensive control regime of the TDGA 1992, which applies to all modes of transportation and is also administered by Transport Canada. The regime includes standards for classifying different types of dangerous goods to ensure proper containment, packaging, handling, control documents, operator training, and emergency response.

Managing Vessel Sewage Discharges

Division 4 of Part 2 of the Vessel Pollution and Dangerous Chemicals Regulations sets out requirements that all ships of 400 tons gross tonnage or more must follow to manage sewage generated on board and implement Annex IV of MARPOL. The provisions setting limits on the discharge of sewage do not apply in Arctic waters as the AWPPA allows for the discharge of untreated sewage.

Managing Vessel Garbage

Division 5 of Part 2 of the Vessel Pollution and Dangerous Chemicals Regulations sets out requirements for vessels to manage the garbage generated on board and implements Annex V of MARPOL. Garbage can include:

- Waste from the vessel's crew.
- Operational waste such as galley or maintenance shop waste.
- Cargo associated waste such as dunnage or packing material or residues of dry cargoes carried in bulk (such as ore or grain).

The provisions setting limits on the discharge of garbage do not apply in Arctic waters as the AWPPA prohibits the discharge of garbage.

Managing Vessel Air Emissions

Division 6 of Part 2 of the Vessel Pollution and Dangerous Chemicals Regulations sets out requirements for vessels to manage air emissions and implements Annex VI of MARPOL. The requirements:

- Prohibit emissions of ozone depleting substances.
- Set controls for emissions of nitrogen oxides (combustion products from nitrogen in the air), sulphur oxides (combustion products from sulphur in the fuel), and volatile organic compounds.
- Set performance standards for incinerators.

For example, the regulations set a maximum limit for the sulphur content of any fuel oil used on a vessel to 4.5%. In addition, tankers using a vapour collection system for volatile organic compounds are required to meet international standards for the collection system. These criteria will become even more stringent once the new air emissions requirements come into force.

Antifouling Systems

Division 7 of Part 2 of the Vessel Pollution and Dangerous Chemicals Regulations requires vessels not to have any tributyl tin compounds present in hull coatings. This applies a global ban on such compounds under the International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001.

Reporting Pollution

In the event of an incident involving harmful substances, responsibilities are set out in the AWPPA, Part 3 of the Vessel Pollution and Dangerous Chemicals Regulations and the Release and Environmental Emergency Notification Regulations. These instruments outline when and how a vessel's master or an owner or operator of an oil handling facility must report any discharge of a pollutant that occurs or the probability that such a discharge will occur. Reports are to be made according to either the:

- Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants, TP 9834 (http://www.tc.gc.ca/eng/marinesafety/tp-tp9834-menu-1684.htm).
- General Principles for Ships Reporting Systems and Ship Reporting Requirements, including Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants, IMO Resolution A.851(20).

Vessels are also required to report the presence of any pollutant in the water under the CSA 2001's Vessel Traffic Services Zones Regulations.

As noted in section 2.1.2 above, vessels in Arctic waters are subject to the AWPPA. The Arctic Shipping Pollution Prevention Regulations, which set requirements for how vessels operating in Arctic waters must be built and details conditions on the no-discharge regime, and the Arctic Waters Pollution Prevention Regulations, which include a civil liability regime for vessels to ensure there is insurance to cover damages should deposits of wastes occur, both regulate pollution.

3.2.3 Agencies Responsible for Various Marine Components of this Project

All standards set out in Canadian Regulations implement the standards recognized worldwide and negotiated at the IMO, the United Nations specialized agency governing safety and environmental protection in shipping. Canada is key member of IMO. By implementing IMO standards in Canadian regulations, Canada ensures foreign vessels calling in Canadian ports will understand and comply with standards. For details on the IMO, see http://www.imo.org.

Transport Canada is Canada's primary regulator for shipping and implements a comprehensive system to implement standards under the CSA 2001 and the AWPPA. Transport Canada inspectors perform inspections to verify vessels are in compliance with these Acts. As well, Transport Canada has agreements with five Recognized Organizations to perform detailed surveys of vessels as they are built and later maintained, repaired and upgraded through their operational lives. The Recognized Organizations that conduct ships' surveys on behalf of Transport Canada are the American Bureau of Shipping, Bureau Veritas, Det Norske Veritas, Germanisher Lloyd, and Lloyd's Register. For details on Transport Canada's Marine Safety and Security Directorate, see: http://www.tc.gc.ca/eng/marinesafety/menu.htm.

16. Borrow Pits and Quarry Management Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Borrow Pits and Quarry Management Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 16	All	George	Removed waste rock associated with George to reflect the updated Project plan.
	All	Borrow Sources	The Project will be using the existing Airstrip quarry and the Umwelt Open Pit as borrow areas. The MLA will also have a borrow area.

BACK RIVER PROJECT
BORROW PITS AND QUARRY MANAGEMENT PLAN

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1. Introduction

This chapter describes the Borrow Pits and Quarry Management Plan (the Plan) that Sabina Gold & Silver Corp. (Sabina) will follow in the development and operation of the Project. This plan and other management plans are intended to describe the ways in which Sabina will address or mitigate issues identified in the Final Environmental Impact Statement (EIS). This plan outlines the construction, operation, and closure approach of approved borrow and rock quarry areas within the Back River Project (the Project) including the Goose Property and the Marine Laydown Area (MLA).

Quarry operations are currently permitted at the Project under the appropriate land and water use authorizations. These operations will continue to support ongoing exploration and associated activities in the area.

The Plan addresses the following topics:

- Applicable legislation and guidelines.
- Roles and responsibilities.
- Environmental protection measures.
- Monitoring plans.
- Mitigation and adaptive management plans to avoid or minimize potential adverse effects on air and water quality.
- Checking and corrective actions.
- Record keeping and environmental reporting.
- A framework for the evaluation of plan effectiveness.
- A quality assurance/quality control program to be applied to the monitoring program.

The information presented herein is current as of August 2015. The Borrow Pits and Quarry Management Plan is a "living document" and will be updated based on engineering design, management reviews, incident investigations, regulatory changes, or other Project-specific protocols. The plan may be updated again prior to construction if instructed to do so by the Nunavut Water Board (NWB) during the licensing process. The plan will be reviewed on a regular basis to incorporate any lessons learned, major changes to facility operations or maintenance, and environmental monitoring results.

2. Scope and Objectives

This plan has been prepared to meet Section 9.4.12 of the NIRB EIS Guidelines issued by the Nunavut Impact Review Board (NIRB 2013), requirements under the NWB license and the KIA land use licenses, and applies to all quarry activities at the Goose Property and the MLA. Subject to annual internal review and revision, it will remain applicable throughout the duration of the Project.

The purpose is to ensure sound management of borrow and quarry material, explosives, dust, and water in order to minimize the impacts to the local environment during the life of a quarry. Implementing

best-management practices and working responsibly will ensure the protection of the environment and personnel safety.

The main environmental concerns related to quarry operations are the potential for metal leaching and acid rock drainage (ML/ARD) and/or total suspended solids (TSS) on downstream water quality as well as potential for dust emissions and protection of the permafrost.

Management of quarry operations is intended to protect the following valued ecosystem components (VECs):

- Air Quality.
- Surface Hydrology.
- Freshwater/Marine Water Quality.
- Freshwater/Marine Sediment Quality.
- Freshwater/Marine Fish/Aquatic Habitat.
- Freshwater/Marine Fish (primarily Arctic Grayling and Lake Trout).

Quarry operations can also impact archeological sites; management of those sites is addressed in this plan and within the Cultural and Heritage Resources Protection Plan (Volume 10, Chapter 27). The goal of any management plan is to reduce and prevent impacts to the environment while ensuring personnel safety and appropriate fiscal considerations during mineral exploration activities and Project development.

3. Planning and Implementation

3.1 EXISTING BORROW AND ROCK QUARRY FACILITIES

The primary purpose of borrow and rock quarries is to support construction and operation of all-weather airstrips, all-weather roads, and camp operations/enhancements at Goose and the MLA. These current quarry agreement locations are on Inuit Owned Lands (IOL) as authorized by the Kitikmeot Inuit Association (KIA) with associated water management authorized by the Nunavut Water Board (NWB). The quarry areas will be developed, inspected, maintained, and closed by Sabina or contractors working under the direction of Sabina.

During the 2013 season (March 1 to May 15, 2013) approximately 40,000 m^3 of rock material was quarried from a site approximately 750 m west of the existing Goose camp. The run of quarry (ROQ) material was trucked over a winter ice road corridor from the quarry to crushing equipment located at the all-weather airstrip. The material was crushed to 4 inch and ¾ inch aggregate. This material was used to build a pad and containment for bulk fuel tanks in the existing Goose camp and to surface the all-weather airstrip and connecting road between the airstrip and Goose camp. Estimates indicate that there is approximately 550,000 m^3 (1.5 Mt) of available material remaining within this quarry area, 125,000 m^3 of which is currently permitted (permit KTP11Q001).

3.2 INFRASTRUCTURE REQUIREMENTS FOR THE PROJECT

At Goose Property an estimated 5 million tonnes of aggregate will be required for construction. Of this 5 Mt, 1.5 Mt will be required to construct the Main TSF Dam and 3.5 Mt will be required for the other Goose infrastructure including:

- Haul roads connecting mine workings.
- Pads for mine infrastructure and laydown.
- Goose Airstrip.
- Tailings Storage Facility.
- Fuel storage and other containment areas.
- Water management berms and structures.

A portion of this material (800,000 tonnes) will be sourced from the Airstrip Quarry, which is estimated to contain 1.5 Mt of suitable NPAG material. Additional construction material necessary for construction will be sourced from the cut/fill balance of the Goose Plant Site area and from open pit mining.

At Goose Property, it is currently planned that only one quarry will be developed (Airstrip Quarry); at later phases of design, this could be expanded to additional quarries and borrow sources. Only quarries with geochemically suitable material will be developed. Where feasible, NPAG waste rock from the open pit workings will be used for construction material.

At the MLA an estimated 1.3 million tonnes of aggregate will be required for construction of service roads, laydown pads, infrastructure foundations, and fuel storage and other containment areas. All of this material will be sourced from the MLA Fuel Storage foundation (MLA Quarry) and will be used to fill all other infrastructure areas. It is currently planned that only one quarry will be developed; at later phases of design, this could be expanded to additional quarries and borrow sources. Only quarries with geochemically suitable material will be developed.

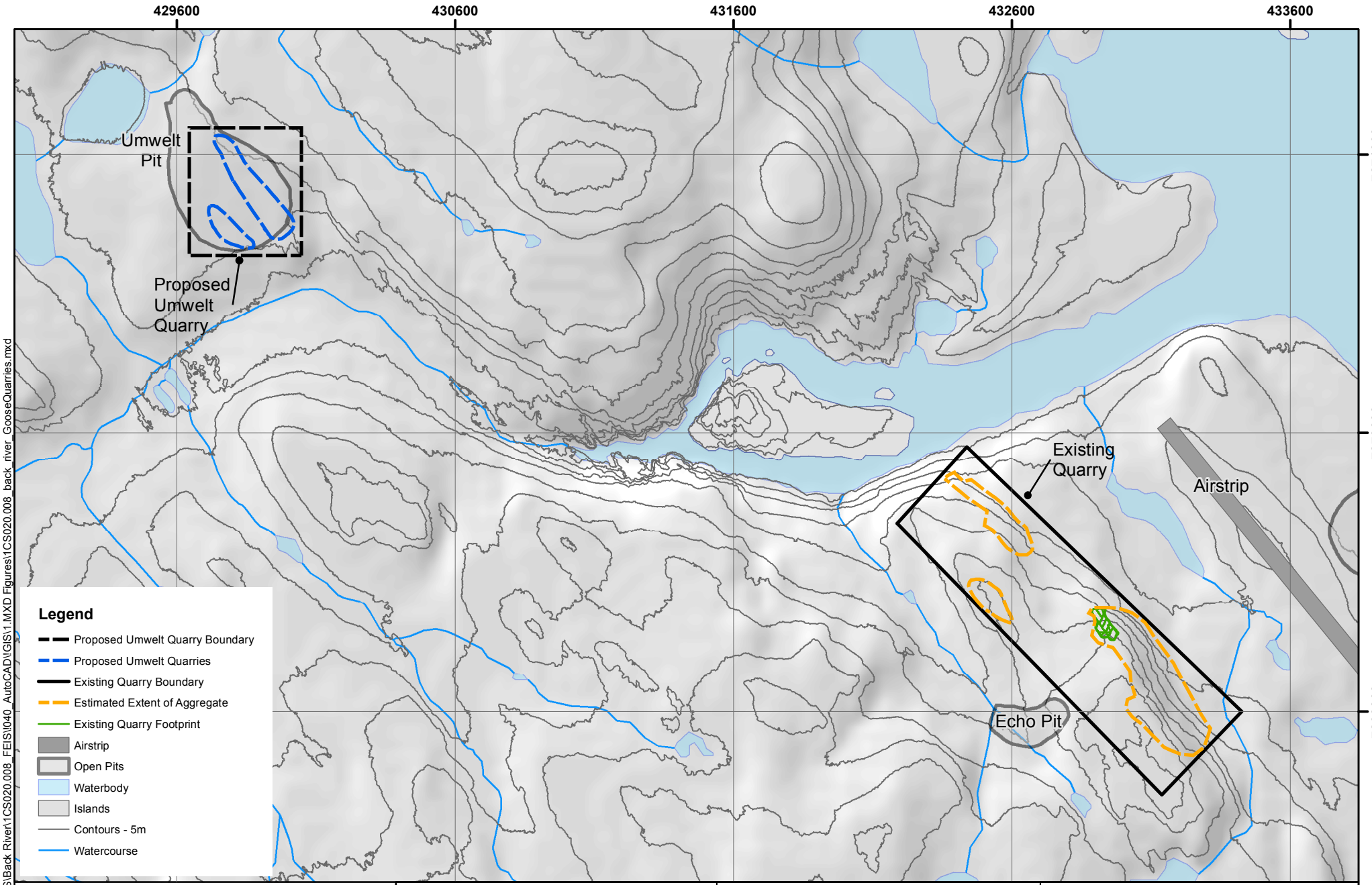
All volumes of quarry material are based on engineering design at a feasibility level, accounting for permafrost and local thermal conditions. Additional information, including longitudinal profile estimates of embankments, site roads, and airstrips, will be included in future Type A Water License applications.

3.3 PROPOSED BORROW AND ROCK QUARRY FACILITIES

The proposed borrow and rock quarry locations will be located on Inuit Owned Lands (IOL), as authorized by the Kitikmeot Inuit Association (KIA) or on Crown Land, as authorized by Aboriginal Affairs and Northern Development (AANDC).

Borrow pit and quarry locations are assessed by the geotechnical properties of the material, the geochemistry and ARD/ML potential, available volume of material, proximity to infrastructure, and avoidance of environmentally sensitive (e.g., fish and fish habitat) and culturally sensitive (e.g., archaeological) areas.

Current and proposed borrow and quarry locations at Goose Property and MLA are illustrated on Figures 3.6-1 and 3.6-2, respectively. During the life of Project, there may potentially be numerous borrow and rock quarry activities. These will be determined and approved as needed but all will meet the requirements of this Plan.



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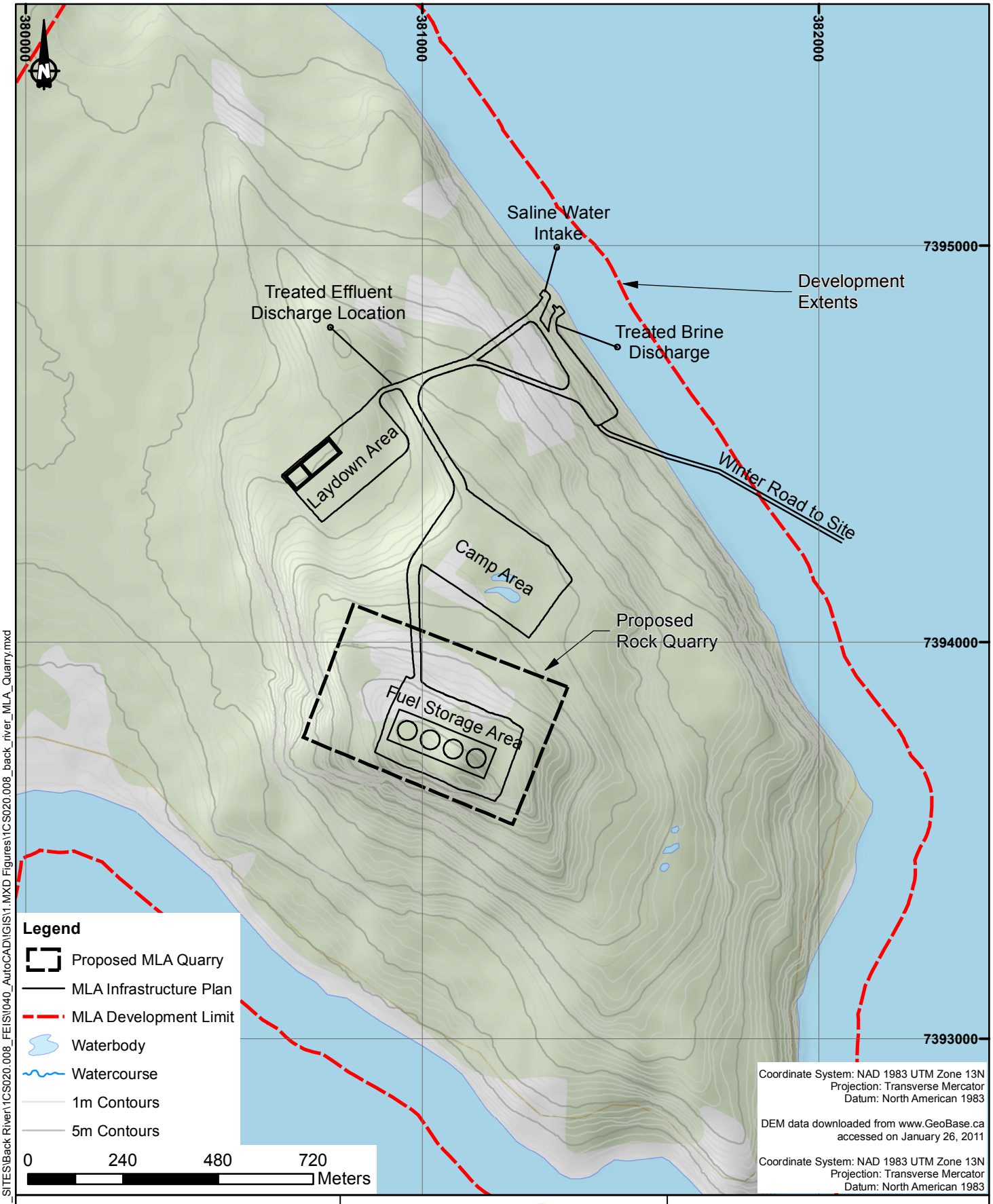
Back River

Quarry Management Plan

Goose Property Infrastructure and Proposed Quarry Locations and Extents

Date:	Approved:	Figure:
November 2015	EH	3.6-1



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Back River

Quarry Management Plan

MLA Infrastructure and Proposed Quarry Location

Date:	Approved:	Figure:
November 2015	EH	3.6-2

Quarry operations at the Goose Property will begin with sourcing material from the Airstrip Quarry for construction of the Goose Airstrip, and some all-weather roads. Once all-weather access to the Goose Plant Site area is established, construction material will be sourced by cutting bedrock material to create a suitable area for the Goose Plant Site and Goose Fuel Storage areas. This extracted material will be used to build roads, infrastructure pads, storage pads, containment area. Once all-weather access to the Umwelt open is established, the majority of construction material will be source from open pit operations.

Quarry operations at the MLA include cutting bedrock material to create a suitable area for the MLA Fuel Storage and using the extracted material to build the MLA Camp foundation and MLA Laydown Area. This cut/fill material may also be used to build other laydowns, storage pads, containment areas, site roads, and other mitigation measures at the Marine Laydown Area. This will minimize the footprint of the Marine Laydown Area by maximizing the use of stripped material.

3.4 GEOCHEMICAL CHARACTERISTICS

Quarry Rock at the Goose Property

Detailed geochemical characterization studies to assess the metal leaching/acid rock drainage (ML/ARD) potential of quarry rock associated with the Back River Property was carried out, and can be found in Appendix V2-7D: Geochemical Characterization Report. The testing program included ABA and trace element analyses on 40 samples from the Airstrip Quarry, and 16 samples from the Umwelt quarry.

The Airstrip Quarry is comprised mainly of a series of turbiditic meta-sedimentary rocks (greywacke and mudstone) with minor amounts of banded iron formation, large intrusive gabbro dykes, and smaller felsic to intermediate dykes. Results indicate that rock from the Airstrip Quarry has a variable potential for ARD. Gabbro is generally non-potentially acid generating (NPAG), iron formation is potentially acid generating (PAG), and the other rock types (mainly greywacke and mudstone) include a mixture of material that is PAG, NPAG, or that has an uncertain potential for ARD. Based on these results, Sabina has committed to complete further testing within the existing quarry footprint to further delineate PAG materials in advance of or concurrent with sourcing additional material from this quarry. Only NPAG quarry rock will be used for construction. The criteria that will be used to classify NPAG waste rock will be an NP/AP ratio greater than 3, or a sulphur content of less than 0.15%. The testing programs described in Appendix V2-7D show that these criteria provide an appropriate level of conservatism.

The Umwelt Quarry locations were selected to be entirely within the upper greywacke unit. The majority of these unit samples are classified as NPAG or low sulfide (S) material with a limited potential for ARD. Therefore, no special management measures are required at this location.

Based on analogous samples tested as part of the waste rock characterization program, contact water associated with quarry rock from both the Airstrip Quarry and the Umwelt Quarry area is expected to contain slightly elevated levels of arsenic, and arsenic loading from this material has been considered in the overall assessment of environment effects. Results from the water and load balance indicate that infrastructure constructed using this material is a relatively minor source of arsenic loading in comparison to the WRSAs or the Tailings Storage Facility (TSF), and that no specific water management will be required to control arsenic loading from the quarry rock (Appendix V2-7H).

Quarry Material at the MLA

Preliminary geochemical characterization was completed on surface outcrop samples and sandy gravel representing quarry material that will be excavated during construction of the MLA Fuel Storage area (MLA Quarry). These samples were described as weathered quartzite conglomerate, quartz arenite/quartzite (sandstone) and sandy gravel. The test results showed that these materials have a negligible potential for

ML/ARD. Sabina intends to complete additional sampling and testing in advance of, or concurrent with, development to characterize materials from greater depths.

3.5 ARCHEOLOGICAL PROXIMITY

At the Goose Property, the Airstrip Quarry and the proposed Umwelt Quarry areas are in moderate proximity (>50 m) to identified archeological sites. At the MLA, the proposed MLA Quarry is located in close proximity (<50 m) to identified archeological sites. Both Goose Property and the MLA may require some sites to be mitigated in order for Project work to advance. Information on exact location of archeology is not provided in this document as per guidance from the Government of Nunavut Department of Culture and Heritage (GN-DCH). However, all information on site locations has already been provided to GN-DCH in the form of annual archeology reports. A summary of sites within 1,000 m of the Goose Property PDA and MLA can be found, along with proposed mitigation options, in the Cultural and Heritage Resources Protection Plan (Volume 10, Chapter 27).

3.6 DEVELOPMENT, OPERATION, AND CLOSURE

The proposed areas will be developed, inspected, maintained, and closed by Sabina or contractors charged with this responsibility under the direction of Sabina.

3.6.1 Development Plans – Rock Quarries

A detailed procedure will be prepared before the start of development for each rock quarry. Site development plans will augment this management plan with specific details. These development plans will include:

- Site layout and setup with the following provisions:
  - Minimum setback of 31 m from environmentally sensitive areas.
  - Adequate room for all activities.
  - Estimates of the resources to be extracted.
  - Refueling station with appropriate containment (if required).
  - Confirmation of low ARD/ML potential.
  - Confirmation of archeology, vegetation, and wildlife status.
  - Expected permafrost conditions.
  - Stockpiling location (if required).
  - Equipment lists.
  - Explosive magazine locations.
  - Dust and noise management.
  - Waste management facilities (where applicable).
  - Water management facilities.
- Related documents:
  - Explosives Management Plan.
  - Spill Contingency Plan.
  - Mine Waste Rock Management Plan.
  - Site Water Monitoring and Management Plan.
  - Site specific operating procedures.

- Monitoring:
  - Water management and quality.
  - Quarry wall stability.
  - Extent of permafrost or ground-ice.
  - Wildlife interactions or sightings.

3.6.2 Operations

Quarry operations may use explosives and the design, shape, and size of the blasts shall be planned with safety being the most important consideration. Should blasting be required, a predetermined pattern of drillholes will be drilled to a depth, not exceeding the overall depth of the quarry, and filled with explosives. Prior to the blast, all personnel, and equipment will be moved to a safe distance. The blasted rock will be loaded into haul trucks using either a loader or a hydraulic shovel/excavator. The run of quarry (ROQ) material is then hauled to the construction area, dumped, and placed using a track dozer and/or motor grader. This sequence is called a "drill, blast, load, haul, dump" sequence.

Some of the ROQ will be moved to a crusher to produce aggregate of various sizes. The crusher will be offset from local waterways and may be shielded from the prevailing wind. When possible, the shielding will be managed by placing the crusher within the quarry behind a high wall to reduce the quantity of wind-blown dust and enabling dust to fall within the quarry boundaries.

Borrow pit operations may employ ripping methods using a track dozer. This loosens the material and allows it to be picked up using a loader or a hydraulic shovel/excavator. Standard drill and blast methods similar to quarry operations may be used in instances where ripping is not possible.

3.6.3 Quarry and Borrow Pit Closure

When operations are complete, the overall reclamation objective for the quarry/borrow areas is to return the site to a natural condition that blends in with the existing topography and surrounding landscape. Ongoing operations and closure of quarry areas will focus on progressive reclamation measures to ensure the site:

- Is secure to protect employees, the public, and wildlife.
- Has drainage and erosion control measures to minimize runoff to local waterways.
- Is cleared of all material, equipment, debris, and hazardous/contaminated materials.

Sabina will continue a program of progressive reclamation per the Mine Closure and Reclamation Plan (Volume 10, Chapter 29).

Both temporary and final closure of the quarry areas will include:

- Removal of all garbage and debris.
- Removal of all temporary storages/structures/equipment.
- Reclamation of access roads (all-weather or winter ice roads) to ensure free flow of water during melt.
- Block access (if required) and flag boundaries.
- Water quality monitoring.
- Quarry wall stability monitoring.
- Measuring extent of permafrost or ground-ice.

These procedures will be built into future work plans and conducted in accordance with the measures detailed in the Mine Closure and Reclamation Plan (Volume 10, Chapter 29).

4. Applicable Legislation and Guidelines

Borrow pits and rock quarries within IOL require a land use license or commercial lease and quarry permit issued by the KIA. Quarry permits from the KIA include terms and conditions specifying how operations are to be conducted. The use of explosives will comply with the *Explosives Use and Regulations* and the *Mine Health and Safety Act and Regulations*. A Type B water license will be needed to operate borrow pits and quarries, and the federal *Fisheries Act* may apply if runoff water containing deleterious substances flow from the quarries/borrow pits into fish bearing water. Other applicable legislation from the Government of Nunavut includes the permitting of archaeological surveys completed in advance of operations and compliance with the Nunavut *Wildlife Act* with respect to impacts to raptors and terrestrial animals.

5. Roles and Responsibilities

The Sabina General Manager in charge of the Back River Project will be ultimately responsible for the success of the Plan and will approve all relevant policies and documents, auditing, action planning, and verification processes.

The Mine Manager, Plant Manager, and Safety Superintendent, along with their direct reports, will be responsible for the implementation of this plan including overall management of the Plan and internal reporting.

6. Environmental Protection Measures

The proper implementation of best management practices will ensure sound management of borrow and rock quarry material, explosives, and freshwater which will help to minimize potential impacts to the environment during the life of a quarry.

Table 6-1 outlines the measures will be considered for each rock quarry concurrent with the development of site specific Standard Operating Procedures (SOP).

6.1 IDENTIFICATION, SEGREGATION, AND PLACEMENT OF QUARRY ROCK

Identification and segregation of PAG and NPAG quarry rock from the Airstrip Quarry will either require further sampling and off-site testing in advance of quarry development, or sampling and on-site testing concurrent with the quarry development. The confirmatory testing prior to excavation will also be considered at the other quarry areas (Umwelt and the MLA). Only NPAG quarry rock will be used for construction. Where possible, any areas within the quarry that are delineated as PAG will be avoided. However, if blasting is required to access sufficient material, the PAG quarry rock will be hauled to one of the designated WRSAs for disposal.

Table 6-1. Mitigation Measures to be Considered for Borrow Pit and Quarry Locations

Development Phase	Activities	Environmental Concerns	Mitigation techniques
Site design and development	• Vegetation clearing. • Overburden removal.	• Habitat loss. • Soil erosion. • Sediment deposition.	• Minimize project footprint. • Identify and avoid environmentally sensitive areas. • Locate the development in a well-drained area. • Maintain natural drainage patterns. • Retain vegetation buffer zones to maintain slope stability and protect waterbodies. • Construct ditches/diversion structures to direct runoff away from the site.
Operations and monitoring	• Blasting. • Excavating. • Crushing. • Piling material. • Access road maintenance.	• ML/ARD	• Further delineation and segregation of PAG/NPAG quarry rock. Only NPAG quarry rock will be used for infrastructure construction
		• Soil erosion. • Sediment deposition.	• Limit sediment movement using erosion controls (e.g., silt fence). • Use rip-rap to reinforce drainage channel corners and water discharge points. • Use settling ponds before discharging water. • Revegetate and /or use riprap where required to stabilize slopes.
		• Fuel spills. • Blasting residue.	• Use proper fuel containment and explosives-handling techniques.
		• Permafrost degradation.	• Limit pit or quarry depth to within the continuous permafrost zone. • Minimize in-pit water by directing surface water away from the site. • Thaw ice-rich material at a location where melt water will not re-enter the pit.
		• Dust generation.	• Use water and dust skirts on conveyors to minimize dust.

Modified from source: AANDC (2010)

6.2 SURFACE DRAINAGE AND WATER MANAGEMENT FROM QUARRIES AND BORROW PITS

Water quality monitoring of contact water from the borrow pits and quarries serves to provide information on possible effects to the receiving environment. Surface drainage and water management procedures will be implemented at all quarry/borrow locations. A setback of at least 31 m will be established from the quarry operations and associated workings to any local waterbody. These buffers will be delineated prior to the commencement of work.

Additional management will include the grubbing of materials to expose rock surface for quarrying purposes. The principle concerns associated with grubbing and disposal of related debris are:

- Potential effects on water quality caused by erosion and sedimentation.
- Disturbance of the permafrost leading to ground failure (slumping and erosion).

All grubbing and disposal of debris near watercourses will comply with regulatory approvals. Measures that will be undertaken to minimize effects on aquatic habitat and resources are:

- Grubbing of the organic vegetation mat and/or the upper soil horizons will be minimized, and left in place where possible due to the sensitivity of Arctic soils.
- If needed, the organic vegetation mat and upper soil horizon material, which has been grubbed, will be spread in a manner that attempts to cover exposed areas. Any surplus of such material is stored or stockpiled for site reclamation purposes elsewhere in the Project area. Topsoil will be stockpiled separately from the overburden. The location of the stockpiles will be recorded and accessible for future rehabilitation purposes.
- During grubbing, care will be taken to ensure that the material will not be pushed into sensitive areas which are to be left undisturbed.
- Any evidence of erosion due to surface water flow from the quarries and borrow pits will be repaired by placing riprap over the affected area.

The quarry configuration will consist of a relatively flat surface graded such that water slopes to an area within, or adjacent to, the quarry boundaries. Any flowing water which may leave the working area will be sampled as part of ongoing monitoring and allowed to discharge to the environment if it meets Project discharge criteria. A notification of this discharge will be submitted to appropriate regulatory parties under the land and water authorizations and also reported within annual reports.

Storm and snow melts will be diverted away from the quarry by small berms on the upslope edges of any excavation. Measures will be taken to reduce the velocity of the water (e.g., silt curtains and small dikes) and promote suspended sediments to settle out.

The final quarry configuration will consist of a flat surface graded at approximately 1% in the down slope direction, adjoining a steeper angle rock surface that forms the transition to natural ground on the ridge above. Storm and snow melts water will be diverted away from the quarry by a small berm on the upslope edges of the excavation.

6.3 DUST MANAGEMENT

Crushers may be located near high obstacles to facilitate shielding from the prevailing winds and thereby reduce and restrict the quantity of dust to the quarry boundary. ROQ will be transported from the quarries and borrow pits within speed restrictions to help reduce dust along the road corridors. Dust monitoring for the quarry and borrow pit operations will be considered for inclusion with dust monitoring programs.

6.4 GROUND ICE AND PERMAFROST PROTECTION

Quarry sites are expected to be free of ground ice and will not extend below the bottom limits of the continuous permafrost. There will be some localized impacts to the surrounding active zone of the quarry locations and any water seeps originating in the quarries as a result of permafrost melting, or precipitation events, will be monitored as part of the surface water management.

Borrow pits are formed from glaciofluvial deposits and weathered bedrock. All borrows have positive topography rising about the local setting. These types of granular deposits are selected as they can be relatively free of ground ice. Minimal ground ice reduces the potential for thaw settlement, erosion caused by melt water, and external slumping. In the event that ground ice is prevalent, the area will be monitored and may be stabilized by covering the affected land with granular material. This would allow the permafrost aggrade into the covering material and restrict the remaining ground ice from melting.

7. Monitoring

7.1 ML/ARD POTENTIAL

In addition to the sampling and testing that will be required to identify and segregate NPAG quarry rock for use in construction, further sampling and testing will be completed to verify that the geochemical characteristics of quarry rock used in construction are within expected ranges.

7.2 WATER QUALITY

During high runoff periods, water may drain from borrow and rock quarry areas. If noticeable flows occur, the water will be tested to ensure it meets permitted criteria. An annual seep survey of large infrastructure components will be completed during the open water period (late June to September) during the Operations phase. Parameters will be defined by the water licence and may include field analysis of the following:

- Physical parameters – field pH, water temperature, conductivity, major anions and cations, turbidity, TSS.
- Total and dissolved metals.

The results will be tracked on site, available during inspection, and included in annual reports.

7.3 PIT WALL STABILITY (ROCK QUARRIES)

Regular visual monitoring of pit wall stability within active rock quarry areas will be completed and recorded. Inactive, open areas will be visually monitored (typically monthly) between July and September and this monitoring will be recorded. Closed areas will be visually monitored annually (during the July to September period) and these observations will be recorded.

7.4 PERMAFROST AND GROUND ICE

Daily visual monitoring of permafrost and ground ice within active borrow and rock quarry areas will be completed and recorded. Inactive, but still open, areas will be visually monitored at least monthly between July and September and this monitoring will be recorded. Closed areas will be visually monitored once the year following closure (during the July to September period) and this monitoring will be recorded. Closed areas may require additional monitoring.

7.5 WILDLIFE

Incidental wildlife monitoring will include maintaining a written log of species, number and frequency of sightings near the workings. Data will be maintained by the Environmental Department and presented during inspections and in accordance with permit conditions. More information can be found in the Wildlife Mitigation and Monitoring Plan (Volume 10, Chapter 20).

8. Adaptive Management

Checking and corrective action will occur through evaluation of monitoring data including continuous flow data and daily TSS and turbidity data. Results of the monitoring will be reviewed by an environmental specialist. Water quality and quantity trends will be updated on a time scale relevant to the dewatering activity. If the dewatering activity will take two weeks or less, then data will be

updated daily. If dewatering takes longer than two weeks, then an appropriate time scale may be used (e.g., every 3 days or weekly). This will allow early detection of changes in water quality and implementation of corrective actions, if required. If trigger levels or thresholds are approached or exceeded, dewatering activities will be suspended.

9. Record Keeping and Environmental Reporting

Record keeping will be conducted by the site environmental compliance supervisor. Field and laboratory data will be entered into suitable electronic databases and checked for quality control.

Environmental reporting will be conducted as identified in future permits, approvals, and authorizations relevant to mine waste management. The Type A Water Licence is expected to be the primary regulatory instrument governing quarry and borrow management for the Project.

An annual summary report including results of the geochemical inventory and monitoring programs will be prepared during construction and operations. For years prior to closure, the annual report will include an assessment for additional monitoring and reporting through the closure phase. The report will include documentation of data collection methodology, data management, and observed trends.

The annual summary report will include the following:

- A description of Project activities during the monitoring interval.
- Monitoring data obtained during the most recent reporting period.
- Description of the methods used for sample and data collection.
- Results and conclusions from updated predictive modelling.
- Evaluation of mitigation measures.
- Discussion of the need for any additional corrective actions or control measures.

Standardized formats will be used for the annual reports, and reports will be kept on file and made available on request.

10. Plan Effectiveness

The activities will be reviewed internally on an annual basis relative to the long-term exploration and development strategy for the Project and operational needs.

11. QA/QC

Quality control and quality assurance programs will be part of water quality and geochemical characterization programs based on current best current approach to include appropriate duplicate and blank samples in the analysis. These sampling programs will be revised as site activities, analytical methods and/or regulatory requirements change and adjusted appropriately in the Quarry Development and Management Plan.

17. Air Quality Monitoring and Management Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Air Quality Monitoring and Management Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions)
Chapter 17	All Sections	George	Removal of reference to the George Property
	All Sections	Edits	Numerous syntax edits
	2.1	Figures	Figure updates based on design and commitments
	3.0	Planning and Implementation	Updated text to reflect FEIS
	6.1.2	Mitigation Measures	Updated to capture commitments list items
	7.1.3	Data Analysis	Description of conservative approach
	.2.1	Dustfall Monitoring	Revised sampling locations
	8	Mitigation and Adaptive Management	Clarified incinerator stack testing frequency

BACK RIVER PROJECT
AIR QUALITY MONITORING AND MANAGEMENT PLAN

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Glossary and Abbreviations

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

Air Quality Standards	Objectives for maximum concentrations air contaminants in the atmosphere developed to ensure long-tern protection of public health and the environment.
Ambient Air Quality	The outdoor air quality at a particular site.
ASTM	American Society for Testing and Materials.
CACs	Criteria air contaminants
CALA	Canadian Association for Laboratory Accreditation
Dioxins	Polychlorinated dibenzodioxins (PCDDs), or simply dioxins, are a group of polyhalogenated compounds that can act as environmental pollutants. They are commonly referred to as dioxins for simplicity in scientific publications because every PCDD molecule contains a dioxin skeletal structure. Members of the PCDD family have been shown to bioaccumulate in humans and wildlife due to their lipophilic properties, and are known teratogens, mutagens, and suspected human carcinogens. They are organic compounds.
EC	Environment Canada
Fugitive Dust	Particulate matter, often sand or mineral dust, released to the atmosphere by mechanical disruption of soil or by wind scouring.
Furans	Polychlorinated dibenzofurans (PCDFs), or simply furans, are a group of halogenated organic compounds which are toxic environmental pollutants. They are known teratogens, mutagens, and suspected human carcinogens. PCDFs tend to co-occur with polychlorinated dibenzodioxins (PCDDs). PCDFs can be formed by pyrolysis or incineration at temperatures below 1,200°C of chlorine containing products, such as PVC, PCBs, and other organochlorides, or of non-chlorine containing products in the presence of chlorine donors.
GN-DOE	Government of Nunavut – Department of Environment
Mercury	Mercury is a natural and persistent bioaccumulative element which can be transported many kilometers in the atmosphere. Mercury can be deposited to waterbodies from anthropogenic emissions and poses a threat to human and ecosystem health. Mercury also enters the environment through the disposal (e.g., landfilling, incineration) of certain products. Products containing mercury include: auto parts, batteries, fluorescent bulbs, medical products, thermometers, and thermostats.
NAAQO	National Ambient Air Quality Objectives
NAPS	National Air Pollution Surveillance
NIRB	Nunavut Impact Review Board

Oxides of Nitrogen (NO_x)	NO_x gas primarily consists of nitrogen oxide (NO) and nitrogen dioxide (NO_2). The gases are emitted with exhaust from combustion engines and are products of blasting operations. NO_x can be converted to nitric acid in the atmosphere and thus contribute to acid deposition.
PM_{10}	Inhalable particulate matter. PM_{10} particles are airborne particles that have a diameter of 10 µm or less and are thus a subset of total suspended particulate. The majority of PM_{10} particles are from fugitive dust sources. PM_{10} can enter the respiratory system and has been linked to respiratory problems.
$PM_{2.5}$	Respirable particulate matter ($PM_{2.5}$) particles are a subset of PM_{10} and are defined as particles with a diameter less than 2.5 µm. These particles are small enough to enter deep into the respiratory system. The majority of particulate matter emitted in diesel engine exhaust is $PM_{2.5}$.
Sulphur Dioxide (SO_2)	Fossil fuel contains a small amount of sulphur-containing organic compounds. During fuel combustion, the sulphur is oxidized and emitted as SO_2 gas with the engine exhaust. In the atmosphere, SO_2 can further oxidize to sulphate, which contributes to acid deposition.
Total suspended particulates (TSP)	Total suspended particulates (TSP) are solid matter or liquid droplets having aerodynamic particle sizes from 0.01 to 100 µm in diameter and are found in smoke, dust, fuel ash, or condensing vapours that can be suspended in the air.
US EPA	United States Environmental Protection Agency. The US EPA has promulgated a variety of guidelines, objectives, emission factors, air dispersion modelling procedures and statutes for the protection of ambient air quality.

1. Introduction

The Back River Project (the Project) has been designed to minimise, mitigate and/or manage potential adverse effects on the environment while systematically seeking to enhance positive effects. As part of the requirements of the Environmental Impact Statement (EIS) guidelines issued by the Nunavut Impact Review Board (NIRB), this document presents the Air Quality Monitoring and Management Plan that Sabina Gold & Silver Corp. (Sabina) will follow concurrent with the development of the Project.

This plan is dynamic and it will be updated based on management reviews and associated costing of the mitigation and monitoring activities relative to the long-term strategy for the Project, regulatory requirements, consultation and project operational needs.

2. Scope and Objectives

The intent of this plan is to outline the requirements for air quality monitoring, control and mitigation. The Air Quality Monitoring and Management Plan includes the following:

- Applicable legislation and guidelines.
- Control measures that are already in place or that will be established to avoid, control, and mitigate potential adverse effects on air quality and greenhouse gas (GHG) emissions associated with all phases of the Project, including an Emissions Reduction Strategy Plan, a Dust Reduction Plan, and an Incineration Management Plan.
- A monitoring plan to collect on-site air quality, GHG and meteorological data to allow for an adaptive approach to air quality and GHG management.

The Plan includes the following pollutants:

- Nitrogen dioxide (NO_2).
- Sulphur dioxide (SO_2).
- Total suspended particulates (TSP) matter.
- Particulate matter (PM_{10}).
- Respirable particulate matter ($PM_{2.5}$).
- Carbon monoxide (CO)
- Dust deposition.
- Acid deposition.
- GHG.

The Project is not a significant source of ozone and therefore it is not considered in the management plan. The monitoring program will not include hourly and daily NO_2 or PM_{10} monitoring, as there are no objectives or guidelines for PM_{10} and concentrations of hourly and daily NO_2 are not expected to be significant.

Air quality effects from the project also interact with Country Foods (Volume 8, Chapter 5), Vegetation (Volume 5, Chapter 5), Freshwater Water Quality (Volume 6, Chapter 4), and the Human Health and Environmental Risk Assessments (Volume 8, Chapter 6) through a variety of pathways. The Project has been designed to minimize or eliminate potential adverse effects on other VECs.

3. Planning and Implementation

Planning for this document started with the development of the DEIS, which identified existing (baseline) conditions, assessed potential effects of the Project, developed conceptual mitigation strategies, and developed specific mitigation measures to execute these strategies.

This revised version reflects updates and improvements to the Project design, comments from DEIS reviewers, and the inclusion of relevant commitments from the NIRB PHC Decision Report (December 2014). It is anticipated that this version will be revised again based on comments during the review of the FEIS as well as during the water licensing process.

Conceptual strategies and management plans will continue to be developed and executed throughout the construction, operation, and closure phases of the Project. Environmental management and social aspects will be tracked, reviewed, and updated through ongoing maintenance of the Plan. These updates will incorporate relevant feedback from the public obtained during public consultation.

Significance criteria have been developed that assist in identifying priority aspects, establish management criteria, and activity-specific mitigation measures. For social issues and effects, a key factor for determining significance is ongoing feedback from public consultation. These efforts will be used to communicate progress, and involve the public where necessary, on environmental performance.

Monitoring will be the principal mechanism to provide feedback to continually gauge the effectiveness of environmental performance. Operational control is facilitated through the contractor job-specific standard operating procedures (SOP) work instructions, on-the-job instruction, tailgate meetings where required, contract requirements, and service agreements. The effectiveness of physical operational control will be reviewed according to preventative maintenance and review procedures and schedules.

4. Applicable Legislation and Guidelines

4.1 AIR QUALITY

Air quality standards and objectives are generally intended to protect all members of the general public, including sensitive individuals such as the elderly, infants, and persons with compromised health. Therefore, standards are applicable in areas that are accessible to the general public. Air quality modelling predictions are typically compared to standards and objectives at the fence-line of the industrial property where emissions occur. A fence-line is defined as the limit beyond which public access is restricted.

Air quality standards or criteria for industrial settings are defined by occupational health and safety codes. Air quality guidelines are different for ambient and workplace environments. Occupational health air quality standards and criteria allow for higher concentrations of air contaminants because

working individuals are assumed to be of reasonably good health and therefore have higher tolerance than sensitive receptors, and exposure is limited to the time spent at the workplace. Due to the fact that workers will be housed on-site, more emphasis is placed on the evaluation of air quality standards and objectives in the area containing the accommodation buildings. Indoor air quality control measures will be established during the construction and operations phases of the project.

Canada's national, provincial, and territorial governments have established ambient air quality thresholds for criteria air contaminants (CACs) that are intended to ensure long-term protection of public health and the environment. The Government of Nunavut has established standards for maximum concentrations of ambient SO_2, NO_2, CO, TSP and $PM_{2.5}$. The Canadian Council of Ministers of the Environment (CCME) have also produced Canadian Ambient Air Quality Standards for 2015 and 2020 for $PM_{2.5}$ (CCME 2012). The Back River Project is expected to be operational in 2020 and therefore, as a conservative approach, the 2020 values have been used in this assessment. There are no territorial or national objectives for PM_{10}, therefore the British Columbia (BC) objective has been used (BC MOE 2009).

There are no air quality standards for dustfall in Nunavut; however there are objectives and guidelines for dustfall in other jurisdictions. The most stringent dustfall criterion is the acceptable limit in BC which ranges from 1.7 to 2.9 mg/dm^2/day (BC MOE 1979).

There are also no air quality standards for acid deposition in Nunavut; however critical loads of acid deposition proposed by the WHO (2000) range from less than 250 eq/ha/year to more than 1500 eq/ha/year, dependant on soil type. The Goose Property Area is dominated by shallow, acidic morainal and glaciofluvial deposits, characterized by variable but predominantly coarse to medium textures (Volume 5). Since coarse deposits are more susceptible to acidification, a more conservative critical load value associated with this texture was chosen for the assessment of the effects of acidic deposition on local soils. The critical load guideline for acidic deposition recommended by the WHO for acidic, coarse parent materials is below 250 eq/ha/year (WHO 2000).

Table 4.1-1 summarizes the ambient air quality standards applicable to the Project. The federal National Ambient Air Quality Objectives (NAAQOs) defined under the *Environmental Protection Act*, are also included for comparison.

Table 4.1-1. Federal, Provincial, and Territorial Ambient Air Quality Standards and Objectives

Contaminant	Averaging Period	Nunavut Ambient Air Quality Standards[a]	Dust and Acid Deposition Provincial Guideline Values	Canadian Ambient Air Quality Standards (2020)	National Ambient Air Quality Objectives[b]	
					Maximum Desirable	Maximum Acceptable
Sulphur dioxide (SO_2) (µg/m^3)	1-hour	450	-		450	900
	24-hour	150	-		150	300
	annual	30	-		30	60
Nitrogen dioxide (NO_2) (µg/m^3)	Annual	60	-		60	100
Carbon monoxide (CO) (µg/m^3)	1-hour	-	-	-	15,000	35,000
	8-hour	-	-	-	6,000	15,000
Total suspended particulate (TSP) (µg/m^3)	24-hour	120	-		-	120
	Annual[c]	60	-		60	70
PM_{10} (µg/m^3)	24-hour		50[d]			

(continued)

Table 4.1-1. Federal, Provincial, and Territorial Ambient Air Quality Standards and Objectives (completed)

Contaminant	Averaging Period	Nunavut Ambient Air Quality Standards[a]	Dust and Acid Deposition Provincial Guideline Values	Canadian Ambient Air Quality Standards (2020)	National Ambient Air Quality Objectives[b]	
					Maximum Desirable	Maximum Acceptable
$PM_{2.5}$ ($\mu g/m^3$)	24-hour	30	-	27[e]	-	-
	Annual			8.8		
$PM_{2.5}$ ($\mu g/m^3$)	24-hour	30	-		-	-
Dust deposition ($mg/dm^2/day$)	30-day	-	1.7[f]		-	-
Acid deposition (eq/ha/yr)	annual	-	250[g]		-	-

Notes:
[a] *Government of Nunavut (2011)*
[b] *CCME (1999)*
[c] *Geometric mean: the average of the logarithmic values of a data set converted back to a base 10 number*
[d] *BC MOE (2009)*
[e] *The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations.*
[f] *Most stringent provincial guideline (British Columbia 1979).*
[g] *The critical load guideline recommended for acidic, coarse parent materials (WHO 2000).*

4.2 GREENHOUSE GASSES

Since 2010, facilities emitting over 50,000 metric tonnes (t) of carbon dioxide equivalent (CO_2e) have been required to report to Environment Canada for the Greenhouse Gas Emissions Reporting Program (GHGRP), under the jurisdiction of the *Canadian Environmental Protection Act*, 1999 (Environment Canada 2013).

5. Roles and Responsibilities

The General Manager is ultimately responsible for the success of the plan and approves all relevant policies and documents, auditing, action planning and the verification process.

The Safety Superintendent along with his/her direct reports are responsible for the implementation of safety aspects of this plan.

The Environmental Superintendent along with his/her direct reports are responsible for the implementation of this plan including:

- Overall management of plan.
- Monitoring.
- Operational aspects.
- Internal reporting.
- External reporting.
- Ensuring compliance and adaptive management.

6. Environmental Protection Measures

6.1 EMISSIONS MANAGEMENT

In order to eliminate or reduce the potential for adverse effects on air quality during all phases of the Project, an Emissions Reduction Strategy Plan, a Dust Reduction Plan and an Incineration Management Plan have been developed and are described below.

6.1.1 Emissions Reduction Strategy Plan

An Emissions Reduction Strategy Plan will be in place during all phases of the Project to reduce criteria air contaminant and GHG emissions. The following sources of emissions have been identified:

- Stack emissions, such as generators and incinerators.
- Equipment exhaust emissions from vehicles such as dozers, haul trucks, forklift, graders, and fuel trucks.
- Aircraft emissions.

The plan will include the following:

- Selecting equipment with low emissions that meet latest applicable Canada emissions standards and guidelines.
- Implementation of energy efficiency and heat recovery measures.
- Procurement policies to identify fuel and equipment specifications.
- Ensuring proper equipment maintenance.
- Minimization of vehicle and equipment idling, when not in use, taking account of differing operational requirements in summer and winter.
- Use of large haul trucks for ore and waste transport to minimize the number of trips required between the source and the destination.
- Ensuring vehicles are driven at designated speeds on site roads.
- Installation of a waste oil burner unit equipped with a settling tank and filter system for particulate removal from the waste oil.
- Use of emission control systems (e.g., wet scrubbers, baghouses, and filters) on stacks and on relevant ventilation systems.
- Regular servicing of all mobile and stationary equipment to maintain efficiency.
- Necessary training and instruction for all on-site staff with duties related to the operation of equipment that emit air pollutants or controls air emissions (e.g., the required measures to be implemented during start-up, shut down, and emergency conditions):
  - The site operator will maintain a statement of training requirements for each operational post and keep a record of the training received by each person whose actions may have an effect on the environment.
  - These documents will be made available to the regulator on request.
- Adherence to all permits, authorizations and approvals.

6.1.2 Dust Reduction Plan

A Dust Reduction Plan will be in place during all phases of the Project in order to minimize fugitive dust emissions. The following sources of emissions have been identified:

- Dust from baghouses and dust collectors.
- Fugitive dust on unpaved roads from vehicles travelling on onsite roads.
- Fugitive dust emissions from mining activities such as bulldozing, grading, drilling and blasting, and CAC emissions from explosives used in blasting.

The Plan will include the following:

- Ensuring all-weather roads (local site roads) are regularly compacted and kept in good repair.
- Ensuring vehicles will be driven at designated speeds on site roads.
- Use of large haul trucks for ore and waste transport to minimize the number of trips required between the source and destination.
- Implementation of a frequent watering program on mine site roads.
- Implementation of a dust suppression program for the airstrip. For example, watering 30 minutes or less prior to arrival of aircraft, and 15 minutes or less prior to take-off of aircraft.
- Application of water, calcium chloride, and/or approved chemical dust suppressants along the highest-use segment of roads.
- Regular wheel-cleaning of vehicles travelling around and leaving the site.
- Use of water sprays or dust suppression fluids compatible with the ambient air temperatures to suppress dust generation from equipment in the crushing facility. Dust suppression methods should be approved by the Government of Nunavut as outlined in the Nunavut Environmental Guideline for Dust Suppression (GN 2002a) and should be suitable for use at below freezing temperatures.
- Regular removal of dust deposits on external parts of the plant in order to minimise the potential for wind entrainment.
- Minimize the discharge heights from the crushers onto conveyers, and conveyors onto stockpiles. In addition, the discharge from crushers onto conveyors or into other equipment should be enclosed as far as is practicable (e.g., free fall of materials from conveyors carrying material should be fitted with a full hood such as a plastic chute).
- Conditioning materials which are likely to generate dust with water prior to transfer when temperatures allow.
- Enclose or cover loads carried by vehicles when possible.
- Storage areas should be kept in a condition that does not give rise to visible dust emissions.
- Erection of windbreaks or fences around known problem areas or stockpiles to limit the dispersion of dust emissions from equipment and stockpiles, or activities likely to generate dust.
- Necessary training and instruction for all on-site staff with duties related to activities that may cause fugitive dust:
  - The site operator will maintain a statement of training requirements for each operational post and keep a record of the training received by each person whose actions may have an effect on the environment.
  - These documents will be made available to the regulator on request.
- Adherence to all permits, authorizations and approvals.

6.1.3 Incineration Management Plan

An Incineration Management Plan will be in place during all phases of the Project in order to minimize emissions from incineration activities. The Plan will include the following:

- Installation of an incinerator that complies with Nunavut standards (GN 2002b), Canada-Wide Standards for Dioxins and Furans (CCME 2000a) and Canada-Wide Standards for Mercury emissions (CCME 2000b). Operation of the incinerators will include the following measures:
  - A waste segregation program will be implemented (i.e., materials that are unsuitable for incineration, such as chlorinated plastics, will be diverted to alternate waste disposal facilities).
  - Personnel will be properly trained in incinerator operations.
  - Stack testing will be undertaken during commissioning to ensure compliance with standards.
- Recycling program and waste segregation to ensure incinerator stream is free of plastics.

6.2 SUMMARY

A summary of the various Project phases and relevant emissions management plan is shown in Table 6.2-1

Table 6.2-1. Mitigation Schedule

	Baseline and Pre-construction	Construction	Operation	Temporary Closure	Care and Maintenance	Reclamation and Closure	Post-closure
Emissions Reduction Strategy Plan	Not considered necessary	Required	Required	Required	Required	Required	Not considered necessary
Dust Reduction Plan	Not considered necessary	Required	Required	Required	Required	Required	Not considered necessary
Incineration Management Plan	Not required	Required once incinerator installed	Required once incinerator installed	Required if incinerator is in use	Required if incinerator is in use	Required if incinerator is in use	Not required

[a] *The plan will be re-evaluated as required.*

7. Monitoring Program

The Back River Air Quality Monitoring Program consists of the following components:

- Passive air quality monitoring of NO_2 and SO_2 (baseline collection began in May 2011).
- Dustfall monitoring of particulates, anions, cations and total metals (baseline collection began in May 2011).
- Particulate monitoring of TSP, PM_{10} and $PM_{2.5}$ (baseline collection began in summer 2013).
- Meteorological monitoring, which has been ongoing since 2004.
- Incinerator stack emissions testing.
- Construction monitoring.
- GHG emission monitoring (e.g., fuel use for power, mobile and stationary equipment operation) to determine whether reporting is required.

The design, installation, operation and certification of ambient air quality monitoring systems and programs will comply with the principles contained in the National Air Pollution Surveillance Network Quality Assurance and Quality Control Guidelines (Environment Canada, 2004). The following sections provide further details of these monitoring components.

7.1 PASSIVE AIR QUALITY MONITORING (NO_2 AND SO_2)

Emissions of NO_2 and SO_2 are expected as a result of fuel combustion associated with the Project.

7.1.1 Sample Locations

Baseline air quality data collection took place in 2011, 2012 and 2013. In 2011 a Passive Air Sampling System (PASS) was located within the Goose Property Area and in 2012/2013 three PASSs were installed, one located within the Goose Property Area, one at the George Lake exploration camp, and one at the Marine laydown Area. The stations operated from approximately June until September. The stations were all co-located with dustfall monitoring stations.

Upon Project approval, monitoring would be carried out at two locations during the construction and operation of the Project. In each case the PASS would be sited approximately 100 m downwind of the location with the most activity, for the Goose Property the locations would change depending on which pit is operational. An example of the monitoring locations is shown in Figure 7.1-1. The monitoring locations are based on the assumption that the Goose Main Pit is operational. The exact locations of the sites will be determined based on the final project specifications.

There will also be one additional monitoring site located between the Goose Project Area and MLA, away from the project activities, in order to measure background concentrations (Figure 7.1-1).

7.1.2 Sampling Methods

A PASS was used to monitor NO_2 and SO_2 and will be used should the Project proceed to construction and operation. The PASS monitors gas or vapour pollutants from the air through the process of diffusion through a static air layer or permeation through a membrane (Maxxam Analytics Inc. 2011), and has low detection limit capabilities. The sample media are installed in the field and exposed in protective shelters that are mounted to a support pole for a period of 30 days. Following the set exposure period the samples are retrieved, replaced and sent to the laboratory for analysis along with meteorological data including air temperature, wind speed and relative humidity, to allow the ambient air concentration of the compound over the sampling period to be determined.

7.1.3 Data Analysis

The NO_2 and SO_2 sampling will provide a 1-month average ground-level concentration for each compound. Compliance with the relevant air quality standards will then be determined (Table 4.1-1). In addition, ambient air quality temporal trends of NO_2 and SO_2 concentrations will be determined, taking into consideration the time of year and meteorological conditions during the sampling period.

As a conservative approach, the monitoring results will be compared with annual average criteria. If passive sampling should indicate levels above this annual criterion, then the monitoring data will be used to provide feedback to modify the air quality management procedures incorporated at the site. This will consist of pursing additional investigation and/or further mitigative efforts. However, sampling does not occur in “real time” and there will be a delay between the events that lead to any elevated concentrations and the receipt of monitoring results.

PROJECT #0194096-0040 GIS # BAC-12-024_S_T October 05 2015

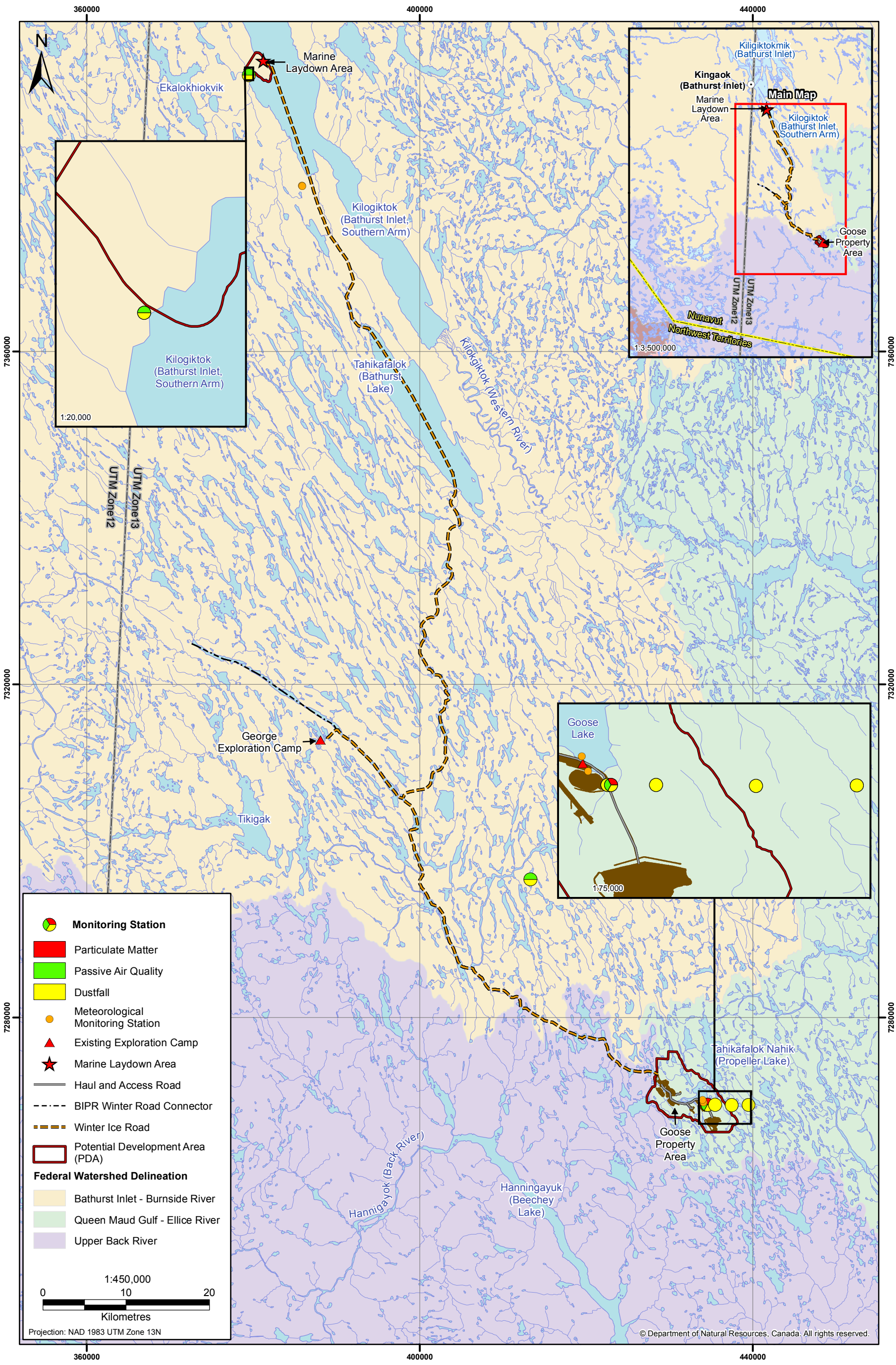

Figure 7.1-1

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Example Air Quality and Dust Monitoring Locations

7.2 DUSTFALL MONITORING

The main dust generation sources will be from wind erosion and movement of vehicles and large equipment on site. The dustfall monitoring program will measure the quantities of dust deposited near the Back River Project during construction and operation.

7.2.1 Sample Locations

Baseline dustfall data collection took place since 2011, 2012, and 2013. The 2011 dustfall monitoring program was carried out at five locations within the Goose Property Area and in 2012 monitoring was carried out at four locations within the Goose Property Area and one location in the Marine Laydown Area. In 2013, there were six monitoring locations within the Project area. The stations monitor dustfall over consecutive 30 day periods from approximately June until September.

Upon Project approval, monitoring would be carried out during the construction and operation of the Project. At the Goose Property, the monitoring will be sited to ensure that all large sources of emissions are monitored approximately 30m, 100m, 1km, 3km, and 5km downwind of the location with the most activity. An example of the monitoring locations, based on the modelled period (Year 3), is shown in Figure 7.1-1. In Year 3, the Main Pit would be the optimal location to establish a transect. This would extend to the east of the pit. The monitoring locations are based on the assumption that the Goose Main Pit is operational. The exact locations of the sites will be determined based on the final project specifications. Note that the locations will change depending on which pit is operational. At the Marine Laydown Area, a dustfall monitoring site will be sited approximately 100 m downwind of the site.

There will also be one additional monitoring site located between the Goose and MLA locations, away from the project activities, in order to measure background concentrations (Figure 7.1-1).

7.2.2 Sampling Methods

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

The baseline dustfall monitoring program was developed in accordance with sampling method ASTM D1739-98 (ASTM Standard D1739-98 Reapproved 2010) and would continue to use this method for future monitoring. The dustfall monitoring stations collect particles small enough to pass through a 1 mm screen and large enough to settle by virtue of their weight. This method requires containers of a standard size and shape, which are sealed in a laboratory. The containers are installed on a 2 m pole, surrounded by a windscreen and are each exposed to the atmosphere for approximately 30 days during the summer months.

Samples are sent to the laboratory for analysis of total, soluble and insoluble particulate matter. Each dustfall station is comprised of two sample containers with separate mounts. One of the containers is analysed for particulates (total, soluble and insoluble) and anions (sulphate, nitrate, chloride and ammonia), while the other is analysed for total metals and various cations. The containers are partially filled with deionized water and algaecide to prevent re-suspension of dust and growth of algae in the containers. The windscreen around the sample container improves the dustfall collection efficiency and bird spikes are used to minimize contaminants from bird faeces.

7.2.3 Data Analysis

The dustfall monitoring provides a 1-month average ground-level mass of deposited dust. This is compared to the relevant BC guidelines since Nunavut does not have dustfall standards (Table 4.1-1). In addition, analysis of temporal trends is undertaken to determine any increasing trends in the measured concentrations, with consideration to the time of year and meteorological conditions.

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

7.3 PARTICULATE MONITORING (PM_{10}, $PM_{2.5}$, AND TSP)

The generation of particulate matter is expected as a result of the movement of vehicles, mobile equipment, crushing, blasting, bulk handling and storage and other associated mineral processing and construction activities. Wind erosion can also generate particulate emissions. Suspended particulate matter is a complex multi-phase system of airborne solid and low vapour pressure liquid particles having aerodynamic particle sizes from 0.01 to 100 µm in diameter.

7.3.1 Sample Locations

Ambient suspended particulate matter will be measured via monitoring of TSP, PM_{10}, and $PM_{2.5}$ concentrations at the following four locations:

- At a dustfall/PASS site within the Goose Property Area.
- At the Goose Property accommodations area.
- At a location along the proposed winter road connecting the MLA and the Goose Property Area.
- At a dustfall/PASS site within the MLA.

Monitoring will be carried out during the construction and operation of the Project. Specific station locations will be sited approximately 100 m downwind of the location with the most activity, the locations will therefore change depending on which pit is operational. The exact locations of the sites will be determined based on the final project specifications.

7.3.2 Sampling Methods

TSP, PM_{10}, and $PM_{2.5}$ measurements will be taken by drawing a known quantity of air through a pre-weighed filter using a BGI PQ100-FRM Sampler. Collection of TSP will occur simply by passing ambient air through the filter, while PM_{10} and $PM_{2.5}$ measurements will require the air to pass through a size exclusion cyclone prior to reaching the filter. All filters will be pre and post weighed by an accredited laboratory. Two 24-hour period samples for each type will be taken at each of the four different locations.

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

Additional factors, not specified in standard site selection criteria, will also be considered. Due to the very cold climate the air samplers will be installed inside a shelter. This should minimize sample schedule

interruptions potentially caused by cold weather, wet conditions and excess humidity (filter conditioning), air leaks, and pump malfunctioning. The monitoring site location will be free from obstructions and nearby pollutant sources that may cause interference in suspended particulate monitoring.

7.3.3 Data Analysis

The particulate sampling provides a 24-hour average ground-level concentration for each size fraction. This is compared to the relevant 24-hour standards (Table 4.1-1). In addition, temporal trends of the TSP, PM_{10}, and $PM_{2.5}$ ambient concentrations are examined taking in to consideration the time of year and meteorological conditions of the sampling period.

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

7.4 METEOROLOGICAL MONITORING PROGRAM

Baseline meteorological data collection has been collected episodically since 2004. A meteorological monitoring program is ongoing. There are currently three meteorological stations in the Back River Project area, one within the Goose Property Area, one near the George Exploration camp, both installed in August 2004, and a micro-met station at Goose Lake, which was installed in July 2012.

These stations measure hourly values of temperature, wind speed, wind direction, relative humidity, solar radiation and rainfall. The Goose Lake micro-met station measures air temperature, water temperature, rainfall, wind speed, wind direction and global radiation in order to determine evaporation rates during the open water season.

Meteorological monitoring will occur at these locations during the construction and operation of the Project. The locations of the meteorological stations are shown in Figure 7.1-1.

7.5 INCINERATOR STACK TESTING

An Incinerator Stack Testing program will be implemented to measure emissions of dioxins, furans and mercury from the waste incinerator(s). A stack test will be conducted following the commissioning of each permanent incinerator. It will then be assumed that all other incinerators being operated under similar conditions will have similar emissions. Stack test results to be reported to NIRB and Environment Canada as required.

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

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

7.6 CONSTRUCTION MONITORING

In addition to the dustfall monitoring stations described above, additional stations will be established to increase the number of dustfall stations used to monitor construction dust emissions. These monitoring locations will be selected based on the following:

- Samplers will be sited up and down wind of the zones of high activity, taking into account the dominant wind direction during the survey period.
- The samplers will be more than 20 m away from other structures, and major topographic features.
- The samplers will be safely accessible.

7.7 GHG MONITORING

A desktop assessment of GHG emissions will be carried out annually to determine whether reporting is required. Sources of GHG emissions (e.g. fuel use for power, mobile and stationary equipment operation) will be monitored and resultant data will be used for GHG assessments.

7.8 SUMMARY

Table 7.8-1 shows the monitoring schedule for air quality and GHG emission monitoring. Monitoring is not considered necessary during care and maintenance or closure phases as there is not expected to be any significant air emission sources.

8. Mitigation and Adaptive Management

The purpose of the Air Quality Monitoring and Management Plan is to document the mitigation measures that will be implemented on site and to document the monitoring programs that will be in place. The plan is intended to ensure air quality levels meet existing legislation, while taking into account operational requirements. Results from the monitoring programs will be reviewed annually to determine if any trends are evident and if target criteria are being met. The need for any corrective actions to on-site emission management or installation of additional control measures will be determined on a case-by-case basis. Indications of the need for corrective actions and additional control measures may include:

- Monitoring data showing concentrations greater then applicable standards.
- Monitoring data showing an increasing trend in contaminant concentrations.
- Issues raised by on-site staff, regulators, or local communities.

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

Measures described in the Air Quality Monitoring and Management Plan apply to all Project components for the life of the Project, unless otherwise indicated. This plan is designed to be adaptive, effective, and achievable in both the short and long term, and includes measurable objectives that will be evaluated in the monitoring program (Section 7). The Management Plan is a “living document.” Components of the Air Quality Monitoring and Management Plan may need to be revised over the life of the Project, based on regulatory changes and/or technological advances. Any modifications made to the overall Plan will be communicated to regulatory authorities where applicable.

Table 7.8-1. Air Quality Monitoring Schedule

Monitoring	Baseline and Pre-construction	Construction	Operation	Temporary Closure	Care and Maintenance	Reclamation and Closure	Post-closure
PASS	Required	Required	Required	Monitoring is not considered necessary; however, the plan will be re-evaluated as required.			
Dustfall	Required	Required	Required	Monitoring is not considered necessary; however, the plan will be re-evaluated as required.			
Particulate Matter	Required	Required	Required	Monitoring is not considered necessary; however, the plan will be re-evaluated as required.			
Incinerator Stack Testing	Not considered necessary	Required upon commissioning	Required upon commissioning	Monitoring is not considered necessary; however, the plan will be re-evaluated as required.			
Construction Monitoring	Required	Not considered necessary	Not considered necessary	Monitoring is not considered necessary; however, the plan will be re-evaluated as required.			
GHG	Not considered necessary	Annual checks	Annual checks	Monitoring is not considered necessary; however, the plan will be re-evaluated as required.			

The monitoring program (Section 7) is intended to monitor the effectiveness of mitigation actions (Section 6). The results of mitigation activities will be reported in an annual report. In addition, the results of facility-specific monitoring programs will be reported in the annual report, along with suggestions for further mitigation activities.

This circle of mitigation activities, monitoring and evaluation and new mitigation activities will adaptively manage air quality issues identified and arising as a result of the Project.

9. Checking and Corrective Action

Checking and corrective action evaluates the predicted effects of the Project, and evaluates the compliance of the Project and its sub-contractors. Evaluation of predicted effects will be conducted through facility-specific monitoring (Section 7). The monitoring, quality control, and reporting procedures detailed in this plan will be used to:

- Assess the effectiveness of mitigation and management measures.
- Identify Project effects requiring further mitigation efforts.
- Comply with requests from regulators and stakeholders.
- Adapt to changes in the regulations or the Project.

10. Record Keeping

Record keeping will be conducted by Sabina and its subcontractors. Data will be entered into suitable electronic databases, checked for quality control and stored with subcontractor responsible for monitoring and with Sabina. Data will be entered in a format and program that allow for comparison between years and storage in a single file format for each type of survey or monitoring activity. QA/QCed data will be appended to the annual Air Quality Monitoring and Management Plan report and the compilation of all years data will be transferred for storage with the Government of Nunavut, Department of Environment.

All formal documents and reports will follow version-control procedures with revision tracking and version numbers. Version control information will be required for all documents and data that are issued, and approval will be given and tracked before issue. Designated personnel will coordinate preparation, review, and distribution, as appropriate, of the data and reports required for regulatory purposes.

11. Environmental Reporting

The results of the Air Quality Monitoring and Management Plan will be reported in various annual reports each year during construction and operation and will be provided to NIRB and other regulators where appropriate. The following reports will be produced:

- Annual Meteorology Compliance Report.
- Annual Air Quality Compliance Report.

- Incinerator Stack Testing Compliance report (when applicable).
- Construction Monitoring Report (when applicable).
- GHG Emission Report (when applicable).

It is not considered necessary to produce an annual report during care and maintenance, closure, periods of temporary closure and post closure. An air quality assessment will be carried out at the start of each of these stages and if no significant air quality sources are identified, no further reports will be produced. If significant sources are identified reporting will be continued on an annual basis.

12. Plan Effectiveness

The Plan is intended to ensure that the Project is conducted as proposed, mitigation and management measures are effective at mitigating adverse air quality effects, and relevant laws and regulations are met. As part of environmental reporting, Sabina will distribute copies of the annual report to stakeholders. Sabina will also conduct an annual (or as necessary) evaluation of the efficacy of mitigation and management activities and of monitoring activities using relevant methods. Should new, more sensitive, monitoring methods be introduced, or existing methods be found to lack statistical power or a robust design, updated methods will be proposed to the stakeholders in a revised plan. This Plan may be updated as frequently as every year, or not at all, if the mine plan, and methods for mitigation and monitoring be found to be robust. The new plan will be implemented following review by stakeholders and an opportunity for response by Sabina.

13. QA/QC

Quality assurance and quality control (QA/QC) measures will be undertaken at three key stages in monitoring activities: 1) during data gathering, 2) during data entry and analysis, and 3) through reporting and reassessment of methods as part of the evaluation of Plan Effectiveness.

The process of data gathering in the field will be quality controlled through the use of qualified personnel and a system of pre- and post-field checks to ensure that consistent, repeatable data is being gathered. Standard Operating Procedures (SOP) will be established for all environmental data collection. All personnel will have necessary training and accreditation. QA/QC of data entry will be conducted via a process of standard data entry templates, and checking data through either double-entry data or feedback entry, where entered data is checked back to the field cards. QA/QC of data analysis will be conducted through a process of clear, written instructions for data analysis and pre-and post-analysis checks. Finally, the efficacy of the methods as a whole will be evaluated through repeated scrutiny of the data using power analysis and through review by stakeholders. SOPs will be reassessed and updated when necessary, as part of the re-iterative QA/QC process.

The re-iterative QA/QC procedures will continuously improve the effectiveness of the Management Plan to detect Project-related air quality effects. These QA/QC processes are important in the overall Adaptive Management of Project effects, and will support the goals of the Project to minimise, mitigate and/or manage potential adverse effects.

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18. Noise Abatement Plan

Sabina
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BACK RIVER PROJECT
Noise Abatement Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 18	All sections		No major revisions made.

BACK RIVER PROJECT
NOISE ABATEMENT PLAN

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Appendix A. *Mine Health and Safety Act* – Consolidation of Mine Health and Safety Regulations

Glossary and Abbreviations

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

dBA	Sound levels measured with an A-weighted filter, which is within a response frequency range for humans and animals, between 1 kHz to 4 kHz (1,000 to 4,000 vibrations per second)
dBC	Unit used to measure C-weighted sound pressure levels. C-weighting is an adjustment made to sound-level measurements which takes account of low-frequency components of noise within the audibility range of humans.
DEIS	Draft Environmental Impact Statement
FEIS	Final Environmental Impact Statement
NIRB	Nunavut Impact Review Board
QA	Quality Assurance
QC	Quality Control
SOP	Standard Operating Procedures
VEC	Valued Ecosystem Component

1. Introduction

The Back River Project (hereafter "the Project") has been designed to minimize, mitigate, and/or manage potential adverse effects on the environment while systematically seeking to enhance positive effects. As part of the final Environmental Impact Statement (EIS) guidelines issued by the Nunavut Impact Review Board (NIRB), this document presents the Noise Abatement Plan that Sabina Gold & Silver Corp. (hereafter "Sabina") will follow concurrent with the development of the Project.

The Noise Abatement Plan is a "living document." It will be regularly updated based on management reviews, incident investigations, regulatory changes, or other Project-related changes.

2. Scope and Objectives

The intent of this plan is to outline the requirements for occupational noise monitoring, control and worker protection. The Plan targets the noise valued ecosystem component (VEC) that is included in the Final Environmental Impact Statement (FEIS). Project activities will create noise; however, the Project has been designed to minimize or eliminate potential adverse effects on workers as described in this Plan.

This Plan includes the following:

- Applicable legislation and guidelines for occupational noise.
- Operational controls focused on worker protection.
- An occupational noise monitoring program.

Mitigation and adaptive management measures focused on minimizing the potential effects of noise on select wildlife species are provided in the Wildlife Mitigation and Monitoring Plan (Chapter 20).

3. Planning and Implementation

Planning for the Noise Abatement Plan started with the development of the DEIS and continued through the FEIS, both of which identified existing (baseline) conditions, assessed potential impacts of the Project, developed conceptual mitigation strategies and developed specific mitigation measures to execute these strategies. Conceptual strategies and plans will continue to be elaborated and executed throughout the construction, operation, and closure phases of mining. Noise management will be tracked, reviewed, and updated through ongoing maintenance of the plan. Significance criteria have been developed that assist in identifying priority aspects, establish management criteria and activity-specific mitigation measures.

Monitoring will be the principal mechanism to provide feedback to continually gauge the effectiveness of environmental performance. Operational control is facilitated through the contractor job-specific standard operating procedures (SOPs) work instructions, on-the-job instruction, tailgate meetings where required, contract requirements, and service agreements. The effectiveness of physical operational control will be reviewed according to preventative maintenance and review procedures and schedules.

4. Applicable Legislation and Guidelines

The noise monitoring component of the Occupational Health and Safety Program will comply with the Consolidation of Mine Health and Safety Regulations under the territorial *Mine Health and Safety Act* (1994; Sections 9.19 through 9.26 and Schedule 5), the relevant portions of which can be found in Appendix A. Schedule 5 states:

> *No person may be exposed without hearing protection to -*
>
> > *(a) steady state noise[1] over 109 dBA;*
> >
> > *(b) a maximum equivalent noise level exceeding 85 dBA for an eight-hour shift, or exceeding the equivalent exposure level set out in* [Table 4-1]*; and*
> >
> > *(c) impact noise[2] at a peak pressure level exceeding 140 dBC, or exceeding the maximum levels set out in* [Table 4-2].
>
> *Where the maximum noise level permitted in paragraph (1)(a), (b) or (c) is exceeded at a work site, a person shall be provided with and shall use the hearing protection recommended in the standard CAN/CSA Z94.2-94, Hearing Protectors.*

Table 4-1. Exposure Limits Equivalent to 85 dBA/Eight-hour Shift

Length of Exposure	Average Noise Level
16 hours	82 dBA
12 hours	83 dBA
10 hours	84 dBA
8 hours	85 dBA
4 hours	88 dBA
2 hours	91 dBA
1 hour	94 dBA
½ hour	97 dBA
¼ hour	100 dBA

Table 4-2. Impact Noise Exposure Limits

Peak Pressure Level (decibels)	Maximum Permitted (impulses per eight-hour day)
120	10,000
130	1,000
140	100
Greater than 140	0

[1] "steady state noise" means noise in which variations of peak pressure levels occur in one second or less.
[2] "impact noise" means noise in which variations of peak pressure levels occur at intervals greater than one second apart.

Two main health effects of working with noise are hearing loss and stress. Workplace noise can be caused by traffic, pneumatic tools, power tools, machinery and ventilation systems, for example. Regulations followed by the employer are meant to protect workers from excessive noise levels.

Noise exposure limits depend on duration of exposure, noise level, and whether the noise is steady state (i.e., constant) or impulse. An employer must ensure that a worker is not working with a noise level above the exposure limits set in these regulations.

Sabina and its contractors will comply with the Mine Health and Safety Regulation requirements for the management and mitigation of workplace noise exposure.

5. Roles and Responsibilities

The General Manager is ultimately responsible for the success of the plan and approves all relevant policies and documents, auditing, action planning and the verification process.

The HSE Manager along with his/her direct reports are responsible for the implementation of safety aspects of this plan including:

- Overall management of plan;
- Monitoring;
- Operational aspects;
- Internal reporting;
- External reporting; and
- Ensuring compliance and adaptive management.

Section 9.19 of the Consolidation of Mine Health and Safety Regulations (Appendix A), states that ”The manager shall take all reasonable measures to ensure the noise levels at work sites in a mine do not exceed the exposure levels shown in Schedule 5 (Noise Exposure).”

6. Environmental Protection Measures

6.1 MITIGATION MEASURES

The following section outlines operational controls that will be implemented during the construction, operation, and care and maintenance and closure phases of the Project. These operational controls were developed in order to minimize workplace noise.

6.1.1 Construction Phase

Noise control during the construction phase of the Project will be focused on materials handling and transportation sources. Based on experience from other mine projects the following noise controls are being considered:

- Ensuring equipment is fitted with appropriate mufflers and silencers.

- Identifying enclosures, berms, acoustic screening and shrouding where stationary sources require control.
- Ensuring equipment is well maintained.

6.1.2 Operation Phase

Noise control during operations will focus on the quarry and crushing areas (materials handling), power generation, processing, mine ventilation and blasting activities. Based on experience from other mine projects the following noise controls are being considered:

- Ensuring equipment is fitted with appropriate mufflers and silencers.
- Identifying enclosures, berms, acoustic screening and shrouding where stationary sources require control.
- Ensuring equipment is well maintained.
- Housing stationary sources in buildings, where feasible.
- Impulse events, such as blasting, will be limited to certain times of the day.
- Scheduling of take-off and landing aircrafts will be limited to certain times of the day.
- Other possible general noise abatement measures that can be implemented on site to minimize static noise due to generators, vehicles, and other sources.

6.1.3 Care and Maintenance and Closure Phases

Noise control during closure will be focused on the Tailings Storage Facility (TSF) and Tailings Facilities (TFs), closure activities, plant and mine areas. Most of the noise sources during closure will be from transportation vehicles. Based on experience from other mine projects the following noise controls are being considered:

- Ensuring equipment is fitted with appropriate mufflers and silencers.
- Identifying enclosures, berms, acoustic screening and shrouding where stationary sources require control.
- House stationary sources in buildings.
- Ensuring equipment is well maintained.

Any sources requiring mitigation identified during monitoring will be addressed using the above mitigation or engineered controls as appropriate. Noise controls that are used will be documented in the noise monitoring report.

Initial controls will be documented prior to Project start-up and the list maintained as additional control needs are identified through the monitoring plan.

6.2 OCCUPATIONAL NOISE MANAGEMENT

The Occupational Noise Management Plan will outline steps that Sabina can take to mitigate negative effects caused by noise. These procedures include the following:

- Where the noise is constant and measurements show noise levels in excess of 85 dBA, the area shall be clearly marked by signs indicating that hearing protection is required.

- Attempting to lower the noise level, reduce the length of exposure, and separate the worker from the sources of noise where they exceed the allowable limits.
- Provide suitable hearing protection, to be used in accordance with recommendations outlined in the *Canadian Standards Association Standard Z.94.2-02, Hearing Protectors* (2014), where other mitigation and management options are not available or reasonable.
- In any area where the noise level may exceed 85 dBA, the manager shall ensure that effective procedures are provided to protect employees from any harmful effects of the noise and copies of the procedures are sent to the chief inspector and given to the Safety Superintendent.

In addition, Sabina will adopt an average constant upper noise limit of 83 dBA for determining where noise protection must be made mandatory and the point at which noise mitigation measures should be focused as a priority. This noise level corresponds with the noise level limit for a 12-hour exposure time.

Sabina and its contractors will comply with all applicable regulations, including the implementation of a hearing conservation program that will include the following (where required):

- Awareness and training of employees, contractors and visitors;
- Noise surveys of worksites and equipment;
- Engineering and administrative controls;
- Hearing protection for employees;
- Audiometric testing; and
- Consultation with employees.

Sabina and its contractors will also follow the Mine Health and Safety Regulation requirements specific for:

- Noise exposure limits (including steady state (i.e., constant) and impulse noise);
- Measurement of noise levels;
- Hearing protection; and
- Audiometric testing.

7. Monitoring Program

The purpose of the monitoring program is to assess the magnitude of noise impacts from Project activities. Section 9.20 of the Consolidation of Mine Health and Safety Regulations (Appendix A), states that the manager shall ensure that a noise level survey is conducted at all work sites and the results of every noise level survey shall be given to the Occupational Health and Safety Committee and made available to an inspector.

The main activities expected to cause noise impacts included the mine site camp operations (including vehicles, generators, and incinerators), aircraft activities, mining, crushing, drilling and transportation activities.

The noise monitoring will be carried out by a qualified professional using a noise level meter. The following noise levels will be monitored at all locations were workers may be present:

- dBA during an eight hour period; and
- dBC during impact events.

A-weighting is the most commonly used parameter when a single-number overall sound level is needed. Results are expected to indicate human perception or the effects of sound on humans. A-weighting accounts for the reduced sensitivity of humans to low-frequency sounds, especially at lower sound levels. C-weighting is used to evaluate sounds containing strong low-frequency components. It was originally devised to approximate human perception of high-level sounds.

Table 7-1 shows the monitoring schedule for occupational noise monitoring. Monitoring is required when equipment is first commissioned and then on an annual basis, or if an employee requests monitoring to be undertaken. Monitoring is not considered necessary during care and maintenance or closure phases as there is not expected to be any significant noise sources.

Sabina will also have a noise monitoring component in the Occupational Health and Safety Program. The noise monitoring component of the Occupational Health and Safety Program will comply with the Consolidation of Mine Health and Safety Regulations under the territorial *Mine Health and Safety Act* (Sections 9.19 through 9.26 and Schedule 5), the relevant portions of which can be found in Appendix A.

8. Mitigation and Adaptive Management

The Noise Abatement Plan describes actions that are intended to reduce occupational noise effects on workers. The plan is intended to ensure occupational noise levels meet existing legislation, while taking into account operational requirements.

Measures described in the Noise Abatement Plan apply to all Project components for the life of the Project, unless otherwise indicated. This plan is designed to be adaptive, effective, and achievable in both the short and long term, and includes measurable objectives that will be evaluated in the monitoring program (Section 7). The Management Plan is a “living document.” It will be regularly updated based on management reviews, incident investigations, regulatory changes, or other Project-related changes

The monitoring program (Section 7) is intended to monitor the effectiveness of mitigation actions (Section 6). The results of mitigation activities will be reported in an annual report. In addition, the results of facility-specific monitoring programs will be reported in the annual report, along with suggestions for further mitigation activities.

This circle of mitigation activities, monitoring and evaluation and new mitigation activities will adaptively manage occupational noise issues identified and arising as a result of the Project.

Table 7-1. Occupational Noise Monitoring Schedule

Phase Component	Baseline and Pre-construction	Construction	Operation	Temporary Closure	Care and Maintenance	Reclamation and Closure	Post-closure
All areas where workers will be present.	Noise monitoring is not considered necessary.	Commissioning of any new equipment. Annual checks. If requested by employee.	Commissioning of any new equipment. Annual checks. If requested by employee.	Noise monitoring is not considered necessary, however the plan will be re-evaluated as required.			

9. Checking and Corrective Action

Checking and corrective action evaluates the predicted effects of the Project on workers, and evaluates the compliance of the Project and its sub-contractors. Evaluation of predicted effects will be conducted through facility-specific monitoring (Section 7). The monitoring, quality control, and reporting procedures detailed in this plan will be used to:

- Assess the effectiveness of mitigation and management measures;
- Identify Project effects requiring further mitigation efforts;
- Comply with requests from regulators and stakeholders; and
- Adapt to changes in the regulations or the Project.

10. Record Keeping

Record keeping will be conducted by Sabina and its subcontractors. Data will be entered into suitable electronic databases, checked for quality control, and stored with subcontractor responsible for monitoring and with Sabina. Data will be entered in a format and program that allow for comparison between years and storage in a single file format for each type of survey or monitoring activity. QA/QC data will be appended to the annual Noise Abatement report and the compilation of annual data will be transferred for storage with the Government of Nunavut, Department of Environment.

All formal documents and reports will follow version-control procedures with revision tracking and version numbers. Version control information will be required for all documents and data that are issued, and approval will be given and tracked before issue. Designated personnel will coordinate preparation, review, and distribution, as appropriate, of the data and reports required for regulatory purposes.

Section 9.20 of the Consolidation of Mine Health and Safety Regulations (Appendix A), states that the results of every noise level survey shall be given to the Committee and made available to an inspector. Section 9.20 also states that in any area where the noise level may exceed 85 dBA, the manager shall ensure that effective procedures are provided to protect employees from any harmful effects of the noise and copies of the procedures are sent to the chief inspector and given to the Occupational Health and Safety Committee.

11. Environmental Reporting

The Noise Abatement Plan will be reported on each year during construction and operation. The report will include monitoring data from the monitoring programs. Reporting on mitigation and management activities, including performance will be reported in an appendix to the report.

The report may be delivered to relevant regulatory agencies and stakeholders, the Government of Nunavut, and any monitoring partners involved in collaborative effects assessment.

It is not considered necessary to produce an annual report during care and maintenance, closure, periods of temporary closure and post closure. A noise assessment will be carried out at the start of each of these stages and if no significant noise sources are identified, no further reports will be produced. If significant sources are identified reporting will be continued on an annual basis.

12. Plan Effectiveness

The Plan is intended to ensure that mitigation and management measures are effective at mitigating adverse noise effects on workers, and relevant laws and regulations are met. As part of environmental reporting, Sabina will distribute copies of the annual report to stakeholders, as requested. Sabina will also conduct an annual (or as necessary) evaluation of the efficacy of mitigation and management activities and of monitoring activities using relevant methods. Should new, more sensitive, monitoring methods be introduced, or existing methods be found to lack statistical power or a robust design, updated methods will be proposed to the stakeholders in a revised plan. This plan may be updated as frequently as every year, or not at all, if the mine plan, and methods for mitigation and monitoring be found to be robust. The new plan will be implemented following review by stakeholders and an opportunity for response by Sabina.

13. QA/QC

Quality assurance and quality control measures will be undertaken at three key stages in monitoring activities: 1) during data gathering, 2) during data entry and analysis, and 3) through reporting and reassessment of methods as part of the evaluation of Plan Effectiveness.

The process of data gathering in the field will be quality controlled through the use of qualified personnel and a system of pre- and post-field checks to ensure that consistent, repeatable data is being gathered. Standard Operating Procedures (SOP) will be established for all environmental data collection. All personnel will have necessary training and accreditation. QA/QC of data entry will be conducted via a process of standard data entry templates, and checking data through either double-entry data or feedback entry, where entered data is checked back to the field cards. QA/QC of data analysis will be conducted through a process of clear, written instructions for data analysis and pre-and post-analysis checks. Finally, the efficacy of the methods as a whole will be evaluated through repeated scrutiny of the data using power analysis and through review by stakeholders. SOPs will be reassessed and updated when necessary, as part of the re-iterative QA/QC process.

The reiterative QA/QC procedures will continuously improve the effectiveness of the Management Plan to detect Project-related noise effects. These QA/QC processes are important in the overall Adaptive Management of Project effects, and will support the goals of the Project to minimize, mitigate and/or manage potential adverse effects on workers.

References

1994. *Mine Health and Safety Ac*t. SNWT (Nu) 1994, c 25.

Canadian Standards Association. *2014. Standard Z.94.2-02, Hearing Protection Devices - Performance, Selection, Care, and Use*.

Appendix A

Mine Health and Safety Act – Consolidation of Mine Health and Safety Regulations

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(4) Abrasive blasting and similar operations conducted outside a building shall be conducted in a place and in a manner that prevents injury to persons.

Protective Equipment

9.16. (1) Where an abrasive blasting operation is being conducted, the manager shall supply and employees shall wear air-supplied hoods or respirators suitable for the work, together with gloves, leggings and clothing designed to protect the employees from dust and projected abrasive or other material.

(2) Air supplied to the hood or respirator shall meet the requirements of the standard CAN3-Z180.1-M85, *Compressed Breathing Air and Systems*, and the volume of air supplied shall be sufficient for respiration and to prevent the entry of contaminants into the hood or respirator and shall not be less than 105 *l* per minute of air to tight fitting face-pieces and 170 *l* per minute of air to loose-fitting helmets, hoods and suits.

Nozzles and Valves

9.17. (1) Blast cleaning nozzles shall be equipped with an operating valve that must be held open manually and the normal operation of this valve shall not be defeated.

(2) A support shall be provided on which the nozzle referred to in subsection (1) can be secured when not in use.

(3) In addition to the operating valve required by subsection (1), another operating control shall be readily accessible to the operator to enable the flow of abrasive material to be stopped immediately.

Workers to be Removed

9.18. (1) Where an abrasive blasting or a similar operation releases harmful substances into the atmosphere, persons who are not required to assist in the operation shall be removed from contaminated areas.

(2) Where removal of persons as required by subsection (1) is not practical, the exposed persons shall be advised of the hazard and supplied with suitable personal protective equipment and the exposed persons shall wear the equipment.

NOISE

Exposure Levels

9.19. The manager shall take all reasonable measures to ensure the noise levels at work sites in a mine do not exceed the exposure levels shown in Schedule 5 (Noise Exposure).

Measurements of Noise Levels

9.20. (1) The manager shall ensure that a noise level survey is conducted at all work sites.

(2) The results of every noise level survey shall be given to the Committee and made available to an inspector.

(3) Where the noise is constant and measurements show noise levels in excess of 85 dBA, the area shall be clearly marked by signs indicating that hearing protection is required.

(4) In any area where the noise level may exceed 85 dBA, the manager shall ensure that effective procedures are provided to protect employees from any harmful effects of the noise and copies of the procedures are sent to the chief inspector and given to the Committee.

(5) Where personal noise dosimeters are used they shall have the following measurement specifications:

(a) a noise measurement exchange rate of 3 dB;
(b) a threshold level of 75 dBA or lower; and
(c) if measurement is expressed as a percentage, a reading of 100% for an average exposure of noise equivalent to 85 dBA for eight hours (Lex).

R-016-2003,s.92.

9.21. Repealed, R-016-2003,s.93.

Hearing Protection

9.22. (1) Subject to subsection (2), the selection of the type of hearing protection devices provided by the owner is a matter to be jointly decided by the manager and the Committee or, where there is no Committee in place, other representatives of the employees.

(2) Hearing protective devices shall be used in accordance with the recommendations of Table A1 (Selection of Hearing Protectors) in the standard CAN/CSA Z.94.2-94, *Hearing Protectors*.

9.23. Where an inspector has reason to believe that the type of hearing protective device provided by the manager is unsuitable for use by the employee, the inspector may require the manager to provide an alternative type.

9.24. Every manager shall ensure that any mould of the auditory canal taken for manufacture of a hearing protective device shall be moulded for the employee by a qualified person and the initial fitting of the employee shall be done by a qualified person.

9.25. The manager shall develop and implement a hearing conservation program that shall include:

(a) education of the employees;
(b) noise surveys of work sites and equipment;
(c) engineering and administrative controls;
(d) hearing protection for employees;
(e) audiometric testing; and
(f) consultation with employees.

Audiometric Testing

9.26. (1) Every employee who works in an environment where the noise level is 80 dBA or greater shall, at the expense of the owner, be given an audiometric test for hearing acuity by a person who is certified, by a body acceptable to the chief inspector, to conduct such tests

(a) on commencing employment;
(b) annually on the anniversary of commencing employment; and
(c) at any other time when required by the manager or the chief inspector.

(2) The manager shall keep on file a record of the audiometric tests and the record shall be available for examination by an inspector.

(3) The manager shall give the results of an audiometric test of an employee to the employee within three days of receiving the results. R-016-2003,s.94.

NON-INHALATION EXPOSURE

Injury to Eyes

9.27. (1) Where there is potential for injury by eye contact, a manager shall

(a) provide exposed workers with such personal protective equipment as may be appropriate to their actual or potential exposure, including safety glasses, goggles or face shields or other eye protective equipment that complies with CSA Standard CAN/CSA Z94.3-M88, *Industrial Eye and Face Protectors*; and
(b) provide, at or near the exposure site, the appropriate hygiene facilities including portable eye wash stations or eye wash fountains and maintained in a hygienic and working condition.

SCHEDULE 5

(*Section 9.19*)

NOISE EXPOSURE

1. (1) In this Schedule,

(a) "steady state noise" means noise in which variations of peak pressure levels occur in one second or less; and

(b) "impact noise" means noise in which variations of peak pressure levels occur at intervals greater than one second apart.

(2) For purposes of Table 2, an unweighted peak measurement may be used if an instrument is not available to measure a C-weighted peak.

2. (1) No person may be exposed without hearing protection to

(a) steady state noise over 109 dBA;

(b) a maximum equivalent noise level exceeding 85 dBA for an eight-hour shift, or exceeding the equivalent exposure level set out in Table 1; and

(c) impact noise at a peak pressure level exceeding 140 dBC, or exceeding the maximum levels set out in Table 2.

(2) Where the maximum noise level permitted in paragraph (1)(a), (b) or (c) is exceeded at a work site, a person shall be provided with and shall use the hearing protection recommended in Table A1 of the standard CAN/CSA Z94.2-94, *Hearing Protectors*.

Table 1

Exposure Limits Equivalent to 85 dBA/Eight-Hour Shift

Length of Exposure	**Average Noise Level**
16 hours	82 dBA
12 hours	83 dBA
10 hours	84 dBA
8 hours	85 dBA
4 hours	88 dBA
2 hours	91 dBA
1 hour	94 dBA
½ hour	97 dBA
¼ hour	100 dBA

Table 2

Impact Noise Exposure Limits

Peak Pressure Level (decibels)	**Maximum Permitted (impulses per eight-hour day)**
120	10,000
130	1,000
140	100
greater than 140	0

19. Aquatic Effects Management Plan

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BACK RIVER PROJECT
Aquatic Effects Management Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions)
Chapter 19	All Sections	FS Update	General updates to reflect improvements to the Project design, comments from DEIS reviewers, and the inclusion of relevant commitments from the NIRB PHC Decision Report (December 2014).
	7.2	AEMP Sampling Design	Update to sampling locations and descriptions
	7.2.3.1	Power Analysis	Added to satisfy a PHC Report commitment
	7.2.5	AEMP Sampling Details	Update to sampling design and frequencies
	7.2.6.1	Water Quality	Added a power and statistical analysis for project effects on water quality

BACK RIVER PROJECT
AQUATIC EFFECTS MANAGEMENT PLAN

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Glossary and Abbreviations

AEMP	Aquatic Effects Monitoring Program
ANOVA	Analysis of Variance
ARD	Acid rock drainage
BACI	Before-After/Control-Impact
BMP	Best management practices
CCME	Canadian Council of Ministers of the Environment
DEIS	Draft Environmental Impact Statement
DFO	Department of Fisheries and Oceans
DO	Dissolved oxygen
EEM	Environmental Effects Monitoring
FEIS	Final Environmental Impact Statement
ISQG	Interim Sediment Quality Guidelines
LSA	Local study area
MEND	Mine Environmental Neutral Drainage
ML	Metal leaching
MLA	Marine Laydown Area
MMER	Metal Mining Effluent Regulations
NIRB	Nunavut Impact Review Board
NLCA	Nunavut Land Claims Agreement
NWB	Nunavut Water Board
PAG	Potentially Acid Generating
PEL	Probable effects levels
RSA	Regional study area
SOP	Standard Operating Procedures
the Project	the Back River Project
TBD	To be determined
TIA	Tailings Impoundment Area
VEC	Valued Ecosystem Component
WRSA	Waste Rock Storage Area
WMF	Water Management Facility

1. Introduction

The Back River Project (the Project) has been designed to minimize, mitigate and/or manage potential adverse effects on the environment while systematically seeking to enhance positive effects. As part of the requirements of the final Environmental Impact Statement (EIS) guidelines issued by the Nunavut Impact Review Board (NIRB 2013), this document presents the Aquatic Effects Management Plan (the Plan) that Sabina Gold & Silver Corp. (Sabina) will follow concurrent with the development of the Project.

The Aquatic Effects Management Plan is conceptual and will be developed further with the appropriate regulatory authorities. The Plan is a "living document" and may be updated based on regulatory changes, Project-related changes, or changes to existing mitigation measures.

2. Scope and Objectives

The Aquatic Effects Management Plan targets the following valued ecosystem components (VECs) that are included in the final Environmental Impact Statement (FEIS):

1. Freshwater Water Quality;
2. Freshwater Sediment Quality;
3. Freshwater Fish/Aquatic Habitat;
4. Freshwater Fish (Arctic Grayling and Lake Trout);
5. Marine Water Quality;
6. Marine Sediment Quality;
7. Marine Fish/Aquatic Habitat; and
8. Marine Fish (Arctic Char).

Project activities may interact with surface freshwater and marine environments through a variety of pathways. The Project has been designed to minimize or eliminate potential adverse effects on the freshwater and marine environments as described in this Plan. The Plan describes and presents the following components:

- the planning and implementation processes for the Plan, including the personnel and their responsibilities;
- the mitigation and adaptive management measures;
- the Aquatic Effects Monitoring Program (AEMP); and
- the processes for adaptive management, checking, record keeping, reporting, and QA/QC.

3. Planning and Implementation

Planning for the Aquatic Effects Management Plan (the Plan) started with the development of the DEIS, which identified existing (baseline) conditions, assessed potential effects of the Project, developed conceptual mitigation strategies, and developed specific mitigation measures to execute these strategies.

This updated version of the Plan reflects updates and improvements to the Project design, comments from DEIS reviewers, and the inclusion of relevant commitments from the NIRB PHC Decision Report (December 2014). It is anticipated that this version of the AEMP will be revised again based on comments during the review of the FEIS as well as during the water licensing process.

Conceptual strategies and management plans will continue to be developed and executed throughout the construction, operation, and closure phases of the Project. Environmental management and social aspects will be tracked, reviewed, and updated through ongoing maintenance of the Plan. These updates will incorporate relevant feedback from the public obtained during public consultation.

Significance criteria have been developed that assist in identifying priority aspects, establish management criteria, and activity-specific mitigation measures. For social issues and effects, a key factor for determining significance is ongoing feedback from public consultation. These efforts will be used to communicate progress, and involve the public where necessary, on environmental performance.

Monitoring will be the principal mechanism to provide feedback to continually gauge the effectiveness of environmental performance. Operational control is facilitated through the contractor job-specific standard operating procedures (SOP) work instructions, on-the-job instruction, tailgate meetings where required, contract requirements, and service agreements. The effectiveness of physical operational control will be reviewed according to preventative maintenance and review procedures and schedules.

4. Applicable Standards, Guidelines, and Regulations

This Aquatic Effects Management Plan (the Plan) has been designed to comply with existing regulations and follow the available guidelines provided by the federal government and the government of Nunavut. Applicable regulations include:

- *Arctic Waters Pollution Prevention Act* (1985a);
- *Canada Shipping Act* (2001);
- *Fisheries Act* (1985b), including the *Metal Mining Effluent Regulations* (SOR/2002-222);
- *Nunavut Environmental Protection Act* (1988);
- *Nunavut Land Claim Agreement Act* (1993); and
- *Oceans Act* (1996).

Mitigation and management measures have been drawn from knowledge and experience contained in guidelines and research documents. Project infrastructure and activities would follow the relevant guidelines, and the adaptive management strategy includes seeking new knowledge and strategies to minimize Project effects on the aquatic environment. Relevant guidelines for the monitoring, mitigation, and management plans presented in this Plan include:

- *A Guide to Canada's Ballast Water Control and Management Regulations* (Transport Canada 2007);
- *Acid Mine Drainage in Permafrost Regions: Issues, Control Strategies and Research Requirements* (MEND 1996);
- *Canadian Council of Ministers of the Environment Sediment Quality Guidelines for the Protection of Aquatic Life* (CCME 2015);
- *Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Aquatic Life* (CCME 2013);
- *Measures to Avoid Harm to Fish and Fish Habitat* (Fisheries and Oceans Canada 2013);
- *Environmental Code of Practice for Metal Mines* (Environment Canada 2012a);
- *Environmental Guideline for Dust Suppression* (Environmental Protection Service 2002);
- *Environmental Guideline for the Burning and Incineration of Solid Waste* (Government of Nunavut 2012);
- *Good Environmental Practices for Northern Mining and Necessary Infrastructure Task 2 Report* (Nunavut Regional Adaptation Collaborative 2012);
- *Guidelines for Development and Management of Transportation Infrastructure in Permafrost Regions* (Transportation Association of Canada 2010);
- *Guidelines for the Operation of Tankers and Barges in Canadian Arctic Waters* (Transport Canada 1997);
- *Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters* (Wright and Hopky 1998); and
- *Metal Mining Effluent Regulations* (SOR/2002-222).

5. Roles and Responsibilities

The General Manager is ultimately responsible for the success of the plan and approves all relevant policies and documents, auditing, action planning and the verification process.

The Environmental Superintendent along with his/her direct reports are responsible for the implementation of this plan including:

- overall management of plan;
- monitoring;
- operational aspects;
- internal reporting;
- external reporting; and
- ensuring compliance and adaptive management.

The Safety Superintendent along with his/her direct reports are responsible for the implementation of safety aspects of this plan.

6. Environmental Protection Measures

6.1 GENERAL MITIGATION MEASURES

The primary mitigation approach will be to minimize the number and magnitude of pathways through which Project activities can adversely affect the aquatic environment. The Project has used design and alternatives analysis to control potential effects and will use relevant Best Management Practices (BMP) to further mitigate or eliminate effects on the freshwater and marine environments. The Project has been designed to reduce or eliminate direct runoff and discharge pathways to the aquatic environment by planning to have no direct discharge of site contact water, mine water, or treated sewage effluent during the construction and operational phases, and potentially throughout the life of the Project. Furthermore, efforts will be made during planning and construction to minimize the footprint of infrastructure in order to minimize disturbance of the landscape, which reduces the potential for the transport of sediment in runoff.

6.1.1 Site Water Management

The Site Water Monitoring and Management Plan (Volume 10, Chapter 7) was designed to mitigate potential negative effects from Project activities on the aquatic environment. Detailed figures can be found in the Site Water Monitoring and Management Plan for each Project phase. A generalized summary of water management during operations is provided here. In the Goose Property Area, site contact water (including runoff from waste rock storage areas (WRSA) and mine water) and treated sewage effluent will be directed to water management ponds and discharged to an approved site meeting applicable water licence criteria (Figure 6.1-1). At the MLA, reconstituted brine from the desalination plant (source of drinking water for camp) will be discharged back to Bathurst Inlet, and greywater will be discharged on-land at an approved site and sewage will be collected by Pactos and incinerated (Figure 6.1-2).

6.1.2 Sediment and Erosion Control

Sediment and erosion control measures will be applied throughout construction and maintained for the life of the Project. Efforts will be made to minimize the disturbance of the landscape and natural vegetation cover, and to schedule ground preparation to maintain adequate cover and avoid activities during periods of expected rainfall. The Project has been designed to use winter road only access corridors thereby limiting stream crossing and instream works and hence the potential effects on water and sediment quality. Efforts will be made during the final design stage to have the right-of-way cross each stream as close to perpendicular as possible to minimize the amount of riparian vegetation that may need to be disturbed during construction. Depending on the site-specific requirements, civil design structures may be used to prevent erosion and the deposition of sediment in the aquatic environment (a list of potential structures and approaches shown in Table 6.1-1).

Runoff in the Project area occurs during a short period of June through September/October, due to the Arctic climate and permafrost ground conditions. Streams and rivers begin to flow in May, after freezing solid during the winter, and peak during freshet in June and July. The freshet period is typically short, and instantaneous flows can be quite large (see the Hydrology baseline information, Volume 6, Chapter 1 of the FEIS). Water control and erosion control structures will be designed to freshet peak flows, and areas and structures vulnerable to freshet flows will be identified. Water control structures will be monitored for ice and snow blockages, which will be cleared as necessary.

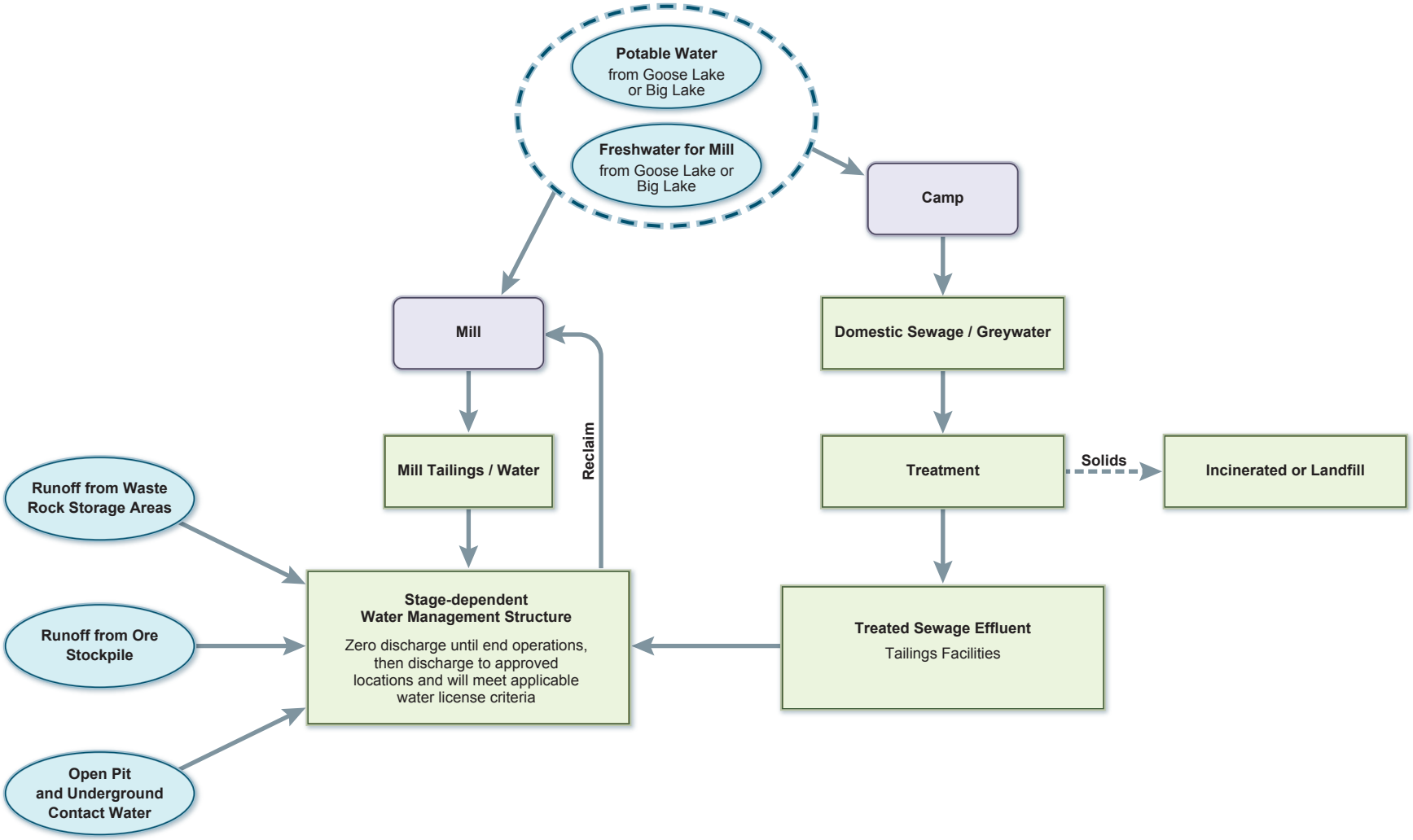

Figure 6.1-1

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Conceptual Water Management - Goose Property Area

Figure 6.1-1

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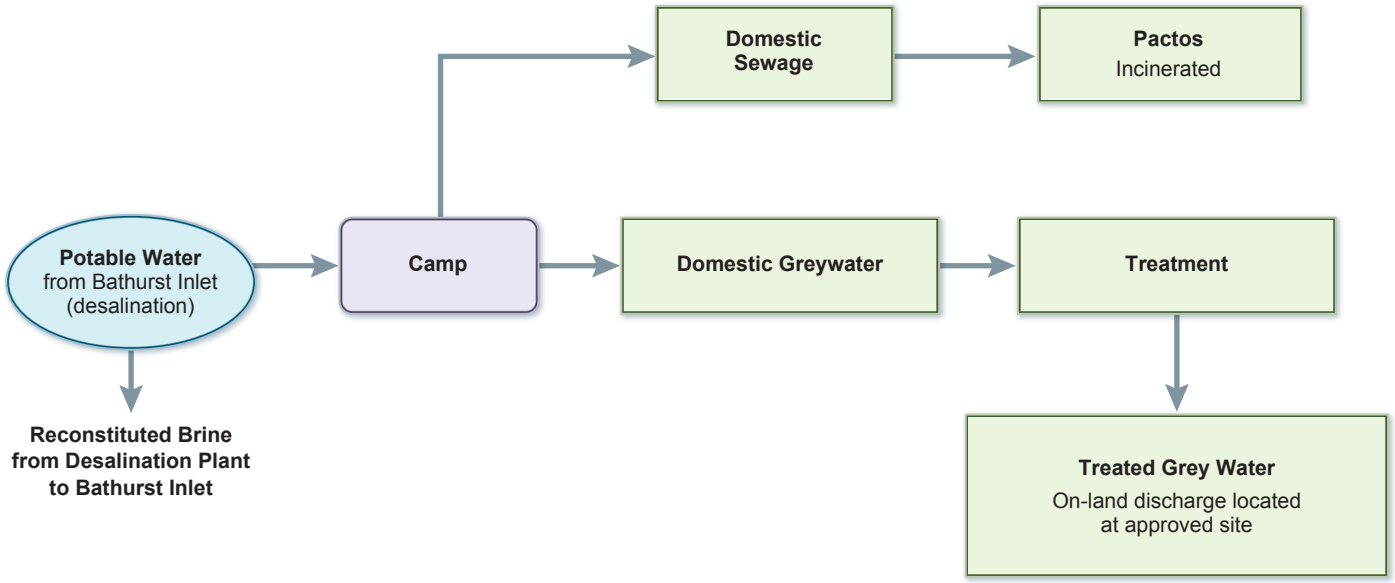

Figure 6.1-2

Sabina GOLD & SILVER CORP.

Conceptual Water Management - Marine Laydown Area

Figure 6.1-2

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Table 6.1-1. Sediment and Erosion Control and Mitigation Measures, Back River Project

Slope Texturing	
Description	Contouring and roughening of slope face.
Installation Locations	Slopes and in large, flat surface areas
Performance Issues	May cause sloughing in very wet soils; should be used in combination with other measures.
Benefits	Reduces runoff flow velocities, increases infiltration, collects sediment, and promotes growth of vegetation.
Fibre Rolls	
Description	Tube-shaped devices filled with plant-derived fibres.
Installation Locations	Along slopes and in channels with low flow velocities.
Performance Issues	Labour intensive installation. Have limited sediment capture zones. May be displaced by soil movement (i.e., slumping) or by high flows.
Benefits	Function well in freeze-thaw conditions. Can be used on slopes too steep for silt fences. Biodegradable.
Check Dams and Energy Dissipation Structures	
Description	Structures made from rock that reduce flow velocities and dissipate energy.
Installation Locations	In-channel, particularly in regions of high flow velocities.
Performance Issues	Requires supply of suitable material non-potentially acid generating (PAG) or metal leaching (ML) rock. May require maintenance after high flow events.
Benefits	Permanent structures that reduce flow velocities and energy, and filter sediments. May be a suitable substitute for gabions and armouring entire channel.
Gabions	
Description	Caged structure filled with riprap or granular borrow material. Slows flow velocities and dissipates energy.
Installation Locations	In-channel or in runoff flow paths.
Performance Issues	Labour intensive installation. Requires supply of suitable material (non-PAG or ML rock).
Benefits	Robust structure able to resist high flow velocities. Can be built from riprap too small in diameter to be used as armouring.
Riparian Zones	
Description	Preserve a native vegetation buffer.
Installation Locations	Buffers along existing natural surface flow features.
Performance Issues	Requires careful planning and management during construction to preserve zone.
Benefits	Most effective natural sediment control feature; slows runoff velocity and filters sediment.
Silt Fences	
Description	Temporary barriers used to divert and slow runoff to allow suspended material to sediment before reaching waterbodies.
Installation Locations	Used in areas of cuts and excavations, downslope from exposed or erodible areas.
Performance Issues	Temporary structures only for short-term diversion of sediments from aquatic systems.
Benefits	Usable in areas where armouring or other measures are not applicable.

(continued)

Table 6.1-1. Sediment and Erosion Control and Mitigation Measures, Back River Project (completed)

Armouring and Riprap	
Description	Quarry rock and/or natural granular borrow material used to protect fined-grained material from scour and erosion. Constructed barrier between water flows and areas susceptible to erosion. May be combined with geotextiles for addition protection.
Installation Locations	Used in areas of cuts and excavations, typically on exposed or erodible slopes. Road and pad embankments; water control and diversion structures, particularly where flow may be concentrated.
Performance Issues	Requires supply of suitable material (non-PAG or ML rock).
Benefits	Effective as a long-term erosion barrier. May be constructed from locally-source materials.
Geotextile (Woven and Non-woven)	
Description	Low erodible material placed on the surface as an erosion barrier
Installation Locations	Liner in water channels. Combined with riprap in areas of concentrated water flow.
Performance Issues	Installation requires anchoring. Difficult to remove once no longer required.
Benefits	Effective as an erosion barrier. Ease of installation. Can slow runoff velocities.

6.1.3 Fish and Fish Habitat Protection from Blasting

All Project activities requiring the use of explosives in or near waterbodies will adhere to the *Guidelines for Use of Explosives In or Near Canadian Fisheries Waters*, as directed by Fisheries and Ocean Canada (DFO; Wright and Hopky 1998). The blasting management plan will be discussed with DFO prior to any blasting activities, and will be subject to adaptive management.

6.1.4 Fish-out Program

A fish-out program will be carried out for any lakes that are lost as a result of the Project. The fish-out program will follow DFO's *General Fish-Out Protocol for Lakes and Impoundments in the Northwest Territories and Nunavut* (Tyson et al. 2011). A fish-out or the removal of fish from a waterbody offers a unique opportunity to gather information on lake productivity and the fish community, as well as avoid any "wastage" by making the fish available for traditional use by local communities (Tyson et al. 2011).

The DFO fish-out program protocol is divided into three components:

1. Fish Community, this is divided into three phases:
   - Marking Phase (part of a mark-recapture study)
   - Catch-per-Unit-Effort (CPUE)/Recapture Phase
   - Final Removal Phase
2. Aquatic Biology and Limnology; and
3. Habitat Inventory.

In addition to following the DFO protocols for a fish-out, Sabina would collaborate with communities to involve interested parties in the program with the possibility to distribute fish for human or dog consumption. In addition, measures to avoid wildlife entrapment (e.g., mechanical or noise deterrents) during the gillnetting will be considered where appropriate with DFO's *Fish-Out Protocol* (Tyson et al. 2011).

The current mine plan includes the development of the Llama deposit, which is located under Llama Lake, and the construction of the Saline Water Pond at Umwelt Lake. Llama Lake and Umwelt Lake will be fished-out prior to development of those Project components.

6.1.4.1 Fish Community

Marking Phase

The Marking Phase is the first part of a mark-recapture study that will provide a population estimate for large-bodied fish, and help determine the end-point of the fish-out program. The Marking Phase will occur at the beginning of the fish-out. There will be one week of gillnetting after ice-off (June/July), using smaller mesh gillnets of short one-hour sets to reduce mortalities. Nets will be periodically moved to survey all available habitats. All captured fish will be live-released. Additional capture methods, such as angling, may be employed if the mortality rate using gillnets is too high during the marking phase. Captured fish will be identified to species, measured for fork length and weight, noted for any signs of injury/stress, and all healthy fish (lake trout and round whitefish) will receive a caudal fin clip and a numbered T-bar anchor tag inserted through the dorsal sinus under the base of the dorsal fin. Metals and contaminants will be assessed in a sub-sample of fish by taking a non-lethal tissue biopsy sample after anaesthetization to confirm if fish are safe for transfer or human and/or dog consumption.

CPUE/Recapture Phase

The CPUE/Recapture Phase involves intensive fishing and is the recapture portion of the mark-recapture study. Fishing will occur between July and August. During this phase, the standard unit of fishing effort remains unchanged (e.g., the duration of net sets are the same). Gillnets (for larger fish) and minnow traps (for smaller fish) will be set for 24 hours. The standard gillnet gang used throughout the CPUE/Recapture Phase will include different mesh sizes to obtain all sizes of fish (e.g., 102 mm (4"), 76 mm (3"), 51 mm (2"), 38 mm (1 ½"), 25 mm (1"), and 13 mm (1/2")). Baited Gee minnow traps will be used to fish the littoral zone for smaller fish. The number of nets/traps will vary throughout the fishing period (generally increasing as catches decrease yet depends on crew size) and are set randomly in the lake (only in the littoral zone for the minnow traps). Ideally, the CPUE/Recapture Phase will be completed when no fish are captured for 24-48 hours of continuous netting, nets are removed for 48 hours, and then re-deployed for 24-48 hours and fish are still not captured. All fish will be sacrificed, sampled, and distributed to members of the communities. All fish will be identified by species, given a unique fish number, measured for fork length and weight, and the presence of tags (and tag numbers) and fin clips recorded. If the population is large, the following sampling will occur for the first 50 individuals per 20 mm size class (smaller size classes for smaller fish): sex, maturity, reproductive status, ageing structures taken (e.g., otoliths, pectoral fin rays, and scales), note obvious internal and external deformities, erosions, lesions and tumours (DELTs), and collect biological tissues [e.g., gonads, livers, stomachs, muscle tissue (for contaminants and stable isotopes)]. All food fish will be eviscerated and prepared to be sent to local communities.

Final Removal Phase

The Final Removal Phase involves capturing the remaining fish using all available gear (plus the same gear as before). This final phase can start once the CPUE Phase is completed (typically between August and September) and can occur when lake dewatering has begun. Biological sampling is the same as the CPUE Phase. The Final Removal Phase is complete when the majority of marked fish have been captured.

6.1.4.2 Aquatic Biology and Limnology

The Aquatic Biology and Limnology component of the fish-out program includes physical limnology measurements, water quality, chlorophyll *a*, and zooplankton samples. All samples will be collected three times during the fish-out program: July (before the fish-out), August, and September (before dewatering). Benthic invertebrate samples will be collected once in August, from four different depth intervals and sampling methods will be the same as those outlined in the Aquatic Effects Monitoring Program (AEMP). All sampling will follow the DFO's *General Fish-Out Protocol for Lakes and Impoundments in the Northwest Territories and Nunavut* (Tyson et al. 2011).

6.1.4.3 Habitat Inventory

The Habitat Inventory component will be conducted using bathymetry and littoral habitat surveys prior to the fish-out in July as well as an additional habitat survey after lake dewatering has begun (e.g., September) to confirm accuracy of the original survey.

6.1.5 Routine Inspection and Monitoring

In addition to specific monitoring programs, including those required under regulatory approvals, routine inspections will be done on Project activities and components that could interact with the aquatic environment (Table 6.1-2). These routine inspections will ensure mitigation and management goals are met, help identify if additional mitigation measures are required, and provide important information on the performance of the Aquatic Effects Management Plan.

Table 6.1-2. Routine Inspection and Monitoring, Aquatic Effects Management Plan, Back River Project

Site	Routine Inspection
All Project Sites *Goose Property Area* *MLA*	Water management systems Sediment and erosion control structures Water intakes and outfalls Flow meter readings Evidence of hydrocarbon leaks from containment areas Drip pans and spill response kits Supervision of fueling operations Equipment condition Road surface quality (rutting, washboarding) Dust suppressant application Geotechnical stability, including road embankments Snow and ice damming prior to and during freshet Culvert and water management structure obstructions

(continued)

Table 6.1-2. Routine Inspection and Monitoring, Aquatic Effects Management Plan, Back River Project (completed)

Site	Routine Inspection
Mine sites *Goose Property Area*	Sediment and erosion control structures Evidence of hydrocarbon leaks from containment areas Supervision of fueling operations Fuel leaks Equipment condition Geotechnical stability, permafrost degradation
Borrow sites and rock quarries	Evidence of hydrocarbon leaks from containment areas Supervision of fueling operations Fuel leaks Sediment and erosion control structures Equipment condition Geotechnical stability, permafrost degradation
Waste Rock Storage Areas *Goose Property Area*	Sediment and erosion control structures Geotechnical stability and permafrost condition Evidence of hydrocarbon leaks from containment areas Evidence of ML/ARD Equipment condition
Bulk Fuel Storage and Hazardous Waste Storage Areas *Goose Property Area* *MLA*	Primary containment structure Geotechnical stability and permafrost condition Evidence of hydrocarbon leaks from containment areas Equipment condition Spill response kits
Explosives Storage *Goose Property Area*	Primary containment structure Access and security Equipment condition Spill response kits
Laydown and Storage Areas *Goose Property Area* *MLA*	Sediment and erosion control structures Evidence of hydrocarbon leaks from containment areas Equipment condition Supervision of fueling operations Fuel leaks Spill response kits Road surface quality (rutting, washboarding) Geotechnical stability and permafrost condition
Tailings Facility *Goose Property Area*	Inspections for physical stability, liner integrity, and leaks Annual geotechnical inspection and report by a registered geotechnical engineer Spill response kits Equipment condition

Note: Routine inspections at the MLA will only be conducted with the MLA camp is operational

7. Aquatic Effects Monitoring Program

The overall purpose of the AEMP will be to monitor the receiving aquatic environment around Project infrastructure and activities. Results from the monitoring will be used to determine if existing mitigation and management measures are adequate and provide an opportunity for adaptive management on an annual basis. It is anticipated that an Aquatic Effects Monitoring Program (AEMP) will be a requirement of the future Type A Water Licence for the Project.

The AEMP has also been designed to meet the requirements of mining Environmental Effects Monitoring (EEM), as required by the Metal Mining Effluent Regulations (MMER; SOR/2002-222). The main objective of the EEM monitoring is to evaluate the effects of mining effluents on fish, fish habitat, and the use of fisheries resources. MMER EEM requirements will be triggered by the following activities:

- effluent discharge rates exceed 50 m^3/d; and/or
- deleterious substances are discharged into any waterbody as per subsection 36(3) of the *Fisheries Act* (1985b).

7.1 SPECIFIC OBJECTIVES OF THE AEMP

The specific objectives of the AEMP are as follows:

1. determine the short and long-term effects in the aquatic environment resulting from the Project;
2. evaluate the accuracy of Project effect predictions;
3. assess the effectiveness of mitigation and management measures on Project effects;
4. identify additional mitigation measures to avert or reduce environmental effects due to Project activities; and
5. comply with MMER requirements, should an EEM program be triggered.

The first objective will be met by measuring the receiving environment in the short-term (on an annual basis) and the long-term (across all phases of the Project). Physical, chemical, and biological characteristics of the aquatic environment will be monitored to detect Project effects, and to determine the pathways and the magnitude of the effects.

The accuracy of effect predictions (Objective 2) will be based on the results of the monitoring program addressed in Objective 1, and will be assessed as required by NIRB under Section 12, Part 7 of the Nunavut Land Claims Agreement (NLCA, 1993).

The AEMP will assess the effectiveness of impact mitigation and management measures (Objective 3) by comparing the conditions in the receiving environment to baseline conditions and to reference sites, prior to and throughout the Project. The effectiveness of mitigation measures will be determined by analyses of the changes in the receiving environment measured by the sampling program. The AEMP will report the results of the sampling program and the analyses of effects throughout the Project.

Objective 4 will be met by identifying changes in the receiving environment should they occur, and communicating those changes to Project Management. As a key part of the adaptive management strategy, the reporting of adverse environmental changes will facilitate the identification and implementation of addition mitigation measures. These additional mitigation and management

strategies will be detailed along with the relevant environmental monitoring information in the annual AEMP reports.

The objective of EEM will be met by monitoring components of the fish communities, fish habitat, and fisheries resources as outlined in the EEM guidance documents if MMER is triggered (Objective 5). These environmental components will be evaluated for effects by the methods outlined in the AEMP, which conform to the methods outlined in the EEM guidance documents (Environment Canada 2012b). All required monitoring and reporting will be completed as required should MMER be triggered.

7.2 AEMP STUDY DESIGN

7.2.1 Incorporation of MMER into AEMP Study Design

The Back River Project AEMP is designed to be consistent with the requirements and objects of the MMER. The primary goal of the mining EEM program is to evaluate the effects of mining effluents on fish, fish habitat, and the use of fisheries resources. The EEM program has two components:

- Effluent Characterization and Water Quality Monitoring Studies that are designed to aid the interpretation of biological data; and
- Biological Monitoring Studies that include surveys for fish populations and health, fish prey resources (benthic invertebrate surveys), and fish usability (mercury/metal tissue content).

The Effluent Characterization and Water Quality Monitoring Studies consist of three components:

1. effluent characterization (deleterious substances and other contaminants);
2. water quality monitoring; and
3. sub-lethal toxicity testing.

The AEMP is designed to include the biological and water quality monitoring (including sediment quality) specified in the EEM guidance documents (Environment Canada 2012b). The AEMP includes the following components: water quality, phytoplankton and periphyton biomass, sediment quality, benthic invertebrate abundance and community composition, fish abundance and condition, and fish metal concentrations (including mercury). The methods used will be consistent with the EEM guidance documents. If one of the MMER criteria are triggered, then effluent characterization (deleterious substances and other contaminants) and sublethal toxicity testing will be added to the monitoring program and follow the methods in the EEM guidance documents. The frequency of sampling will also be changed to align with EEM monitoring requirements if MMER is triggered.

7.2.2 Study Areas and Sampling Locations

The AEMP study area is comprised of those areas anticipated to be potentially influenced by Project activities (exposure areas), and those areas beyond Project influence (reference areas). In Schedule 5, Section 1 of the MMER, exposure areas are defined as “all fish habitat and waters frequented by fish that are exposed to effluent,” and a reference area is defined as “water frequented by fish that is not exposed to effluent and that has fish habitat that, as far as practicable, is most similar to that of the exposed area.” The exposure areas to be monitored as part of the AEMP have been selected to encompass Project activities in addition to exposure to effluent. The primary Project activities that could affect the aquatic environment, and were considered for the AEMP sampling design, include:

1. operation of the tailings facilities at the Goose Property (potential changes to water quality);

2. runoff from waste rock storage areas (WRSAs), ore stockpiles, saline holding ponds, roads, site infrastructure, and explosive storage (potential changes to water quality);
3. water management and closure scenarios such as closing open pits and re-establishing water courses (potential changes to water quality);
4. in-water infrastructure and discharge from the desalination plant at the MLA (potential changes to water quality); and
5. dust-generating activities, such as the operation of open pits, waste rock storage areas (WRSAs), air strips, and roads (potential dust generation).

7.2.2.1 Goose Property Area

Exposure Sites

The principal exposure sites in the Goose Property Area are those waterbodies downstream and adjacent to the tailings facility, WRSAs, and Project infrastructure (Table 7.2-1; Figure 7.2-1). Goose Lake is adjacent to most of the Project infrastructure, is the receiving environment for runoff from all of the WRSAs, saline water storage pond, closed open pits, and is the potential potable water source for the camp. Propeller Lake is downstream of Goose Lake.

Reference Sites

Reference Lake B is ~15 km southeast of the Goose Property Area and is topographically and bathymetrically similar to lakes potentially exposed to Project activities. Reference B Lake and its outflowing stream have been sampled repeatedly since 2010 during the baseline sampling program, and will serve as a suitable reference site in the Before-After/Control-Impact (BACI) statistical analysis.

7.2.2.2 Marine Laydown Area

Exposure Sites

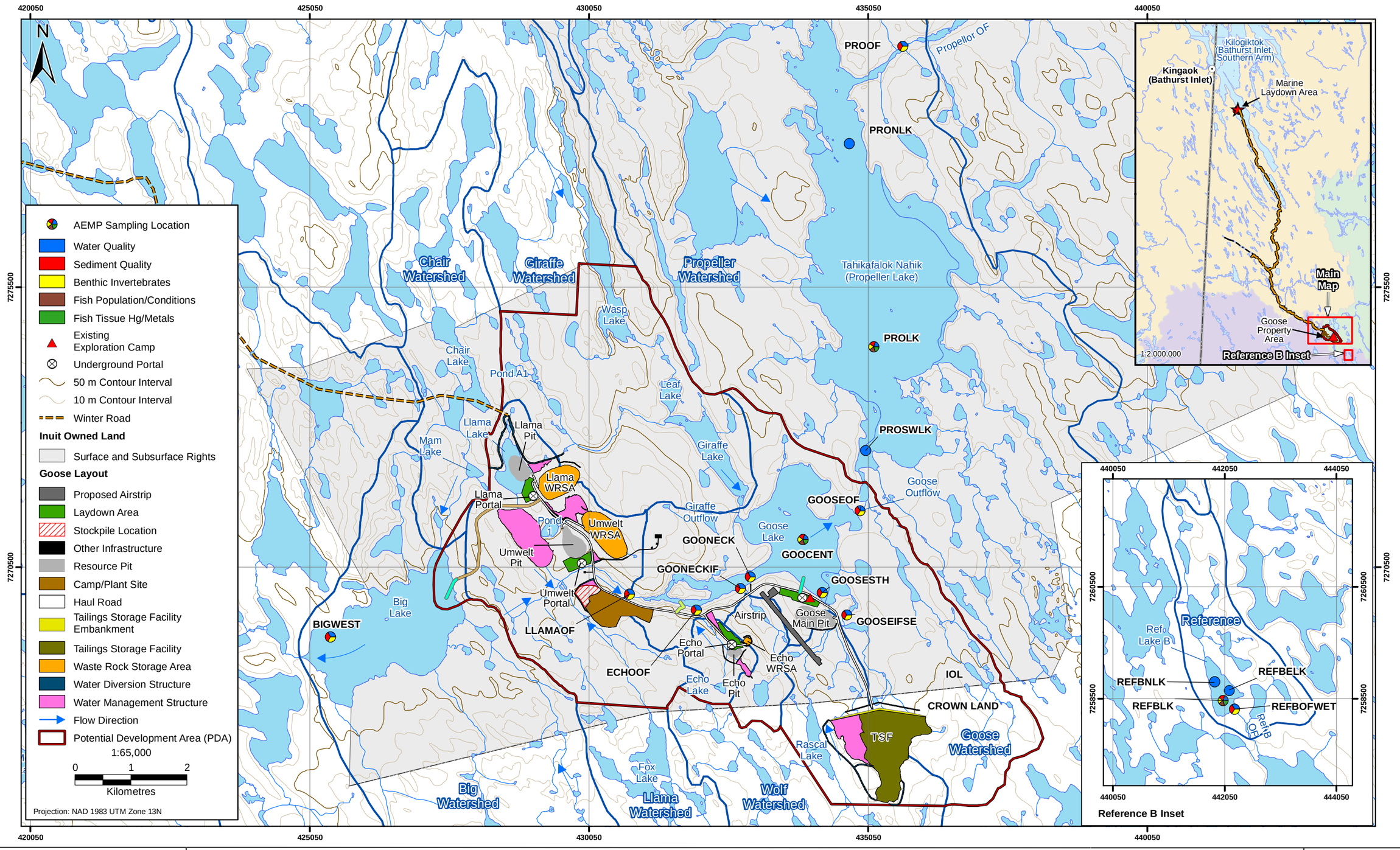
The MLA will be monitored at three sampling sites. The first site will be in the near-shore area, in water ~4 m deep, and likely will be the area of greatest influence from the barge unloading activities. The second and third sites, in the mid-shore area in water ~13 m deep, will monitor the marine aquatic environment for effects beyond the immediate zone of influence and proximate to the outfall from the desalination facility (Table 7.2-1; Figure 7.2-2).

Reference Site

The marine reference sites will be ~28 km south of the MLA on the western shore of Bathurst Inlet. The environment is topographically and geologically similar to the MLA, and the proposed locations have already been sampled as part of the baseline sampling program.

7.2.3 Sampling Design

The sampling design for the AEMP is designed to provide information for a statistical analysis incorporating a Multiple Before-After/Control-Impact (BACI) design on water quality, sediment quality, and biological parameters sampled from lakes, streams, and near-shore marine habitat. Exposure sampling locations are listed in Table 7.2-1 and shown in Figures 7.2-1 and 7.2-2. The number of sites and samples considers the replication necessary for sufficiently powered statistical analyses.



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Proposed AEMP Sampling Locations in Goose Property Area, Back River Project

Figure 7.2-1

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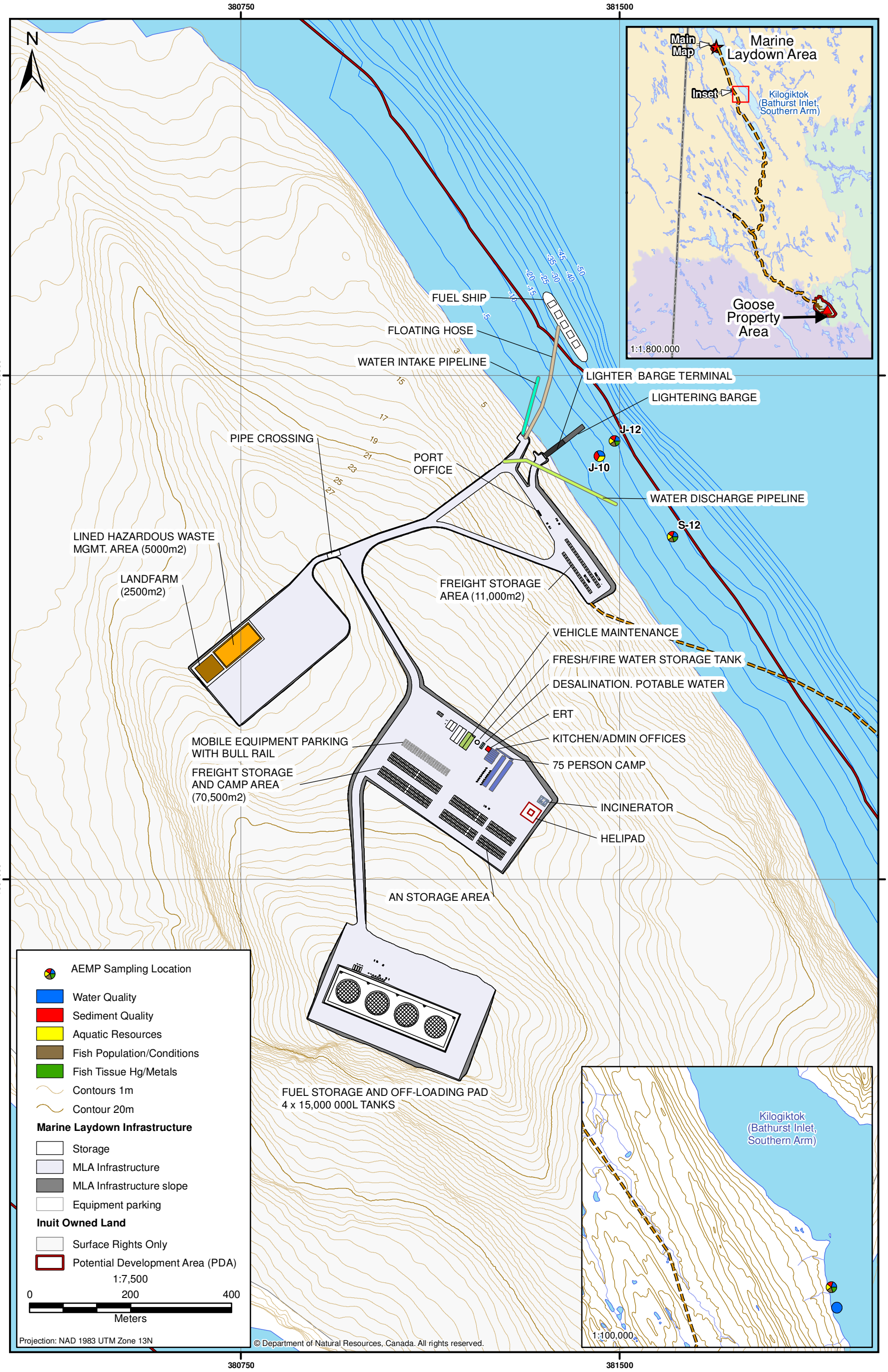

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Figure 7.2-2

Proposed AEMP Sampling Locations in Marine Laydown Area, Back River Project

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Table 7.2-1. AEMP Sampling Locations, Descriptions, and Purposes, Back River Project

Sampling Location	Description	Purpose
Goose Property Area		
Lakes		
Reference B Lake	Reference lake located ~15 km to the southeast of the Goose Property	Reference lake
Goose Lake – Central Basin, South, West	Large lake adjacent to Project activities; potential source of potable water. Receiving environment for all Project activities including runoff from WRSAs, saline pond, closed pits, tailings facility	Potential exposure lake due to proximity to Project infrastructure and activities, including: water withdrawals, downstream of Llama/Umwelt area (WRSAs, open pits, saline pond storage), downstream of Echo Pit and activities, downstream of Gander Pond area (airstrip, infrastructure), downstream of Tailings Facility, Goose Main Pit, and closed/overflow from Goose Main Pit
Propeller Lake Propeller Lake – SW Propeller Lake – N	Large lake downstream of catchments with the majority of Project activities.	Potential exposure lake due to location downstream of all Goose Property Area activities.
Big Lake	Lake located to the west of Project activities and infrastructure.	Potential water source, water withdrawals
Streams		
Ref B Outflow	Reference stream draining from the reference lake.	Reference stream site.
Goose Outflow	Outflow of large lake proximate to Project activities and infrastructure.	Potential exposure site and primary outflow from catchments encompassing the Project infrastructure.
Llama Outflow	Outflow of catchment containing Llama Pit, Umwelt Pit, saline storage pond, WRSAs	Potential exposure site due to proximity to Project infrastructure and activities.
Echo Outflow	Outflow of catchment containing Echo Pit and WRSA	Potential exposure site due to proximity to Project infrastructure and activities.
Gander Pond Outflow (Goose Neck IF)	Outflow of catchment proximate to Project activities and infrastructure (i.e., airstrip)	Potential exposure site due to proximity to Project infrastructure and activities.
TSF downstream (Goose SE IF)	Outflow of catchment containment the TSF and Goose Main Pit. This is the location where overflow from the closed Goose Main Pit will enter Goose Lake	Potential exposure site due to proximity to Project infrastructure and activities.
Propeller Outflow	Outflow of catchment containing majority of Project activities and infrastructure.	Potential exposure stream due to location downstream of all Goose Property Area activities. Farthest downstream site to constrain geographic extent of potential Project effects.
Marine Laydown Area		
Marine Reference Sites	Near-shore marine reference sites located ~29 km southeast of the MLA.	Reference sites south of marine laydown area with similar local topography and bathymetry, but not adjacent to any Project-related or anticipated human activities.
Barge Landing near-shore (J-10)	Near-shore marine site at MLA.	Potential exposure site due to proximity to Project infrastructure and activities.
Barge Landing mid-shore (J-12)	Mid-shore marine site at MLA.	Potential exposure site due to proximity to Project infrastructure and activities.
MLA mid-shore (S-12)	Mid-shore marine site at MLA.	Potential exposure site due to proximity to Project infrastructure and activities, including outfall for desalination facility.

All monitored parameters (see Section 7.2.5) will be analyzed using a BACI design. Multiple exposure (impact) and control sites from lake, stream, and marine habitats will be sampled according to the Schedule presented in Table 7.2-4 in Section 7.2.4. Each of the parameters will be collected at the same time (paired) over the course the AEMP and will be analyzed in a sequential statistical workflow starting with a before-after comparison and then a BACI analysis for Project effects. For each waterbody, a before-after comparison between the baseline and Project conditions will be conducted for each evaluated parameter. A mixed model Analysis of Variance (ANOVA) will be used for the before-after comparison. The model will have fixed effects of *period* (before vs. after) and *season* (ice-cover vs. open-water; term included in model only if necessary), and a random effect of year to account for inter-annual variation. For the *period* effect, observations will be grouped into one of two *periods*: before the start of construction or after the start of construction. If the season term is necessary, then samples will be grouped into one of two *seasons* depending on the time of sampling; otherwise samples will be pooled by year. If the before-after analysis concluded a parameter is significantly different than the baseline condition, the next step of the workflow will be a BACI analysis to determine if the observed difference in the parameter was also seen at the reference site (which would indicate that the difference was due to a natural process). The BACI analysis adds a *class* term to the mixed model ANOVA, which is the classification of the waterbody as an exposure or a reference site. The interaction between the *period* and *class* terms will test if any change in the parameter that occurred at the exposure site also occurred at the reference site. If the change was statistically significant in the before-after analysis, but the BACI analysis concluded a parallel change occurred at the reference site, then this change will be interpreted as a natural phenomenon unrelated to the Project activities. The statistical analysis will use established methods and all assumptions will be detailed and examined using graphical techniques, statistical analysis, and best professional judgment as part of the analytical process.

7.2.3.1 Preliminary Power Analysis

In order to address commitment AANDC-52 in the NIRB PHC Decision Report (December 2014), a preliminary power analysis was completed and is included in the text below.

The number of replicate samples for each monitored component was informed by guidance documents and by a statistical power simulation. As a starting point, the sampling design considered five replicates. This five-replicates design followed the Environment Canada recommendation for one factor ANOVA EEM designs for benthic invertebrates that controls for equal false-positive and false-negative probabilities ($\alpha = \beta = 0.1$; Environment Canada 2012b). To corroborate these suggested sample sizes, a simulation model was constructed.

Simulations are an established method for estimating statistical power in the absence of analytical solutions (Bolker 2008). Although analytical estimates are available for simple statistical designs, such as linear regression or one-factor ANOVA, these methods are not applicable to the two-factor ANOVA required for BACI analyses (Environment Canada 2012b). The design of this power modeling analysis followed from the basic principles of frequentist statistics, where the false-positive rate (Type I error, α) and the false-negative rate (Type II error, β) describe the acceptable levels of uncertainty in the statistical analysis. The standard ANOVA approach is designed to control the false-positive rate, whereas the false-negative rate is determined by a number of factors, including sample size, variation, and experimental design.

For this power analysis, the effect was fixed to a minimum critical effect size (CES) of 2 standard deviations (SD). With this known effect size, the model simulated the results of a monitoring program that compares observations of an indicator at an exposure site and a reference site. Observations were drawn as random values from a normal distribution determined by baseline indicator statistics, and included the +2 SD effect at the exposure site. For each run of the simulation, these modelled

observations were analyzed with a two-factor BACI model, and the significance of the interaction term between *period* (Before-After) and *treatment* (Control-Impact) was compared against an α = 0.1 (as suggested in the *Metal Mining Technical Guidance for Environmental Effects Monitoring*). If the simulation run did not identify the change in the monitoring parameter to be significant, even though the value increased by 2 SD, then the run was flagged as a false-negative. The simulation was repeated for 1,000 iterations and the frequency of false-negative flags was used to estimate the power of the statistical test under those simulated conditions.

Table 7.2-2 describes the source data and specific model characteristics used in the simulations. The R (http://www.r-project.org/) code for the model, which includes a tool for presenting the simulation results, is provided in Appendix V10-19A. The simulation model used baseline data from reference sites (Reference B Lake and outflow) and proposed monitoring sites on Goose Lake (GOOSECENT and GOOSEOF) as input parameters, along with a critical effect size of 2× standard deviation to simulate a hypothetical effect at the monitoring site.

Table 7.2-2. BACI ANOVA Power Analysis Model Inputs and Settings

Parameter	Site	*n*	Mean	SD
Turbidity (NTU)	GOOSECENT[†]	4	0.36	0.039
	REFBLK[*]	2	0.42	0.014
Water Arsenic (metal, mg/L)	GOOSECENT	4	0.00021	0.000002
	REFBLK	2	0.00014	0.000001
Lake Sediment Arsenic (metal, mg/kg)	GOOSECENT	3	11.43	0.70
	REFBLK	3	3.20	0.27
Stream Sediment Arsenic (metal, mg/kg)	GOOSEOF	3	29.6	0.86
	REFBOF	3	2.96	0.89
Lake Benthic Invertebrate Density (individuals/m^2)	GOOSECENT	3	5,350	2,270
	REFBLK	5	6,110	2,160
Stream Benthic Invertebrate Density (individuals/m^2)	GOOSEOF	3	2,030	1,240
	REFBOF	5	1,260	940

[†]*Statistics for Goose Lake and Goose Outflow sites, as exposure sites, calculated baseline samples from Goose Lake collected in 2012.*
[*]*Statistics for Reference B Lake, and Reference B Outflow sites, as control sites, calculated from baseline samples collected in 2011.*

The results of the simulation studies were compared to the optimal power of 0.9 (i.e., $\alpha = \beta = 0.1$) while considering the practicality of sampling. Generally, statistical power increased substantially between three and five replicates, but only modest increases were observed between five and nine replicates (Table 7.2-3). The simulation analysis concluded that the six replicates proposed for the water quality indicators and lake sediment indicators will provide statistical power near the theoretical goal of 0.9. Other parameters are naturally more variable, which reduced the statistical power of the proposed sampling design. The proposed number of replicates (see Section 7.2.5) balanced the achievable power with the practicality of sampling. For example, streams in the Project area are generally small and have low flows during the summer open-water season. As a result, the available habitat for benthic invertebrates is small. The proposed number of benthic invertebrate replicates was a feasible number of replicates to be collected from stream sites in the Project area that will provide a usable indicator for the AEMP while presenting a viable level of sampling effort.

Table 7.2-3. Statistical Power for Simulated BACI AEMP for Selected Parameters for a Range of Sampling Replication

Parameter	Simulation Model Characteristics	Power (1- ß)			
		n = 3	*n* = 5	*n* = 6	*n* = 9
Turbidity	Model used log_{10}-transformed data to stabilize variances.	0.66	0.80	0.83	0.86
Water Total Arsenic	Model used log_{10}-transformed data to stabilize variances.	0.73	0.82	0.86	0.88
Lake Sediment Arsenic	Model used un-transformed data.	0.69	0.75	0.83	0.86
Stream Sediment Arsenic	Model used un-transformed data.	0.47	0.57	0.59	0.64
Lake Benthic Invertebrate Abundance	Model used un-transformed data.	0.48	0.63	0.65	0.69
Stream Benthic Invertebrate Abundance	Model used un-transformed data.	0.53	0.64	0.69	0.75

7.2.4 Monitoring and Reporting Schedule

7.2.4.1 Core AEMP

The proposed monitoring schedule is detailed in Table 7.2-4. Baseline information has been collected from 2010 to 2015 for the 'Before' category. Additional baseline sampling may be required if the Project design changes in the future. Monitoring for the 'After' category would start upon Project approval and site construction (or any activities that could potentially effect the aquatic receiving environment).

An AEMP report will be produced annually during construction and operational phases for submission to the Nunavut Water Board (NWB). The monitoring and reporting frequency will be re-evaluated prior to closure to determine an appropriate monitoring and reporting schedule at that time.

7.2.4.2 EEM

If MMER is triggered at any point during the Project, two reports will be required for the EEM program. A First Study Design report will be completed no more than 12 months after the mine becomes subject to MMER (Schedule 5, s. 14(a)), and six months before biological monitoring for EEM is initiated (Schedule 5, s. 15; SOR/2002-222). The First Study Design report will describe the sampling design for the EEM fish population monitoring, fish tissue, and benthic invertebrate community studies. Site characterization information is required as a subset of the biological monitoring studies (Schedule 5, s. 9) when mines become subject to MMER. If MMER is triggered, then this information will be included in the First Study Design report. The second report is the first EEM Cycle 1 Interpretive report that will present the findings of the fish population, fish tissue, and benthic invertebrate studies within 30 months of effluent discharge.

7.2.5 Summary of AEMP Sampling Details

Table 7.2-5 presents the physical, chemical, and biological parameters to be measured in the AEMP, and details on the proposed intra-seasonal sampling frequency, replication, timing, and sampling equipment. All proposed field sampling equipment and methods comply with the EEM guidance documents.

Table 7.2-4. AEMP Monitoring Schedule, Back River Project

Mine Phase	Baseline (prior to construction)	Construction	Operations	Temporary Closure[a]	Care and Maintenance[a]	Reclamation and Closure	Post-closure
Years	**Multiple years**	4 years	10 years	up to 2 years	2 to 10 years	8 years	at least 5 years
BACI Category	Before	After					
Reporting Schedule	Annual			Re-evaluated for AEMP and EEM requirements.			
Lakes							
Water Quality	2 times / yr	2 times / yr		Adaptively managed and re-evaluated for AEMP monitoring and EEM requirements.			
Phytoplankton Biomass	2 times / yr	2 times / yr					
Sediment Quality	1 time / yr	every 3 years[b]					
Benthic Invertebrates	1 time / yr	every 3 years[b]					
Fish Population/Condition	1 time / yr	every 3 years[b]					
Fish Tissue Hg/Metals	1 time / yr	every 3 years[b]					
Streams							
Water Quality	2 times / yr	2 times / yr		Adaptively managed and re-evaluated for AEMP monitoring and EEM requirements.			
Periphyton Biomass	1 time / yr	1 time / yr					
Sediment Quality	1 time / yr	every 3 years[b]					
Benthic Invertebrates	1 time / yr	every 3 years[b]					
Marine							
Water Quality	2 times / yr	2 times / yr		Adaptively managed and re-evaluated for AEMP monitoring and EEM requirements.			
Phytoplankton Biomass	2 times / yr	2 times / yr					
Sediment Quality	1 time / yr	every 3 years[b]					
Benthic Invertebrates	1 time / yr	every 3 years[b]					
Fish Population/Condition	1 time / yr	every 3 years[b]					
Fish Tissue Hg/Metals	1 time / yr	every 3 years[b]					

[a] *Monitoring schedule post-closure will be initially set to the schedule during the previous year of operations, but may be subject to re-evaluation as part of adaptive management.*

[b] *Monitoring program will be conducted once during the Construction Phase and then continued every three years throughout the Operational Phase.*

Note: EEM studies only required if triggered. Effluent and Water Quality Monitoring Report due within 3 months following the calendar year of MMER trigger, EEM First Study Design Report due within 12 months (includes Site Characterization and detailed descriptions of Biological Monitoring Studies), and Cycle 1 Interpretative Report (detailing the methods and results of the Biological Monitoring Studies, as well as on-going Effluent and Water Quality Monitoring) within 30 months of MMER trigger.

Table 7.2-5. Physical, Chemical, and Biological Parameters in AEMP Sampling Program, Back River Project

Monitoring Parameter	Sampling Frequency	Sample Replication and Depths	Sampling Dates/Timing	Sampling Equipment
Lake and Marine Water Quality[a]				
Physical (dissolved oxygen, temperature, conductivity/salinity profile), nutrients, total metals, Secchi depth	2 ×	Lakes: n = 1/site at 1 m below the surface and 2 m above the sediments; Marine: n = 2/site; + 20% replication	April, August	GO-FLO sampling bottle, Conductivity-Temperature-Depth (CTD) probe; DO meter
Lake and Marine Phytoplankton				
Biomass (chlorophyll *a*)	2 ×	n = 6/site at 1 m below the surface	April, August; coincident with lake and marine water quality sampling	GO-FLO sampling bottle
Lake and Marine Benthic Invertebrates				
Abundance and taxonomy	1 × (every 3 years)	n = 5/site (3 replicate subsamples)	August; coincident with August lake and marine water quality sampling	Ekman grab (lakes) or Ponar grab (marine); 500 µm sieve
Lake and Marine Sediment Quality				
Physical characteristics, nutrients, metals, TOC	1 × (every 3 years)	n = 6/site	August; coincident with August lake and marine water quality sampling	Ekman grab (lakes) or Ponar grab (marine)
Stream Water Quality				
Physical (temperature and dissolved oxygen), nutrients, total metals	2 ×	n = 3/site	Freshet (June), August	Clean water sampling bottles; DO/Temperature meter
Stream Periphyton				
Biomass (chlorophyll *a*)	1 ×	n = 5/site	August; coincident with stream water quality sampling	Areal templates
Stream Benthic Invertebrates				
Abundance and taxonomy	1 × (every 3 years)	n = 5/site (3 replicate subsamples)	August; coincident with stream water quality sampling	Hess sampler
Stream Sediment Quality				
Physical characteristics, nutrients, metals	1 × (every 3 years)	n = 5/site	August; coincident with stream water quality sampling	Bowl and scoop; 500 µm sieve
Freshwater Fish Survey				
Condition and reproduction (length, weight, age, DELT, liver weight, gonad weight, egg counts); tissue metals	1 × (every 3 years)	Lethal sampling: n = 60 fish per site (20 male + 20 female + 20 immature); Non-lethal sampling: n = up to 100 fish per site; 8 fish / site for tissue metals	August; coincident with August lake water quality sampling	Electrofishing; gillnetting; beach seine

(continued)

Table 7.2-5. Physical, Chemical, and Biological Parameters in AEMP Sampling Program, Back River Project (completed)

Monitoring Parameter	Sampling Frequency	Sample Replication and Depths	Sampling Dates/Timing	Sampling Equipment
Marine Fish Survey (Shellfish)				
Condition (whole animal wet weight, soft tissue wet weight, shell length); tissue metals	1 × (every 3 years)	n = 20 shellfish / site (condition); n = 8 shellfish / site (tissue metals)	August; coincident with lake fish survey	Ponar; sieve

[a] *The frequency of water quality sampling for some locations will become monthly if the Project becomes subject to MMER.*

7.2.6 AEMP Sampling Details

7.2.6.1 Water Quality

Core AEMP

Water quality samples collected in the AEMP will focus on the receiving environment and reference areas. The results of the water quality sampling program will be analyzed for Project effects on the aquatic environment, and will be used to inform adaptive management. Water quality monitoring is also a component of the Effluent and Water Quality Monitoring Studies required by EEM, should MMER be triggered.

Lakes and Marine Areas

Water quality samples from lakes and the marine environment will be collected twice annually and no less than one month apart. Table 7.2-6 details the parameters to be monitored, including the parameters required under Schedule 5, section 7 of the MMER should it be triggered. Samples will be collected one time during ice-covered conditions in winter (late April, when under-ice water quality may be most strongly affected by seasonal changes), and one time during the open-water season (August). If the Project becomes subject to MMER, water quality samples will be collected monthly from relevant monitoring locations.

Phytoplankton biomass (measured as chlorophyll *a* concentrations) and Secchi depths (water clarity; open-water only) will be measured to assess any changes in primary production due to eutrophication or other Project effects. The physical and chemical environment will be described by dissolved oxygen, temperature, and conductivity (salinity at marine sites) measurements through the water column at all lake and marine sites.

Streams

Stream water quality samples will be collected twice per year between June and September, depending on the duration of ice-free conditions. The first annual samples will be collected 1-2 weeks after freshet, which often occurs in mid to late-June, with subsequent samples collected in August.

The same water quality parameters will be analyzed for stream samples as for lakes (Table 7.2-6). Periphyton biomass (measured as chlorophyll *a* concentration) will also be sampled at the stream sites once annually in August, along with dissolved oxygen and temperature measurements to characterize the physical and chemical environment of the stream sites.

Table 7.2-6. AEMP Water Quality Parameters, Back River Project

Physical and Chemical Parameters	Nutrients	Total Metals (cont'd)
Conductivity[a]	Ammonia[c]	Lithium (Li)
Salinity[b]	Nitrate[c]	Magnesium (Mg)
Total Hardness[f]	Nitrite	Manganese (Mn)
pH[f]	Total Phosphorus	Mercury (Hg)[c]
Total Alkalinity[f]	**Total Metals**	Molybdenum (Mo)[c]
Total Suspended Solids[d]	Aluminum (Al)[c]	Nickel (Ni)[d]
Turbidity	Antimony (Sb)	Phosphorus (P)
Temperature[e]	Arsenic (As)[d]	Potassium (K)
Dissolved Oxygen (DO)[e]	Barium (Ba)	Selenium (Se)
Secchi Depth	Beryllium (Be)	Silicon (Si)
Water Depth	Bismuth (Bi)	Silver (Ag)
Anions	Boron (B)	Sodium (Na)
Chloride (Cl)	Cadmium (Cd)[c]	Strontium (Sr)
Fluoride (F)	Calcium (Ca)	Thallium (Tl)
Free Cyanide (CN)	Chromium (Cr)	Tin (Sn)
Total Cyanide (CN)[d]	Cobalt (Co)	Titanium (Ti)
Phytoplankton & Periphyton Biomass	Copper (Cu)[d]	Uranium (U)
Chlorophyll *a*	Iron (Fe)[c]	Vanadium (V)
	Lead (Pb)[d]	Zinc (Zn)[d]

[a] *freshwater samples*
[b] *marine samples*
[c] *subject to EEM Effluent Characterization Study (Schedule 5 s. 4(1a-g))*
[d] *MMER deleterious effluent substance (Schedule 4 - Column 1)*
[e] *subject to EEM Water Quality Monitoring Study (Schedule 5 s. 7(b))*
[f] *subject to EEM Water Quality Monitoring Study (Schedule 5 s. 7(c))*
Note: If MMER is triggered, the Effluent and Water Quality Monitoring Studies will also include Sublethal Toxicity Testing.
Note: other parameters may be added if required (e.g. DOC, TOC)

The indicators for suspended material, turbidity, and total suspended solids (TSS), are related parameters estimating the quantity of suspended material using optical (turbidity) and gravimetric (TSS) techniques. Optically measured turbidity provides a rapid assessment tool for suspended material quantities, but depends in a site-specific manner on the composition, size, and colour of suspended material. One component of the AEMP will be the development of site-specific calibration relationships between turbidity and TSS to improve the applicability of turbidity as a rapid-response indicator of suspended sediment.

EEM

Effluent and Water Quality Monitoring Studies are required as part of an EEM, should MMER be triggered, and consist of Effluent Characterization, Sublethal Toxicity Testing, and Water Quality Monitoring. Effluent Characterization and Water Quality Monitoring will be done following the EEM Guidance document at an initial frequency of no less than 4 times per year (parameters described in Table 7.2-6). Sublethal Toxicity Testing will be conducted using the methodologies detailed in the EEM Guidance document at an initial frequency of no less than two times per year.

Power and Statistical Tests

The statistical analysis for Project effects on water quality requires estimation of the effect size of the effects on the quantitative measures of water quality indicators, which includes suspended sediments, nutrients, and metals. For the statistical analysis of water quality indicators, samples from each lake will be pooled to characterize within-lake variation. Simulations indicated the proposal program would provide statistical power near the theoretical goal of 0.9 (Section 7.2.3.1). Statistical power, and the subsequent required sample sizes, will be re-assessed throughout the course of the AEMP.

Descriptive summary statistics will be reported for all collected water quality parameters. BACI ANOVAs will be used to determine statistically significant difference in water quality indicators between reference and exposure areas. Statistical assumptions will be considered and met before accepting the results of statistical inference.

Quality Assurance/Quality Control

QA/QC principles will follow those outlined in the MMER guidance document throughout the field sample collection and laboratory analysis phases. All water quality samples will be collected by qualified personnel using suitable sampling equipment (e.g., acid-rinsed GO-FLO sampling bottles). Samples will be preserved (where applicable) in appropriate containers, and transported and stored following accepted procedures. Chain-of-Custody forms will be used to track the samples.

Replicate samples will be collected from a subset (10 to 20%) of all samples collected to quantify environmental variability and analytical consistency. Travel, equipment, and field blanks will be collected to detect potential sources of contamination.

Table 7.2-7 summarizes the proposed monitoring program for freshwater and marine water quality.

Table 7.2-7. Summary Description of Monitoring Program for Freshwater and Marine Water Quality VECs

Indicator/Monitoring Target	Freshwater and Marine Water Quality
Monitoring Category	AEMP (and MMER if triggered)
Design Type	Before-After, Reference-Exposure
Measurable Parameter and Endpoints	Parameters with CCME guidelines and MMER criteria
Key Project Interactions	Runoff from WRSAs, water holding ponds, open pits, closed open pits, tailings facility, desalination plant discharge, dust or sediment deposition/dispersion, water withdrawal
Objective	Evaluate potential changes in water quality due to Project activities. Confirm EIS predictions; provide monitoring data for adaptive management.
Threshold	Early warning indicator: Significant change from background values (CES of ±2 SD) Exceedance threshold: CCME Guidelines for the Protection of Freshwater or Marine Aquatic Life *or* site-specific water quality objectives *or* greater than the 90% percentile of baseline values if indicator is naturally greater than CCME Guideline
Scope of Monitoring	Sampling program for Project effects on the freshwater and marine receiving environments that capture spatial and temporal variability.

7.2.6.2 Sediment Quality

Sediment quality samples will be collected every three years in conjunction with the benthic invertebrate surveys to measure Project effects on freshwater and marine sediments, and by extension on the benthic invertebrate community and fish habitat. Sediment quality samples will measure the

total organic carbon concentration and particle size distribution at each site, to provide contextual information for the benthic invertebrate community analysis as per the EEM guidance documents, as well as sediment total metal concentrations (Table 7.2-8).

Table 7.2-8. AEMP Sediment Quality Parameters, Back River Project

Physical and Chemical Characteristics	Metals (cont'd)	Metals (cont'd)
% Moisture	Bismuth (Bi)	Nickel (Ni)
pH	Cadmium (Cd)	Phosphorus (P)
% Gravel (>2 mm)[a]	Calcium (Ca)	Potassium (K)
% Sand (2 – 0.063 mm) [a]	Chromium (Cr)	Selenium (Se)
% Silt (0.063 mm – 4 µm) [a]	Cobalt (Co)	Silver (Ag)
% Clay (<4 µm) [a]	Copper (Cu)	Sodium (Na)
Organic Carbon	Iron (Fe)	Strontium (Sr)
Total Organic Carbon [a]	Lead (Pb)	Total Sulphur (S)
Metals	Lithium (Li)	Thallium (Tl)
Aluminum (Al)	Magnesium (Mg)	Tin (Sn)
Antimony (Sb)	Manganese (Mn)	Titanium (Ti)
Arsenic (As)	Mercury (Hg)	Vanadium (V)
Barium (Ba)	Molybdenum (Mo)	Zinc (Zn)
Beryllium (Be)		

[a] *mandatory for EEM benthic invertebrate surveys*

Power and Statistical Tests

The statistical analysis for Project effects on sediment quality requires estimation of the effect size of the effects on the quantitative measures of metal concentrations, organic carbon concentrations, and particle size composition. Adequate sample sizes will be determined using power analysis and estimates of parameter variability from the baseline and historical sampling programs. A preliminary power analysis, for an *a priori* effect size of ± 2 SD and $\alpha = 0.1$, estimated that six replicate lake sediment quality samples will have a power 0.83 to detect a significant difference between a control site and a reference site. The greater natural variability in stream sediment quality samples reduced the estimated power of the statistical analysis, but the proposed program balanced the feasibility of sampling from small streams against the achievable statistical power. Statistical power and the required sample sizes will be re-assessed throughout the course of the AEMP.

Descriptive summary statistics will be reported for all collected sediment quality parameters. ANOVAs will be used to determine statistically significant difference in particle size composition and the concentrations of nutrients, metals, and organic carbon between reference and exposure areas. All statistical assumptions will be considered and met before accepting the results of statistical inference.

Quality Assurance/Quality Control

QA/QC principles will follow those outlined in the EEM guidance documents during sample collection and laboratory analyses. All sediment quality samples will be collected by qualified personnel using suitable sampling equipment (e.g., Ekman grabs). Samples will be stored in appropriate containers and transported following accepted procedures. Chain-of-Custody forms will be used.

Table 7.2-9 summarizes the proposed monitoring program for freshwater and marine sediment quality.

Table 7.2-9. Summary Description of Monitoring Program for Freshwater and Marine Sediment Quality VECs

Indicator/Monitoring Target	Freshwater and Marine Sediment Quality
Monitoring Category	AEMP (and MMER if triggered)
Design Type	Before-After, Reference-Exposure
Measurable Parameter and Endpoints	Parameters with CCME guidelines and MMER criteria
Key Project Interactions	Runoff from WRSAs, water holding ponds, open pits, closed open pits, tailings facility, desalination plant discharge, dust or sediment deposition/dispersion, water withdrawal
Objective	Evaluate potential changes in sediment quality due to Project activities. Confirm EIS predictions; provide monitoring data for adaptive management.
Threshold	Early warning indicator: Significant change from background values (CES of ±2 SD) Exceedance threshold: CCME Interim Sediment Quality Guidelines (ISQG) *or* site-specific sediment quality objectives *or* greater than the 90% percentile of baseline values if indicator is naturally greater than CCME Guideline
Scope of Monitoring	Sampling program for Project effects on the freshwater and marine receiving environments that capture spatial and temporal variability.

7.2.6.3 Benthic Invertebrate Community

Core AEMP

Benthic invertebrate surveys will be conducted as per the schedule in Table 7.2-4 to measure the effects of Project activities on the lower trophic levels of the aquatic environment, which serve as an important food resource for fish. The benthic invertebrate community will be sampled in all three aquatic habitats, lakes, streams, and the near-shore marine environment, and analyzed for abundance and taxonomic composition. From the taxonomic analysis of the benthic invertebrate community, the following summary statistics will be calculated and used to evaluate for potential Project effects:

- total organism abundance;
- taxon richness; and
- Simpson's diversity and evenness indices.

Samples will be collected from the most "ecologically-relevant" area, after consideration by qualified personnel for the site-specific characteristics of habitat types and distributions. Benthic invertebrate surveys are planned to be conducted in August, which is the most "ecologically-relevant" season, and is when the benthic invertebrate community is most biologically-active and susceptible to Project-related effects. Benthic invertebrate surveys will coincide with water quality, primary producer (phytoplankton and periphyton) biomass, and sediment sample collection.

EEM

Biological Monitoring Studies are required by EEM, if MMER is triggered, and include a benthic invertebrate community survey. The benthic invertebrate community survey conducted for the core AEMP will be consistent with the requirements of EEM, and will occur at the selected exposure and reference areas. The details of the benthic invertebrate survey will be included in the First Study Design report.

Power and Statistical Tests

The statistical analysis for Project effects on the benthic invertebrate community requires estimation of the effect size of the effects on the quantitative measures of community structure, diversity, and abundance. Adequate sample sizes will be determined using power analysis and estimates of parameter variability from the baseline and historical sampling programs. A preliminary power analysis, for an *a priori* effect size of ± 2 SD and $\alpha = 0.1$, estimated that five replicate benthic samples will have a power ($1 - \beta$) of = 0.64 to detect a significant difference between a control site and a reference site (Section 7.2.3.1). The natural variation in the abundance of benthic invertebrates presents a challenge for high statistical power. The modest increases in statistical power provided by additional replication may not be feasible in the small streams in the Project area. However, the statistical power and the required sample sizes will be re-assessed throughout the course of the AEMP.

Descriptive summary statistics will be reported for all collected biological parameters. ANOVAs will be used to determine statistically significant differences for the four benthic invertebrate summary statistics (abundance, richness, diversity, and dissimilarity) between reference and exposure areas. All statistical assumptions will be considered and met before accepting the results of statistical inference.

Quality Assurance/Quality Control

QA/QC principles will follow those outlined in the EEM guidance document for the collection of samples and subsequent laboratory analyses. Samples will be collected by qualified personnel using suitable sampling equipment (e.g., Hess sampler in streams). Samples will be uniformly pre-sieved and preserved in appropriate containers. Samples will be stored and transported using accepted procedures.

All laboratory processing and taxonomic identification will be conducted by expert taxonomists and appropriate sub-sampling and random re-sorting techniques will be used. Data quality will be verified by screening for potential data entry errors. All samples will be stored for six years following analysis and a reference collection will be compiled.

Table 7.2-10 summarizes the proposed monitoring program for freshwater and marine benthic invertebrates.

7.2.6.4 Fish Monitoring

Core AEMP

Fish population surveys and detailed biological sampling on a finned-fish species at lake habitats and bay mussels (*Mytilus trossulus*) at marine habitats will be conducted as per the schedule in Table 7.2-4. The streams in the Project area do not contain resident fish populations as they are completely frozen during the winter. Thus, freshwater sampling will be focused on lakes where potential Project effects are most likely to be detected. Sampling will occur at three AEMP lake sites (Goose Lake, Propeller Lake, and Reference B Lake) and marine sites (around the MLA and the reference marine site). As part of the AEMP, fish or mussel tissue surveys will be conducted in exposure and reference sites every three years during construction and operations concurrent with the fish biological and population sampling outlined above.

Table 7.2-10. Summary Description of Monitoring Program for Freshwater and Marine Benthic Invertebrates

Indicator/Monitoring Target	Freshwater and Marine Benthic Invertebrates*
Monitoring Category	AEMP (and MMER if triggered)
Design Type	Before-After, Reference-Exposure
Measurable Parameter and Endpoints	Abundance of organisms, taxonomic diversity
Key Project Interactions	Runoff from WRSAs, water holding ponds, open pits, closed open pits, tailings facility, desalination plant discharge, dust or sediment deposition/dispersion, water withdrawal
Objective	Evaluate potential changes in benthic invertebrate communities due to Project activities. Confirm EIS predictions, provide monitoring data for adaptive management, and meet EEM requirements (if necessary)
Threshold	Early warning indicator: Significant Project effects on water and sediment quality (CES of ±2 SD) Exceedance threshold: Significant change in organism abundance and/or taxonomic diversity
Scope of Monitoring	Sampling program for Project effects on freshwater and marine benthic invertebrate communities.

* *Significant biological receptor in aquatic ecosystems and important for the freshwater and marine Fish/Aquatic Habitat VECs and Fish Community VECs.*

Freshwater

Fish population surveys in lakes will take place every three years in August using gillnets, beach seines, and electrofishing. Sampling locations will be determined randomly and conducted throughout each lake to collect fish of all species and determine an unbiased catch-per-unit-effort (CPUE) within lakes. Fish to be used for tissue metal sampling are required to be of the same sex and approximate size, therefore, if random sampling does not result in sufficient sample size to meet these requirements, additional sampling may be conducted using targeted methods. For example, sampling for forage species may be conducted at a specific area of the lake, or using a single gillnet mesh size to capture fish of a certain size. CPUE for these methods will be recorded separately so as not to bias the results of the random sampling.

Freshwater biological sampling to assess fish and population health will focus on two sentinel species, Lake Trout (*Salvelinus namaycush*) and Slimy Sculpin (*Cottus cognatus*). Lake Trout are a large-bodied, long-lived species and thus highly susceptible to long-term population level effects from lethal sampling. To avoid any negative effects on population size and structure, non-lethal biological sampling will be employed for Lake Trout. Non-lethal sample sizes of up to 100 adults are recommended for each site (Environment Canada 2012b); however, it is recognized that this may not always be attainable for Lake Trout in northern waterbodies. Lethal sampling will, however, be employed on the small-bodied, short-lived, benthic Slimy Sculpin. The objective will be to collect data from 20 mature male, 20 mature female, and 20 juvenile Slimy Sculpin from each lake. However, 60 lethal samples of Slimy Sculpin may also be unattainable for most waterbodies in the AEMP. The EEM guidance document fully recognizes that this number samples is unlikely to be caught in many waterbodies (Environment Canada 2012b).

Survival, growth, reproductive and condition parameters will be collected from the fish and compared between sites and over time to properly assess changes in fish populations and health over the life of the mine. Lethal sampling of Slimy Sculpin will measure and assess all the biological variables and

effects endpoints listed in Table 7.2-11, while only a subset of variables will be assessed from non-lethal sampling of Lake Trout.

Table 7.2-11. Fish Biological Variables and Effects Endpoints

Biological variables	Effects Endpoints	Lake Trout	Slimy Sculpin
Age	Age	X	X
Size (length and weight)	Condition (body weight against length)	X	X
Liver weight	Relative liver size (liver weight against body weight)		X
	Growth rate (body weight against age)	X	X
Gonad weight	Relative gonad size (gonad weight against body weight)		X
Fecundity (egg number and weight)	Relative fecundity (# of eggs/female against body weight)		X
	Relative egg size (mean egg weight against body weight [or age])		X
Stomach contents	Diet		X
DELT (deformities, eroded fins, lesions, and tumours)		X	X

Freshwater biological sampling to assess fish tissue contamination will focus on the same two sentinel species, Lake Trout and Slimy Sculpin. For each species, a minimum of eight samples of the same sex and approximate body size will be collected from each lake (Environment Canada 2012b) during the fish population surveys conducted every three years in August. To avoid any negative impacts on population size and structure, non-lethal sampling using tissue plugs will be employed for Lake Trout. Tissue plugs will be collected from Lake Trout for analysis using methods developed by Baker et al. (2004), whereas Slimy Sculpin will be sacrificed for whole-body tissue metal analysis.

Marine

For the marine areas, previous studies have shown that finfish biological sampling often performs poorly in the marine environment because of insufficient fish catches or inadequate quantification of exposure time. This is likely the result of the high mobility of fish in this environment. According to Section 2(b) of the *Fisheries Act*, 'shellfish, crustaceans, marine animals…' are considered 'fish' (1985b). Therefore, a bivalve mollusc commonly present in the marine sampling area will be used as a sentinel species in the AEMP analysis of effects.

For the marine component of the AEMP, the Bay Mussel will be collected as per the schedule in Table 7.2-4. This mollusc is present in Arctic marine habitats and is sufficiently large (>4 cm) for tissue collection. Parameters to be measured will include those required to address bivalve condition (whole animal wet weight, soft tissue wet weight, shell length, width, and height) as well as tissue metal and polycyclic aromatic hydrocarbon (PAH) concentrations. Twenty Bay Mussels will be collected from each marine area.

In the marine habitat, Bay Mussels will be collected for tissue metal and moisture content analyses in a consumable species. A minimum of eight samples of the same approximate body size will be collected from each site (Environment Canada 2012b).

EEM

If the MMER is triggered by total discharges of more than 50 m^3/d and/or the release of deleterious substances into any waterbody, then Biological Monitoring Studies are required. The Biological Monitoring Studies include a site characterization, benthic invertebrate surveys, and fish studies. The fish studies will be conducted in select exposure and reference areas, with the intent of evaluating the effects of mining effluents on two components: 1) Fish Population and Health; and 2) Fish Tissue Metal Concentration.

Site Characterization

The site characterization studies profile the physical, chemical, and biological nature of the sites and are required if the MMER is triggered for the First Study Design Report. Site characterization studies include:

- a description of effluent mixing with the exposure area, with an estimate of the effluent concentration in water 250 m from the discharge point;
- a description of the reference and exposure areas where the biological monitoring studies will be conducted. Information will include the geology, hydrology, oceanography, limnology, and the chemical and biological features of these areas;
- the type of production process used by the mine, and the environmental protection practices used;
- a description of any anthropogenic, natural, or other factors, unrelated to Project activities, that may contribute to an observed effect; and
- any additional information relevant to the site characterization.

Fish Population and Health

The EEM program requires fish population monitoring to be undertaken if the effluent in the exposure area is greater than 1% in the area located within 250 m of a final discharge point (MMER, Schedule 5, s. 9(b); SOR/2002-222). In the freshwater environment, fish population surveys will occur annually at the selected exposure and reference areas. The surveys will follow the protocols and methods as the proposed AEMP. Fish health biological sampling in the EEM program will also follow the approach as described for the proposed AEMP. Lake Trout and Slimy Sculpin will continue to serve as the sentinel species, with non-lethal sampling employed for Lake Trout health sampling.

If MMER is triggered in the marine environment, the Bay Mussel will be the target for EEM biological sampling. Sampling for Bay Mussel population and health will occur annually to assess for effluent effects, and will follow the methods used in the AEMP sampling program.

Fish Tissue – Use of Fisheries Resources

Effects on fish usability are monitored by comparing contaminants in edible fish tissue. For the EEM program, the mercury concentration in fish tissue is used to determine if fish are safe for human consumption, and monitoring is triggered when the mercury concentration in the mining effluent (determined during effluent characterization) equals or exceeds 0.10 µg/L (MMER, Schedule 5, s. 9(c); SOR/2002-222). If MMER is triggered, then sampling for the use of fisheries resources will be incorporated into the fish health sampling program. Tissue samples from Lake Trout and Slimy Sculpins (freshwater) or Bay Mussels (marine) will be collected and analyzed for contaminants in tissue.

Power and Statistical Tests

When assessing fish population and health, collecting and lethally sampling more than 20 Slimy Sculpin of each sex and 20 juveniles at each site does little to increase the statistical confidence in the

parameter estimates (i.e., confidence limits). Non-lethal sampling of a minimum of 100 Lake Trout at each site is recommended (Environment Canada 2012b), although this sample size may be unachievable in Arctic waterbodies.

Effects endpoints will be considered statistically different between reference and exposure sites at $\alpha = 0.1$. For fish tissue, an effect on fish usability is defined as measurements of total mercury that exceed 0.5 mg/kg wet weight of fish tissue taken from an exposure area that are statistically different from fish tissue measured in a reference area (MMER, Schedule 5, s. 1; SOR/2002-222). While most sample sizes in this study were set to achieve a power of 0.9 (β=0.1), fish tissue metal analyses will be conducted using a power of 0.95 (which will be achieved with eight samples from each site; Environment Canada 2012b). Adjustment to sample sizes for future sampling may be required and will be determined based on power calculations from the data collected from previous AEMP sampling and professional judgement.

Descriptive summary statistics will be reported for all collected biological parameters. Potential effects to fish size (length and weight) and age will be determined using Analysis of Variance (ANOVA). All ANOVA assumptions will be met prior to analysis, including normally distributed populations, equal variances between populations, and sample independence. If populations or variances are unequal, the appropriate transformation will be applied before ANOVA is carried forth.

The remaining effects endpoints, except diet and DELT, will be analyzed for statistical differences and interactions between the exposure and reference sites using Analysis of Covariance (ANCOVA). Assumptions of normality and constant variance will be met before an ANCOVA is applied. The assumption of equal regression slopes will also need to be met for relative fecundity, to control for variability in weight. However, for most of the endpoints (excluding relative fecundity), the slope of the natural log of the dependent variable and covariate is the endpoint of interest (e.g., the slope of ln(weight) and ln(length) is condition). Thus, it is the differences in slope that indicates significant effect, and thus the assumption of equal regression slopes will not apply.

Potential differences in DELT characteristics between exposure and reference sites will be compared using the Chi Square (X^2) test. While multivariate tests (e.g., multi-response permutation procedures; MRPP) will determine potential differences in diet composition between exposure and reference sites.

Quality Assurance/Quality Control

QA/QC measures will be followed throughout the data, field, and laboratory phases. Data quality will be screened for entry errors and will be checked for outliers using the appropriate boxplot, residual plot or quantile-quantile plot. It will be determined whether outliers are due to data entry or occur through biological means (e.g., sick or damaged fish, parasitized fish). If there is no clear explanation for the outlier, analysis will be conducted in the presence and in the absence of the outlier(s) to determine the magnitude of influence it has on the conclusions. Data entry errors will be corrected, while outliers may be removed to avoid strong leverage.

In the field, all personnel will have suitable expertise to conduct surveys and perform dissections. All safety measures and SOP will be followed. Proper sampling gear (e.g., dissecting equipment) and methods (e.g., electrofishing) will be employed by personnel while in the field. All sampling information will be appropriately documented, preserved (as necessary), stored, and shipped. Chain of Custody forms will used to track all sample shipments.

Fish samples will be analyzed by accredited laboratories with trained staff. Analyses will be conducted by recognized protocols and methods with properly calibrated and maintained instrumentation.

Records of samples, analyses, method detection limits, and laboratory staff conducting analyses must be kept and be readily available. Analyses will be conducted by as few as technicians as possible to maintain consistency and reduce measurement error. If sub-sampling is required (e.g., fecundity, egg size), efficiency and accuracy results of the technique must be documented and the information used to calculate appropriate correction or scaling factors to minimize potential differences in methods and efficiency. All records of lesions, parasites, and other deformities will be noted.

Table 7.2-12 summarizes the proposed monitoring program for freshwater and marine fish.

Table 7.2-12. Summary Description of Monitoring Program for Freshwater and Marine Fish VECs

Indicator/Monitoring Target	Freshwater and Marine Fish Communities
Monitoring Category	AEMP (and MMER if triggered)
Design Type	Before-After, Reference-Exposure
Measurable Parameter and Endpoints	Relative Abundance, Size, Age, Growth rate, Relative gonad size, Condition, Relative liver size, Relative fecundity, Relative egg size, and mercury tissue concentration
Key Project Interactions	Runoff from WRSAs, water holding ponds, open pits, closed open pits, tailings facility, desalination plant discharge, dust or sediment deposition/dispersion, water withdrawal
Objective	Evaluate potential changes in fish population and health. Confirm EIS predictions, provide monitoring data for adaptive management.
Threshold	Early warning indicator: Significant Project effects on fish community indicators Exceedance threshold: 0.5 mg/kg wet weight mercury levels; Significant change in fish population or biological variable
Scope of Monitoring	Sampling program for Project effects on freshwater and marine fish and fish habitat that capture spatial and temporal variability.

8. Mitigation and Adaptive Management

The Aquatic Effects Management Plan (the Plan) is a "living document." It may be updated based on regulatory changes, Project-related changes, incident investigations, or the need for changes to existing mitigation measures. The Aquatic Effects Monitoring Program (AEMP) is central to the plan, as it serves as the early warning indicator to identify effects, and trigger additional monitoring or the implementation of additional mitigation measures.

Unless otherwise indicated, measures described in the AEMP apply to all Project components for the life of the Project. This plan is designed to be adaptive, effective, and achievable in both the short and long term, and includes measurable objectives that will be evaluated in the monitoring program. The plan presented here is only the beginning of a chain of plans and reports that will ensure the Project minimizes its effects on the aquatic environment.

9. Checking and Corrective Action

Checking and corrective action evaluates the predicted effects of the Project on freshwater and marine water quality, sediment quality, fish habitat, and fish populations, and evaluates the compliance of the Project and its sub-contractors. Evaluation of predicted effects will be conducted

through the AEMP. The monitoring, quality control, and reporting procedures detailed in this plan will be used to:

- assess the effectiveness of mitigation and management measures;
- identify Project effects requiring further mitigation efforts;
- comply with requests from regulators and stakeholders; and
- adapt to changes in the regulations or the Project.

10. Record Keeping

Record keeping will be conducted by Sabina and its subcontractors. Data will be entered into suitable electronic databases (e.g., MS Access), checked for quality control and stored with subcontractor responsible for monitoring and with Sabina. Data will be entered in a format and program that allow for comparison between years and storage in a single file format for each type of survey or monitoring activity. Data that has been quality assured will be appended to the annual AEMP report and the compilation of all cumulative data will be transferred for storage with the Government of Nunavut, Department of Environment.

All formal documents and reports will follow version-control procedures with revision tracking and version numbers. Version control information will be required for all documents and data that are issued, and approval will be given and tracked before issue. Designated personnel will coordinate preparation, review, and distribution, as appropriate, of the data and reports required for regulatory purposes.

11. Environmental Reporting

11.1 ANNUAL AEMP REPORT

An annual AEMP report on the status of the aquatic environment and detailing any observed trends will be prepared during the construction and operations phases of the Project. The frequency of reporting after the operations phase will be determined prior to the Project moving in to closure. Reporting of environmental monitoring will include documentation of data collection methodology and data management. The reporting process is an important component of adaptive management, and will serve to track developments in mitigation measures to minimize Project effects on the aquatic environment.

All formalized documents and reports will follow version-control procedures to ensure they are approved before use and the internal and external users are accessing the most current information. All monitoring will be done using documented and accepted methods. All sampling and analytical services will have the necessary accreditation and qualifications, and QA/QC procedures will be used. Quality assurance procedures will include internal audits, management of non-conformance to QA/QC protocol events, report, and data management, as well as sampling verification and validation studies. The QA/QC procedures will help to continuously improve the effectiveness of the sampling program, and will be a key component of the adaptive management of the Plan.

Reporting of all environmental monitoring data will be conducted in accordance with all licences and approvals. Regulatory requirements are anticipated to entail formal annual reports, including disclosure of issues of non-conformance. The annual AEMP report will include the following:

- a description of Project activities during the monitoring interval;
- all of the raw monitoring data obtained during the most recent reporting period;
- description of the methods used for sample and data collection;
- a detailed evaluation of effects on the designated monitored parameters;
- results from the evaluation of effects, in text and figures;
- conclusions from the evaluation of effects;
- description of mitigation measures in place, and a discussion of effectiveness; and
- identification of additional mitigation measures.

Standardized formats will be used for the annual reports, and reports will be kept on file and made available upon request.

11.2 REPORTS UNDER MMER

If MMER is triggered at any time, then the AEMP will conform to the reporting requirements of MMER in addition to the annual AEMP reports. An initial study design will be submitted to an authorization officer with 12 months of the trigger and six months before biological monitoring is initiated (Schedule 5, s. 14(a) and 15; SOR/2002-222). This report will contain:

- a site characterization;
- a detailed description of the fish population study;
- a detailed description of the fish tissue study;
- a detailed description of the benthic invertebrate surveys;
- the sampling schedule; and
- a description of the quality assurance and quality control measures for the EEM program.

Pursuant to Schedule 5, s. 18(a) of the MMER, the first interpretative report will be submitted within 30 months after the mine becomes subject to MMER (SOR/2002-222). The first Cycle 1 interpretative report would follow the Study Design Report, and would occur during any phase where discharge occurs. The interpretative report will contain:

- documentation of latitude and longitude of sampling areas and a sufficient description of sampling areas to allow proper identification;
- schedule of sample collection;
- sample design, including sample sizes;
- the results of data assessment with appropriate statistical analyses and all supporting raw data;
- the identification of any biological effects;
- the comparison of any effects with results from sublethal toxicity testing (from effluent characterization);

- the conclusions of biological monitoring and water quality studies, taking into account any other potential factors not related to the effluent (anthropogenic or natural), and a description of quality assurance and control measures that were implemented;
- a description of how future study design for monitoring will be affected by the results; and
- the date when the next biological EEM cycle will commence.

12. Plan Effectiveness

The Plan is intended to ensure that the Project is conducted as proposed, mitigation and management measures are effective at mitigating adverse effects on the freshwater and marine receiving environments, and relevant laws and regulations are met. As part of environmental reporting, Sabina will distribute copies of the annual AEMP report to stakeholders and conduct annual information sharing workshops with the Kitikmeot Inuit Association to report on mitigation, management and monitoring activities. Sabina will also conduct annual (or as necessary) evaluations of the efficacy of mitigation and management activities and of monitoring activities using relevant methods, such as power analyses or time series analyses. Should new, more sensitive, monitoring methods be introduced, or existing methods be found to lack statistical power or a robust design, updated methods will be proposed to the stakeholders in a revised Plan. This Plan may be updated as frequently as every year, or not at all, if the mine plan and methods for mitigation and monitoring be found to be robust. The new Plan will be implemented following review by stakeholders and an opportunity for response by Sabina.

13. QA/QC

The Aquatic Effects Management Plan will use re-iterative quality assurance and quality control processes to ensure the Plan's goals are met. QA/QC measures will be applied to each stage of the monitoring program, starting with data collection, then to data entry and analysis, and through reporting. The process will be iterative and reassessment of methods and processes will occur for every annual cycle.

Standard Operating Procedures (SOP) will be established for all environmental data collection. All personnel will have necessary training and accreditation. The SOP will cover all aspects of data collection, data processing, data QA/QC, and data management. SOP will include duplicate sampling, relevant blanks, chain-of-custody procedures, and record keeping. SOP will be reassessed and updated when necessary, as part of the re-iterative QA/QC process. Data analysis will be conducted using established and standardized workflows, and analytical results will be cross-checked and validated. Statistical hypothesis testing will be validated using power analysis and any other relevant methods. Internal quality audits will be conducted to record and analysis quality issues and will be subject to quality assurance procedures for documenting, tracking, and resolving QA/QC issues. The annual AEMP reports will include detailed descriptions of the analytical methods, including the relevant validation and QC procedures.

The re-iterative QA/QC procedures will continuously improve the effectiveness of the AEMP to detect Project-related effects in the freshwater and marine environments. These QA/QC processes are important in the overall Adaptive Management of Project effects, and will support the goals of the Project to minimize, mitigate and/or manage potential adverse effects on the environment while systematically seeking to enhance positive effects.

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Appendix V10-19A

R Code for the BACI ANOVA Power Analysis

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Appendix V10-19A.
R Code for the BACI ANOVA Power Analysis

```
# Simulation model for calculation power for two-factor ANOVA
# with an interaction term. Corresponds to a one-site vs. one-site
# sampling design, without a term for inter-annual variation.

# setting starting conditions; nsim = number of simulations,
# nbase is the number of baseline samples (generally 3 to 5),
# nmon = levels of AEMP sampling replication,
# meanexp = mean value of the parameter in a exposure site,
# sdexp = standard deviation of the parameter at the exposure site,
# meancon = mean value at the control site,
# sdcon = standard deviation of the parameter at the control site,
# alpha = defined probably of Type I error (false negative),
# ces = defined threshold of an effect (2 standard deviations),
# log.flag = flag for log-10 transformation of data prior to model

# simulation model for power (1-beta) for each of the # levels of AEMP
  sampling replication defined above. Power # is calculated as the frequency
  of simulated data with significant
# interaction terms (site*treat) at the defined alpha.

power.sim.anova2<-function(nbase, nmon, meanexp, sdexp,
                           meancon, sdcon, alpha, ces, nsim,
                           log.flag,
                           setseed=1001){

  power.n <- numeric(length(nmon))

  for (i in 1:length(nmon)) {
    naemp <- nmon[i]
    pval <- numeric(length(nsim))
    for (j in 1:nsim){
      con.before <- rnorm(nbase, meancon, sdcon)
      con.after <- rnorm(naemp, meancon, sdcon)
      exp.before <- rnorm(nbase, meanexp, sdexp)
      exp.after <- rnorm(naemp, meanexp + ces * sdexp,
                         sdexp)

      value <- c(con.before, con.after, exp.before, exp.after)
      site <- c(rep("control", nbase + naemp),
                rep("exposure", nbase + naemp))
      treat <- rep(c(rep("before", nbase), rep("after", naemp)), 2)

      data.f <- data.frame(site, treat, value)
```

```
      ifelse(log.flag == 1,
             m <- lm(log(value,10) ~ site * treat, data = data.f),
             m  <- lm(value ~ site * treat, data = data.f))
      pval[j] <- coef(summary(m))[4,4]
    }
    power.n[i] = sum(pval < alpha)/nsim
  }
  power.summ <- cbind(nmon, power.n)
  #find first occurrence of value greater than power = 0.9
  pfin<-power.summ[which(power.summ[,2]>=0.9, arr.ind = TRUE)[1],1]
  #print to console
  print(power.summ)
  #plot power function
  scatter.smooth(power.summ, span=2/3, type="p",
                 xlab="Number of Samples", ylab="Power", pch=19)
  options(warn=-1)
  #add sample size at power =0.9 to plot
  legend("topleft", legend=c("lowess fit", "simulated\nscores"),
         title=paste("Power >0.9 @ N =", pfin),
         lty=c(1,0), pch=c(26,19), bty="n")
  options(warn=0)
}

#function call: provides plot of power, identifies sample size and prints
      dataframe of values to console
power.sim.anova2(nbase=5, nmon=seq(3,20,1),
                 meanexp=3.23, sdexp=1.29,
                 meancon=1.14, sdcon=0.65,
                 alpha=0.1, ces=2, nsim=100,
                 log.flag = 0,
                 setseed=1001)
```

20. Wildlife Mitigation and Monitoring Program Plan

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BACK RIVER PROJECT
Wildlife Mitigation and Monitoring Program Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 20	6	Environmental Protection Measures	Re-written to add more detail
	7	Wildlife Effects Monitoring Program	Re-written to add more detail

BACK RIVER PROJECT
WILDLIFE MITIGATION AND MONITORING PROGRAM PLAN

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1. Introduction

The Back River Project (the Project) has been designed to minimize, mitigate, and/or manage potential adverse effects on the environment while systematically seeking to enhance positive effects. As part of the requirements of the Final Environmental Impact Statement (FEIS) guidelines issued by the Nunavut Impact Review Board (NIRB), this document presents the Wildlife Mitigation and Monitoring Program (WMMP) Plan (the WMMP Plan) that Sabina Gold & Silver Corp. (Sabina) will follow concurrent with the development of the Project.

This Plan describes actions that are intended to reduce Project-related effects on wildlife. The Plan is intended to ensure wildlife habitats and populations are maintained in the area that will be influenced by Project development, while taking into account operational requirements and the safety of Project employees.

Unless otherwise indicated, measures described in the Plan apply to all Project components for the life of the Project. This plan is designed to be adaptive, effective, and achievable in both the short and long term, and includes measurable objectives that will be evaluated in the monitoring program (Section 7).

The WMMP Plan for the FEIS includes considerable changes and additions in response to comments, suggestions and requests from the reviewers of the DEIS WMMP Plan, including the Kitikmeot Inuit Association (KIA), the NIRB, the Government of Nunavut Department of Environment (GN DOE), the Government of the Northwest Territories Department of Environment and Natural Resources (GNWT ENR) and Aboriginal groups from the NWT.

1.1 INTEGRATION OF TRADITIONAL KNOWLEDGE

This Plan represents an adaptive approach to understanding the effects of the Project on the landscape and the species that live there. In this context, the Plan is part of a continually evolving process that relies not only on the efficacy of data collection and analytical results, but is also dependent on feedback from the communities, government, Aboriginal groups and the public. Having an adaptive and flexible program allows for appropriate and necessary changes to the design of monitoring studies, and the mitigation and monitoring plans. Some changes may come about through the observation of unanticipated effects or inadequacies in the sampling methods to detect measurable effects. Other changes may result from ecological knowledge acquired through working with Aboriginal community members and discussions with elders, both in the field and through workshops.

Sabina is committed to considering and incorporating traditional knowledge into the Plan. The incorporation of traditional knowledge will occur throughout all stages of the Plan, including identification of mitigation measures, monitoring study design, data collection, and follow-up programs to obtain feedback.

2. Scope and Objectives

The WMMP Plan targets the following valued ecosystem components (VECs) that are included in the Final Environmental Impact Statement (FEIS):

1. caribou (Bathurst, Ahiak, and the Dolphin and Union herds);
2. grizzly bear;
3. muskox;
4. wolverine/furbearers;
5. migratory birds (waterbirds, upland breeding birds);
6. raptors (e.g., falcons, eagles, hawks, ravens, and owls);
7. seabirds and seaducks; and
8. marine mammals (ringed seals).

Mitigation for potential effects of the Project was taken into consideration in the Project design and included avoidance of key wildlife habitats. The process of Project design and avoidance was conducted during the preparation phase for the Draft Environmental Impact Statement (DEIS) and FEIS. The FEIS evaluates the potential for effects given the final footprint after the redesign of Project elements. The overall objective of the Plan is to minimize effects due to the Project given this final footprint design.

The objectives of the WMMP Plan are to:

- guide on-site adaptive management (both monitoring and mitigation activities) at the Project site;
- incorporate Traditional Knowledge (TK) into the Plan wherever possible;
- minimize any Project-related effects on wildlife species and their habitat predicted in the FEIS;
- avoid adverse effects on protected species and their habitats;
- describe regional-based monitoring activities for selected wildlife VEC species and their habitat;
- provide achievable and measureable goals for evaluating mitigation and monitoring activities;
- ensure monitoring is based on current methods that are consistent with other monitoring programs in the Arctic; and
- identify opportunities for regional, collaborative monitoring with government agencies where a need has been identified.

The WMMP Plan describes and presents the following components:

- the planning and implementation processes for the Plan, including the personnel and their responsibilities (Section 5);
- the mitigation and adaptive management measures that will be carried out on-site to reduce any predicted effects due to the Project (Section 6);

- the Wildlife Effects Monitoring Program (WEMP) including:
  - an on-site monitoring program to evaluate the success of, trigger and guide adaptive mitigation and management activities (Sections 7.2);
  - a species-specific monitoring program to monitor regional populations of selected VEC species to evaluate the predicted effects from the FEIS (Section 7.3);
- the process for adaptive management, checking, recordkeeping, reporting, and quality assurance/quality control (QA/QC).

The WMMP Plan is designed to be effective for all Project sites, including:

- the Goose Project Development area (Goose PDA) including buildings, on-site roads, open pits, ponds and the Tailings Storage Facility (TSF);
- the Marine Laydown Area Project Development Area (MLA PDA);
- the winter ice roads between the two PDAs;
- the shipping corridor through the Northwest Passage; and
- areas surrounding the areas above that may be accessed by aircraft.

2.1 MITIGATION AND MONITORING FOR PREDICTED PROJECT EFFECTS

The FEIS evaluated the potential effects of the Project on wildlife through a four step process:

1. valued Ecosystem Components (VECs) were selected;
2. potential effects were identified that may interact with the VECs;
3. mitigation was described that would reduce these effects; and
4. residual effects on wildlife VECs, after mitigation, were identified and evaluated for significance.

Wildlife VECs were chosen based on whether they are species at risk or of conservation concern, require consideration by regulatory agencies, have a strong biological importance in the ecosystem, or have been identified as being culturally, socially and economically important to the Inuit and other community members.

Eight wildlife VECs were chosen, including:

1. caribou;
2. grizzly bear;
3. muskox;
4. wolverine and Furbearers;
5. migratory birds (waterbirds and upland breeding birds);
6. raptors;
7. seabirds and seaducks; and
8. marine mammals (ringed seals).

Potential Project-related effects were included in the assessment based on professional judgement, experience at other similar projects in Nunavut and the Northwest Territories, Aboriginal TK and land user knowledge, and a review of scientific literature of the effects of developments on wildlife. Eight potential effects were evaluated:

1. habitat loss;
2. disturbance due to noise (e.g., displacement from areas of habitat);
3. disruption to movement;
4. direct mortality and injury from Project activities;
5. indirect mortality (e.g., due to increased access and associated increase in hunting);
6. attraction to the Project site (e.g., scents or wastes);
7. exposure to contaminants; and
8. reduction in reproductive productivity as a consequence of the first seven effects.

This Plan describes the mitigation used to reduce the potential effects on wildlife VECs and outlines monitoring to 1) trigger mitigation, 2) evaluate the efficacy of mitigation, and 3) evaluate the predictions of the FEIS. Table 2.1-1 provides an overview of the Sections of the Plan that addresses the mitigation and monitoring for each potential effect on wildlife.

Table 2.1-1. WMMP Mitigation and Monitoring Components that Address Potential Effects on Wildlife

Potential Effect	Mitigation Chapters	Monitoring Chapters
1. Habitat Loss	6.2 Wildlife Construction and Operations Management	7.2.1 Footprint Monitoring
2. Disturbance	6.2 Wildlife Construction and Operations Management 6.6 Noise Abatement for Wildlife 6.5 Aircraft Management for Wildlife 6.10 Mitigation and Management for Caribou 6.11 Shipping Mitigation for Wildlife	7.3.1.4 Ground-Based Visual Monitoring 7.2.3 Pre-Clearing Surveys for Nests 7.2.4 Pit and Quarry Wall Nest Monitoring 7.2.6 Infrastructure Monitoring 7.2.7 Wildlife-Vehicle Interactions 7.2.8 On-Ice Monitoring at the MLA 7.2.9 Incidental Wildlife Monitoring 7.2.10 Noise Monitoring 7.3 Focal Species Monitoring, for: 7.3.1 Caribou 7.3.3 Muskox 7.3.4 Wolverine/Furbearers 7.3.5 Migratory Birds 7.3.6 Raptors 7.3.7 Seabirds and Seaducks 7.3.8 Ringed Seals
3. Disruption of Movement	6.4 Road Management for Wildlife	7.2.7 Wildlife-Vehicle Monitoring

(continued)

Table 2.1-1. WMMP Mitigation and Monitoring Components that Address Potential Effects on Wildlife (completed)

Potential Effect	Mitigation Chapters	Monitoring Chapters
4. Direct Mortality and Injury	6.4 Road Management for Wildlife 6.2 Wildlife Construction and Operations Management	7.2.3 Pre-Clearing Surveys for Nests 7.2.4 Pit and Quarry Wall Nest Monitoring 7.2.7 Wildlife-Vehicle Monitoring 7.2.8 On-Ice Monitoring at the MLA
5. Indirect Mortality	6.7 General Wildlife Management	7.2.2 Human Activity Monitoring
6. Attraction	6.3 Wildlife Attractant Management 6.8 Grizzly Bear and Wolverine Management	7.2.5 Waste Management Monitoring 7.2.6 Infrastructure Monitoring
7. Exposure to Contaminants	6.2 Wildlife Construction and Operations Management	7.2.11 Waterbird Monitoring in Ponds
8. Reduction in Reproductive Productivity	This cumulative effect is addressed indirectly in all management plans above.	7.3 Focal Species Monitoring, for: 7.3.1 Caribou 7.3.3 Muskox 7.3.4 Wolverine/Furbearers 7.3.5 Migratory Birds 7.3.6 Raptors 7.3.7 Seabirds and Seaducks 7.3.8 Ringed Seals

3. Planning and Implementation

Planning for the Wildlife Mitigation and Management Program started with the development of the FEIS, which identified existing (baseline) conditions, assessed potential effects of the Project, developed conceptual mitigation strategies and developed specific mitigation measures to execute these strategies. Conceptual strategies and plans will continue to be elaborated and executed throughout the construction, operation, and closure phases of mining. Environmental management and monitoring will be tracked, reviewed, and updated through ongoing maintenance of the plan. These updates will incorporate relevant feedback from the Kitikmeot Inuit Association (KIA) and the Nunavut Impact Review Board (NIRB).

The FEIS identified potential effects of the Project on wildlife VECs. Mitigation to reduce these effects and monitoring to evaluate the efficacy of mitigation and interactions between the Project and wildlife VECs is included in the Plan (Sections 6 and 7.2). Evidence from the facilities monitoring program (Section 7.2) will guide future mitigation activities (Section 6).

Regional VEC monitoring is described (Section 7.3) for those VEC species included in the assessment. Results of these studies will guide management activities (Section 6). The Plan will be updated periodically, as mitigation standards change, due to data recorded by the WMMP and/or due to data available from outside sources. In some cases, such as caribou, regional monitoring is planned through a collaborative process with government biologists and other industrial operations. To date, no regional monitoring plan is available for Sabina to contribute to.

4. Applicable Legislation and Guidelines

Mitigation measures to lessen Project effects on wildlife are derived, in part, from federal and territorial legislation. A summary of this legislation is listed in Table 4-1.

Table 4-1. Relevant Acts and Regulations for Wildlife and Wildlife Habitat

Act or Regulation	Implications for Management
Canada *Species at Risk Act (SARA)* (2002)	• Protects wildlife on federal lands as well as the critical habitat of those species listed on the "List of Wildlife Species at Risk," and protects all SARA-listed migratory birds. • Section 137 amends the *Canadian Environmental Assessment Act* (1992) to clarify, for greater certainty, that environmental assessments must always consider effects to listed wildlife species, their critical habitat, or the residences of individuals of that species. • Section 79(2) states "the person must identify the adverse effects of the project on the listed wildlife species and its critical habitat and, if the project is carried out, must ensure that measures are taken to avoid or lessen those effects and to monitor them. The measures must be taken in a way that is consistent with any applicable recovery strategy and action plans."
Canada *Migratory Birds Convention Act* (1994a)	• Prohibits the taking or killing of migratory birds, their nests, and eggs, and the deposition of harmful substances in areas frequented by migratory birds. • Species protected include waterbirds, cranes, rails and coots, shorebirds including gulls and terns, pigeons and doves, insectivorous songbirds (excluding blackbirds), seabirds, loons, grebes, herons, egrets, and bitterns. Raptors are not protected under the Act.
Nunavut *Scientists Act* (2011)	• Requires a licence to conduct environmental research (except for wildlife).
Nunavut *Wildlife Act* (2003)	• Provides guidelines on wildlife harvesting, habitat protection, respectful conduct toward wildlife, and designation and protection of species at risk and their habitat. • Pertinent Regulations are: Wildlife General Regulations (1999), and Wildlife Licenses and Permits Regulations (1999).
Nunavut *Land Claims Agreement Act* (1993)	• Provides guidelines for NIRB on the review of potential environmental and social effects of development projects.

5. Roles and Responsibilities

The General Manager of the Project is ultimately responsible for the success of the Plan and approves all relevant policies and documents, audits, action plans and the verification process.

The Environmental Superintendent, along with their direct reports, is responsible for the implementation of this Plan including:

- overall management of plan;
- monitoring;
- operational aspects;
- internal reporting;
- external reporting; and
- ensuring compliance and adaptive management.

6. Environmental Protection Measures

6.1 OVERVIEW

This section identifies mitigation measures that are proposed to eliminate or minimize effects of the Project for wildlife. Wildlife mitigation and management is divided into several sections, based on the activity or the wildlife species in question, as shown in Table 6.1-1. The Plan is designed to be effective and achievable, and will incorporate Aboriginal TK, landuser information, the latest scientific information, best management practices, and the results of monitoring activities specifically designed to evaluate the efficacy of the mitigation and management activities.

Table 6.1-1. Application of Wildlife Management Plans to Project Phases

Wildlife Management	Baseline/ Pre-Cons.	Mobilization and Construction	Operations	Temp. Closure	C&M	Reclam./ Closure	Post-Closure
Wildlife Construction and Operations Management	X	X	X	X	X	X	
Wildlife Attractant Management	X	X	X	X	X	X	
Road Management for Wildlife		X	X			X	
Aircraft Management for Wildlife	X	X	X	X	X	X	X
Noise Abatement for Wildlife		X	X				
Wildlife Policies	X	X	X	X	X	X	X
Grizzly Bear and Wolverine Management	X	X	X	X	X	X	X
Employee Wildlife Education	X	X	X	X	X	X	X
Mitigation and Management for Caribou	X	X	X	X	X	X	X
Shipping Mitigation for Wildlife		X	X			X	

Some mitigation and management activities will be conducted as part of the design and operations of the Project. Other mitigation and management activities will be triggered by various facility-specific monitoring plans (Section 7.2) and focal species monitoring plans (Section 7.3).

An overview of the triggers for actions is presented for each environmental protection measure (Sections 6.2 to 6.10), with an overview presented in Table 6.1-2.

Table 6.1-2. Environmental Protection Measures and the Monitoring Programs that Trigger Additional Mitigation

Environmental Protection Measures	Monitoring Programs that Trigger Mitigation
6.2 Wildlife Construction and Operations Management	7.2.1 Footprint Monitoring
	7.2.3 Pre-Clearing Surveys for Nests
	7.2.4 Pit and Quarry Wall Nest Monitoring
	7.2.6 Infrastructure Monitoring
	7.2.9 Incidental Wildlife Monitoring
	7.2.11 Waterbird Monitoring in Ponds

(continued)

Table 6.1-2. Environmental Protection Measures and the Monitoring Programs that Trigger Additional Mitigation (completed)

Environmental Protection Measures	Monitoring Programs that Trigger Mitigation
6.3 Wildlife Attractant Management	7.2.5 Waste Management Monitoring 7.2.9 Incidental Wildlife Monitoring
6.4 Road Management for Wildlife	7.2.2 Human Activity Monitoring 7.2.7 Wildlife-Vehicle Monitoring 7.2.9 Incidental Wildlife Monitoring 7.2.8 On-Ice Monitoring at the MLA 7.2.12 Pre-Construction Surveys for Bear Dens
6.5 Aircraft Management for Wildlife	7.2.9 Incidental Wildlife Monitoring
6.6 Noise Abatement for Wildlife	7.2.10 Noise Monitoring
6.7 Wildlife Policies	7.2.9 Incidental Wildlife Monitoring
6.8 Grizzly Bear and Wolverine Management	7.2.9 Incidental Wildlife Monitoring
6.9 Employee Wildlife Education	7.2.9 Incidental Wildlife Monitoring
6.10 Mitigation and Management for Caribou	7.2.9 Incidental Wildlife Monitoring 7.3.1.4 Ground-Based Visual Monitoring
6.10 Shipping Mitigation for Wildlife	7.3.7.5 Monitoring for Seabirds During Shipping in the Northwest Passage

To meet the objectives of the Plan, evaluation of the effectiveness of mitigation measures to minimize effects to wildlife VECs will be conducted and adaptively managed. Monitoring activities are described in Section 7.0. Mitigation and management activities are described in the Sections 6.2 to 6.10. The timing of implementation of these plans is presented in Table 6.1-1.

6.2 WILDLIFE CONSTRUCTION AND OPERATIONS MANAGEMENT

6.2.1 Project-specific Issues

This section focuses on design mitigation, which is made up of two elements:

1. managing the design of the Project so that it minimizes effects on wildlife; and
2. managing the Project construction schedule to minimize effects on wildlife.

This section describes the mitigation activities that will be undertaken to reduce the following potential effects on Wildlife VECs:

1. Habitat loss;
2. Disturbance of wildlife;
3. Disruption of movement; and
4. Direct mortality.

6.2.2 Goals and Objectives

The goal of construction and operations management is to minimize wildlife disturbance and mortality associated with the Project. This section focuses on the construction of haul roads during construction

and operation phases, and construction of MLA facilities, camps, and Project infrastructure (e.g., pits, quarries, and Tailings Storage Facility (TSF)). Objectives of the construction and operations management strategies are to:

- minimize effects of habitat loss by designing the Project footprint to be as small as possible;
- minimize effects of habitat loss by designing project infrastructure outside of sensitive areas for wildlife wherever possible;
- minimize disturbance and mortality of wildlife by conducting grubbing, vegetation clearing, and constructing Project infrastructure outside of sensitive periods for wildlife wherever possible; and
- minimize effects of disruption of movement through design and/or management of project infrastructure to reduce the production of linear barriers wherever possible.

6.2.3 Mitigation and Management

6.2.3.1 Footprint Design – Minimizing the Footprint

One of the mitigations discussed in the FEIS for wildlife is limiting the physical size of the footprint so as to minimize the area of wildlife habitat lost.

Triggers for Management

The triggers for minimizing the footprint stem from commitments in the FEIS. No secondary trigger is required for this management action.

Management Actions

The Project will be designed to have as small a footprint as possible within the Project Development Areas (PDAs). Where additions to the Project footprint are made they will be made as close to existing infrastructure as possible to keep the Project as compact as possible. This will concentrate sources of noise and disturbance into a small area, in lieu of having multiple sources of disturbance spread out on the land.

6.2.3.2 Infrastructure Location - Avoidance of Sensitive Areas

The FEIS describes that the Project will avoid sensitive features for wildlife, wherever possible. Where these features cannot be avoided entirely, potential effects can be minimized to the sensitive feature by avoiding construction activities during the period when wildlife are using the feature, as described in Section 6.2.3.3. If Project activities must occur at a sensitive feature during a sensitive period, then pre-construction surveys will be conducted and appropriate buffers will be set up surrounding any sensitive wildlife features (Section 6.2.3.3).

Triggers for Management

Baseline studies identified sensitive wildlife areas, including some eskers (used by caribou, bears and wolves), river crossings (used by caribou), and staging ponds (used by large groups of waterfowl). Information from baseline studies will be used to identify areas for avoidance by the designers of the project footprint.

Management Actions

Construction of Project infrastructure will avoid, where possible, wildlife sensitive areas such as critical habitat for caribou, important cliff habitat for raptor nesting, eskers and denning habitat, and important waterbird staging areas during wildlife sensitive periods. Mitigation measures include:

- identifying locations of dens and raptor nests within 2 km of Project footprint prior to construction;
- identifying eskers used for migration by caribou within 2 km of Project footprint prior to construction;
- road routing to avoid active carnivore dens or raptor nests, where possible;
- avoiding use of eskers containing known carnivore dens as source of quarry material;
- limiting planned construction activities within 1 km of active wolf, fox, and wolverine dens, and 1 km of raptor nests during the active season, wherever possible. Note that this is for planned activities based on results of existing baseline surveys for wildlife. If unforeseen dens or raptor nests are observed during pre-construction surveys, appropriate mitigation and monitoring will occur, which may include a buffer distance to limit disturbance; and
- restricting vehicles to road and quarry footprints during construction and operations to avoid unnecessary disturbance to tundra.

If it is not possible to avoid wildlife sensitive areas or the locations of sensitive areas are not known (e.g., bird nests on the tundra), mitigation measures to minimize disturbance of wildlife sensitive areas include:

- pre-clearing surveys for wildlife to ensure that wildlife are not destroyed or disturbed (e.g., bird nests, seal lairs, and bear dens) (Section 7.2); and
- if a sensitive feature will be removed (den, nest, esker, etc.) then Sabina will liaise with the GN DOE prior to removing the feature.

6.2.3.3 Construction Periods - Avoidance of Sensitive Periods

The FEIS describes that the Project will avoid, wherever possible, sensitive periods for wildlife in sensitive areas when clearing land during the construction of the Project. Sensitive features are identified as the dens or nests of wildlife species that cannot be physically moved. Hence, sensitive features can either be avoided physically (Section 6.2.3.2) or temporally (this Section).

Due to the concern surrounding the Bathurst caribou, the sensitive period of calving and post-calving is included in this section.

Triggers for Management

Sensitive periods have been identified from the academic literature and following guidelines from the GN DOE and CWS. These sensitive periods will be used to trigger mitigation.

Management Actions

Mitigation measures to minimize disturbance of wildlife during infrastructure and road construction and operation include:

- scheduling of construction and operations activities, where possible, to avoid disturbance of wildlife during sensitive periods (Table 6.2-1); and

- conducting pre-construction surveys if it is not possible to avoid wildlife sensitive periods, (Section 7.2).

Table 6.2-1. Wildlife Sensitive Periods Applicable to the Project

VEC	Activity	Sensitive Period
Caribou	Calving Post calving	June 5 to June 15[3] June 16 to July 20[3]
Grizzly Bear dens	Denning Cub rearing	October 15 to May 7 May 7 to October 15
Wolverine dens	Denning Early pup rearing	February 21 to May 7 May 7 to July 1
Wolf dens	Natal Denning Early pup rearing	May 1 to September 15 September 15 to October 31
Raptor nests	Nesting	April 15 to August 15
Migratory bird nests	Nesting	May 15 to August 15
Ringed seal lairs	Pupping Moulting	February 15 to April 15 April 15 to June 30

[1]: *Bathurst and Beverly herds.*
[2]: *Dolphin and Union herd.*
[3]: *Bathurst herd.*

The following actions will be taken if wildlife are detected during construction:

- If a wildlife feature that is legislatively protected (raptor nest, carnivore den, or SARA-listed bird species) is found within the slated Project footprint, then a buffer will be established and the feature will be avoided until such time as the wildlife has completed the use of the feature. Following wildlife leaving the site, activities within the buffer will resume and the feature may be removed from within the stated Project footprint.
- If a wildlife feature that is legislatively protected (raptor nest or carnivore den) is found within a buffer of 1.0 km of construction activities, then the feature will be monitored for the duration of the season and the breeding success of the wildlife VEC will be reported in the following WEMP report.
- If a bird nest (including assumed nests documented from nesting behaviour) is found during pre-clearing surveys within the slated Project footprint, then a species-specific buffer will be instituted around the nest site and the nest will be monitored for the duration of the season and the breeding success of the species occupying the nest will be reported in the following WEMP report (see Section 7.2.3 for further details).
- A species-specific buffer will be employed around all probable or actual nest sites that are detected during pre-clearing surveys as outlined in Table 6.2-2, as per recommendations from Environment Canada. The minimum buffer distance as indicated in Table 6.2-2 will be utilized wherever practicable assuming Project operability; the exact buffer distance employed for any nest sites recorded during pre-clearing surveys will be reported in the next Wildlife Mitigation and Monitoring Program Report or directly to appropriate regulators on a case-by-case basis to advise on the management response, if necessary.
- Measures to address the situation where birds nest, or small/meso mammals den, on Project infrastructure are addressed in Section 6.2.3.6.

- Measures to minimize disturbance to caribou are discussed in Section 6.10, mitigation and management for caribou.

Table 6.2-2. Buffer Distances for Nest Sites Found during Pre-clearing Surveys

VEC	Species Group	Suggested Minimum Buffer Distance for Non-intrusive Construction Activities (e.g., human presence) (m)	Suggested Minimum Buffer Distance for Intrusive Construction Activities (e.g., heavy machinery) (m)
Upland Bird	Songbirds	30	100
	Shorebirds	30	100
Waterbird	Gulls and Terns	30	300
	Ducks	30	150
	Geese	30	500
	Loons, Tundra swan, and Sandhill crane	30	750

6.2.3.4 Infrastructure Design – Excluding Wildlife

One of the mitigation measures discussed in the FEIS for wildlife is designing Project infrastructure, buildings, and other facilities, to minimize the chance that wildlife, such as grizzly bears, wolverine, foxes and birds, can access buildings.

Triggers for Management

The triggers for infrastructure design stem from commitments in the FEIS.

Infrastructure monitoring (Section 7.2.6) will be conducted during the construction, operations, care and maintenance, and closure phases of the Project. Evidence that wildlife may be able to, or have, accessed buildings or facilities will trigger additional mitigation.

Management Actions

Infrastructure components will be designed, where possible, to exclude wildlife and thereby reduce risks to both wildlife and Project personnel, and include the following measures:

- wildlife attractants will be managed (Section 6.3, wildlife attractant management) to reduce the attractiveness of the site to bears and wolverines (e.g., provide bear and wolverine-proof waste storage and management facilities, an incinerator facility with adequate storage and exclusion capabilities);
- design buildings to exclude wildlife (e.g., construct vents to prevent small mammals and birds from entering and build skirting around the bottom of buildings to exclude wolverine);
- build berms or other markers at high walls of quarries to deflect wildlife movement and prevent falls or injury;
- if wildlife (i.e., grizzly bears and wolverine) are found to use elements of the Project infrastructure (e.g., the waste management facility), then a review of waste management activities will be triggered;
- if grizzly bears and wolverine persist in using infrastructure components despite updated waste management and site audits, then other exclusion infrastructure may be used (e.g., fencing);

- if wildlife are able to access buildings through damaged skirting, then skirting will be repaired immediately; and
- if wildlife are able to access buildings through vents, windows, or by other means, then measures will be taken to exclude wildlife.

6.2.3.5 Infrastructure Design – Road Crossing Structures

The FEIS describes that the Project will reduce any potential disruption of movement to caribou (and other wildlife) by building road crossing structures on all permanent Project roads. Note that all-season roads are planned only for inside the Project PDAs. Supply for the project will be via winter ice road to the Marine Laydown Area at Bathurst Inlet.

Triggers for Management

The commitment to construct road crossing structures was made in the FEIS. The locations will be determined from 1) input from Inuit elders and landusers, and 2) surveys of the road area to identify possible caribou movement paths, including on-site wildlife monitoring with cameras as described in Section 7.3.1.4, local-scale and facilities monitoring for caribou.

Management Actions

Road crossing structures will be built on permanent on-site roads at identified caribou crossing locations. Road crossing structures may include ramps, stretches of the road shoulder made of smaller rock sizes, or other methods identified through the management or scientific literature, or based on best practice. Construction of these structures will be reported in the WEMP report.

6.2.3.6 Response to Wildlife Nesting or Denning on or Near the Operating Project Site

The FEIS evaluated the potential of the Project to disturb wildlife as the Project was constructed (see Section 6.2.3.2, infrastructure location; and Section 6.2.3.3, construction periods).

The FEIS also evaluated the potential disturbance to wildlife species that may choose to nest, den or occupy the area on or adjacent to the Project site after the Project has been constructed. Some species are robust to human presence and will become habituated readily. Other species may prefer habitats near human habitation to avoid predation or due to some feature they prefer (e.g., a building as a nesting platform). The purpose of this section is to describe the actions should wildlife be observed nesting or denning near the already-operating Project facilities.

The assumption is that these animals have chosen to den or nest on or near active infrastructure and therefore are acclimated to the Project activities. In general, the response will be to prevent direct disturbance to the den or nest and monitor it until the adult and offspring have left the den.

Triggers for Management

Surveys will be conducted for a variety of VEC species during operations. These surveys, and incidental observations, may report the presence of wildlife near the Project footprint. Presence of a den or nest on or near the Project site will trigger management.

Management Actions

If wildlife are observed near or on the Project footprint, actions will be taken that include the following measures:

- if a special habitat feature (active carnivore den or raptor nest) is located within 1.5 km or within the Project footprint during active operations, the feature will be monitored until the cubs or chicks leave the den or nest; and
- nest or den success will be reported in the WEMP report.

6.3 WILDLIFE ATTRACTANT MANAGEMENT

6.3.1 Project-specific Issues

Features or substances that interest or may be resources to wildlife are considered to be wildlife attractants. Within the Project area, the following were evaluated as wildlife attractants in the FEIS: standing water, waste, waste storage facilities, buildings, lights, and open pits. The following potential effects and concerns exist for wildlife due to Project-specific attractants:

- potential for waterfowl to be attracted to Project ponds that may contain water which does not meet wildlife standards;
- potential for wildlife to be attracted to Project sites by the presence of waste and waste management facilities;
- artificial light on infrastructure as an attractant to migratory birds, which may result in bird disorientation and increase risk of direct mortality (i.e., collisions and disruption of migration); and
- potential for raptors to be attracted to pits and quarry walls as nesting opportunities.

6.3.2 Goals and Objectives

The goal of the wildlife attractant management is to minimize the potential for human-wildlife interactions through control of wastes and potential wildlife attractants in the Project area. The objectives are to:

- ensure Project infrastructure and activities minimize potential attractants that could affect wildlife;
- reduce and manage wastes to minimize wildlife attraction to Project facilities;
- minimize standing water and restrict access to contaminated water through standard methods such as fencing or behavioural modifiers; and
- exclude raptors from open pits.

6.3.3 Mitigation and Management

Mitigation measures to minimize and eliminate Project-specific effects on wildlife due to attractants are described in the following sections and include:

- management of Project ponds to exclude migratory birds;
- waste storage and incineration to reduce the attractiveness of the camps;
- management of on-site lighting; and
- management of raptor in pits and quarries.

In addition to the above, mitigation and management directives outlined in the employee wildlife education (Section 6.9) will be applied during all Project activities (e.g., no littering policy, no feeding wildlife policy).

All mitigation and management directives related to attractant management will apply to all employees and other persons associated with the Project. Education and training programs (Section 6.9) to ensure understanding and compliance with wildlife attractant Management provisions will be undertaken. Management will follow, where possible, guidance provided by CWS (2007), *Preventing Wildlife Attraction to Northern Industrial Sites.*

6.3.3.1 Waste Storage and Incineration

The FEIS evaluated the potential for wildlife to be attracted to Project camps and facilities due to scents or food rewards from wastes.

Triggers for Management

Management of wastes was a commitment in the FEIS. These management actions will be enacted and maintained for the life of the Project.

Monitoring will trigger additional waste management and/or an evaluation of the standing waste management programme, as needed. Monitoring triggers include:

- Waste Management Monitoring (Section 7.2.5); and
- Incidental Wildlife Monitoring (Section 7.2.9).

Management Actions

Various waste products that will be produced during the construction and operation of the Project include kitchen, petroleum, and sewage wastes. Wildlife species, particularly grizzly bear and wolverine, may be attracted to the site if these waste products are not properly managed. Mitigation and monitoring to minimize attractants will include the following measures:

- incinerate all kitchen wastes within a timely manner;
- store recyclable wastes and chemicals in wildlife-proof facilities;
- store all attractants and wastes (garbage, food waste) at temporary (construction) and permanent site infrastructure in bear-proof storage containers. Bear-proof containers must be tightly secured at all times. Standard procedures for waste containers to be considered effective at preventing bears from accessing wastes will be implemented;
- conduct regular road and camp cleanups to ensure that no hazardous substances, wires, or loose materials are present to endanger wildlife and ensure proper storage and disposal of hazardous wastes;
- remove waste from collection sites regularly, incinerate in an approved incinerator or store in wildlife-proof areas and wildlife-proof buildings until incineration;
- dispose of all waste which should not be incinerated at an approved disposal site as soon as possible;
- use landfills only for disposal of non-wildlife attracting waste; and
- prevent wildlife from entering landfills, incinerators and sewage treatment facilities, where possible, using appropriate wildlife exclusion techniques.

6.3.3.2 Project Pond Management

The Project will include the construction of several ponds on site for the collection of runoff water and as a cap on the TSF. In most cases, the FEIS predicts that these ponds will contain water that meets wildlife guidelines. The FEIS evaluated the potential for waterfowl to be attracted to Project ponds during migration or summer and be exposed to contaminants should the water in those ponds not meet wildlife guidelines.

Triggers for Management

The Project will reduce the chance of effects on waterfowl in Project ponds through three steps:

- monitor the quality of water in on-site Project ponds, as outlined in the Site Water Monitoring and Management Plan (Chapter 7 of Volume 10 of the FEIS);
- if the water in Project ponds does not meet wildlife guidelines for waterfowl, then monitor these ponds for waterbirds during staging and breeding periods (see Section 7.2.11 for further details); and
- if ponds contain water that does not meet wildlife guidelines and waterfowl are actively using these ponds, then waterfowl exclusion measures will be employed.

Management Actions

Several methods may be employed to exclude waterfowl from Project ponds. The decision of which method to use will be based on professional judgement and evaluation of efficacy of existing or new technology for waterbird deterrence. For example, propane cannons have been shown to reduce the number of waterbirds landing on tailing ponds in the oil sands; however, habituation to these types of noise deterrents has also be documented (Ronconi and St. Clair 2006). In addition, studies have shown that responses to a single deterrent system (e.g., acoustic, visual) differ among groups of waterbirds (e.g., Boag and Lewin 1980; Golder 2000; Ronconi and St. Clair 2006). Therefore, deterrence methods will be chosen to maximize the likelihood of deterring all species of waterbirds that may use the TSF and other areas of Project storage water.

The choice of exclusion methods will be an evolving process. Guidance will be taken from: Cassady St. Clair, 2014. *Final Report of the Research on Avian Protection Project* (2010-2014). Prepared for Alberta Justice, Edmonton, Canada.

6.3.3.3 Management of On-site Lighting

The FEIS evaluated the potential for wildlife to be attracted to Project camps and facilities due to lighting. Lights are an attractant to some species of wildlife, especially birds. Lighting as an attractant to migrating birds is primarily a problem at night, and so there is a reduced chance of Project-related effects at high latitudes because the majority of birds are only present when there is very little darkness. Nevertheless, lighting on infrastructure will be designed to minimize potential impact to wildlife while ensuring safe operating conditions.

Triggers for Management

Management of lighting is described in the FEIS. These management actions will be enacted and maintained for the life of the Project.

Monitoring may trigger additional lighting management and/or an evaluation of the standing lighting management programme, as needed. Monitoring triggers include:

- Incidental Wildlife Monitoring (Section 7.2.9) that finds wildlife being attracted to Project lighting.

Management Actions

Mitigation measures to reduce sensory disturbance to wildlife include:

- the use of directed lighting rather than broad lighting whenever possible;
- directing all lighting into the facility and toward the ground to limit stray light as a visual disturbance; and
- avoiding the design of tall towers requiring the use of solid and pulsating red lights, which seem to be more attractive to birds at night during inclement weather conditions than are white strobe lights (Erickson et al. 2002).

6.3.3.4 Management of Raptors in Pits

The FEIS evaluated the potential for raptors to be attracted to Project mining pits in order to nest on the pit walls. Raptors may then suffer mortality or disturbance due to blasting.

Triggers for Management

Monitoring for raptors in pits is described in Section 7.2.4, Pit and Quarry Wall Nest Monitoring. The observation of raptors frequenting the pits or attempting to build nests will trigger management actions.

Management Actions

Management measures to exclude raptors from pits include:

- if a raptor nest is observed being constructed in a pit, but the raptor has not yet laid eggs, then the nest will be removed;
- if locations are found that are frequently used as nests, then appropriate mitigation will be used to dissuade raptors from using this area (e.g., netting, bird spikes, etc.); and
- if raptors persist in attempting to nest in the pits despite the mitigation listed above, then raptors will be excluded from the pits using auditory or visual hazing methods (e.g., bear bangers, bright lights, playback of raptor calls, flashers, models of raptors, etc.). The choice of exclusion methods will be constantly evolving, based on those methods that are the most effective.

6.4 ROAD MANAGEMENT FOR WILDLIFE

6.4.1 Project-specific Issues

The FEIS identified three potential effects of roads on wildlife:

- disturbance to wildlife;
- disruption of movement; and
- direct mortality due to vehicle strikes.

6.4.2 Goals and Objectives

The goal for road management is to minimize or reduce potential effects of all-season on-site roads and winter roads on wildlife VECs. Road management will include mitigation for road-related effects during the construction and operation phases. Objectives include the following:

- avoid direct and indirect wildlife mortality due to Project activities;
- maintain the permeability of the landscape by enabling wildlife free passage across roads;
- prevent unauthorized use of roads;
- limit habitat loss or degradation to the Project footprint through dust and vehicle controls; and
- reduce the chance that construction of ice-roads removes ringed seal lairs on sea ice, and grizzly bear dens on portages.

6.4.3 Mitigation and Management

6.4.3.1 Traffic Management

The FEIS evaluated the potential for wildlife to suffer direct mortality due to collisions with Project vehicles. This section describes the management to reduce this potential effect.

Note: see also Section 6.10, Mitigation and Management for Caribou.

Triggers for Management

Traffic management will be conducted on all Project roads. Additional mitigation may be triggered by monitoring programs, including:

- Wildlife-Vehicle Interactions (Section 7.2.7); and
- Incidental Wildlife Monitoring (Section 7.2.9).

Management Actions

Measures to reduce possible mortality to wildlife due to roads include:

- designing and operating roads and infrastructure so as to ensure safe operation (e.g., good sight lines) and eliminate any infrastructure that can trap or injure wildlife;
- truck speed will be limited to 60 km/hour, and trucks will slow to 40 km/hour when wildlife are observed within 250 m of the road or in wildlife sensitive areas;
- traffic will be managed, dispatched, and monitored;
- roads will be closed to the public and to all foot traffic. Road use will be restricted only to persons required for Project construction, operations, and maintenance;
- prohibit private vehicles (including snowmobiles and all-terrain vehicles) on the road;
- wildlife will be given the right-of-way on all roads at all times;
- trucks will stop when groups of wildlife are crossing the road;
- if an individual or small group of wildlife (caribou, muskox, grizzly, wolf, wolverine) are standing on the road, then the driver will stop for up to 20 minutes, then proceed slowly (<15 km/hour) to pass the wildlife;

- groups of caribou on the road may trigger road closures – see Section 6.10, Mitigation and Management for Caribou;
- a reporting system will be in place for wildlife encounters (observations or interactions) along all roads; and
- development of appropriate mitigation strategies (e.g., signage) for areas with higher frequency of encounters with wildlife.

6.4.3.2 Managing Road-related Wildlife Mortalities

The FEIS evaluated the potential for wildlife to suffer direct mortality due to collisions with Project vehicles. This section describes the management should wildlife be struck on the road.

Triggers for Management

Reports of wildlife mortality will trigger management, as reported by one of two monitoring programs, including:

- Wildlife-Vehicle Interactions (Section 7.2.7); and
- Incidental Wildlife Monitoring (Section 7.2.9).

Management Actions

Mitigation measures for managing road-related wildlife mortalities include:

- a reporting system to record all road-killed or injured wildlife, as described in Section 7.2.7, Wildlife-Vehicle Interactions;
- information distribution on wildlife mortalities to drivers through morning safety meetings, with additional training and awareness campaigns should wildlife mortalities occur;
- if a location is found where more than one wildlife mortality has occurred, then this location will be relayed to drivers and site-specific mitigation may be conducted, such as additional signage to alert drivers of speed limits, identified wildlife movement corridors, and wildlife sensitive areas (e.g., nearby active carnivore den); and
- removal of road-kill from the road and disposal using approved methods (i.e., incineration or transport away from the Project site) as quickly as possible to avoid attracting carrion feeders to the road side.

6.4.3.3 Dust Reduction and Control

The FEIS evaluated the potential for dust to alter wildlife habitat in areas adjacent to the road. This section describes the management to reduce and control dust from Project roads.

Triggers for Management

Dust control will be conducted, as needed, on all gravel-surfaced all season roads whenever the Project is active.

Management Actions

Mitigation measures to manage dust production from on-site road traffic include:

- application of dust suppressants; and

- choice of dust suppressants that are non-toxic to wildlife.

6.4.3.4 Avoidance of Seal Lairs

The winter road to the Marine Laydown Area will be built on the sea ice of southern Bathurst Inlet. The FEIS evaluated the potential for seals to abandon lairs under/in the sea ice or be injured/killed if construction activities removed these lairs. The ice road and the airstrip at the Marine Laydown Area are planned to be built during December, while seals build lairs in the sea ice during late February. Therefore construction of the road should not affect seal lairs. However, should additional construction of ice roads be required in the seal pupping period of February 15 to April 15, then pre-construction monitoring and possibly mitigation will be triggered to reduce the likelihood of this potential effect.

Triggers for Management

If new construction of ice roads or airstrips is planned on the sea ice of Bathurst Inlet during the seal pupping period of February 15 to April 15, then monitoring for seal lairs will be triggered: Section 7.2.8, on-ice monitoring at the MLA. If a seal lair is observed in the planned construction area then mitigation would be triggered.

Management Actions

Mitigation measures to reduce the chance of disturbance or mortality due to on-ice activities near a seal lair include:

- marking the location of the seal lair with a GPS;
- communicating the location of lairs to construction personnel; and
- avoiding the seal lair by at least 50 m.

6.4.3.5 Avoidance of Grizzly Bear Dens

The winter road to the Marine Laydown Area will be built across lakes and portages and on the sea ice of southern Bathurst Inlet. The FEIS evaluated the potential for construction of the road to remove or disturb grizzly bear dens in the tundra and concluded that this potential effect was very unlikely because the areas preferred for denning (e.g., eskers) are not preferred for winter roads. During the DEIS review, the GNWT requested that pre-construction surveys be conducted for grizzly bear dens. This section provides mitigation to reduce the likelihood of this potential effect.

Triggers for Management

Prior to construction of the winter road, the road portages between lakes will be planned to avoid areas with a higher chance of supporting grizzly bear denning (e.g., eskers). If the planned portages occur in areas preferred by grizzly bears as den sites, then pre-construction surveys will be conducted. If a likely grizzly bear den is discovered, then management actions will be triggered.

Management Actions

Mitigation measures to reduce the chance of disturbance or mortality of bears due to construction of the ice road portages between lakes include:

- marking the location of the likely bear den with a GPS;
- communicating the location of likely den to construction personnel; and
- avoiding the likely bear den by at least 250 m.

6.5 AIRCRAFT MANAGEMENT FOR WILDLIFE

6.5.1 Project-specific Issues

The FEIS identified one project-specific issue for aircraft:

- disturbance to wildlife.

6.5.2 Goals and Objectives

The goals and objectives of the aircraft management for wildlife are to reduce sources of disturbance to wildlife from aircraft overflights.

6.5.3 Mitigation and Management

The FEIS evaluated the potential for aircraft to disturb wildlife. This section describes the management actions applicable to aircraft to reduce this potential effect.

Triggers for Management

Management to reduce the effects of disturbance on wildlife will be in effect whenever aircraft are on-site. Additional mitigation can be triggered by incidental observations of wildlife (Section 7.2.9) by pilots. Management specific to caribou is described in Section 6.10, Mitigation and Management for Caribou.

Management Actions

Prior to construction, important habitat areas for wildlife will be identified and provided as a map to pilots. This map will include:

- identified areas with concentrations of wildlife during certain seasons, such as lakes used for staging by waterbirds and raptor nests;
- water crossing locations used by caribou;
- other important habitat locations used by caribou; and
- dens that are repeatedly used between seasons, such as wolf, fox, and wolverine dens.

Pilots flying helicopters and fixed wing aircraft used for Project activities will adhere to wildlife-recommended guidelines including:

- avoidance of groups of caribou where possible;
- adhering to the required minimum altitude limit of 300 m for aircraft flight (with the exception of take-off and landing and where low elevation surveys are require);
- operating helicopters above 610 m when caribou are present, as per the caribou protection measure guidelines. Whenever possible, landing and takeoffs are only conducted when herds of caribou are not present in the immediate area;
- implementing pilot education on the potential effects of aircraft on caribou and the importance of maintaining proper distances from animals;
- avoiding low-level aircraft flight paths over high densities of wildlife or over sites expected to support high densities of wildlife;

- reducing disturbance to colony nesting birds and important staging areas during sensitive periods by maintaining an aircraft flight altitude of at least 650 m during horizontal (point to point) flights;
- reducing disturbance to known colonies of nesting, feeding, or moulting birds or known staging areas by maintaining a distance of 3,000 m from colonies of birds;
- monitoring all airstrips to ensure the landing strip is free of wildlife prior to landing and take-off; and
- avoid wildlife harassment and disturbance at all times.

6.6 NOISE ABATEMENT FOR WILDLIFE

Noise abatement for wildlife focuses on environmental airborne noise levels that could affect wildlife VECs.

6.6.1 Project-specific Issues

The FEIS identified two potential effects of noise on wildlife:

- disturbance to wildlife resulting in functional habitat loss or behavioural changes; and
- reduction in reproductive productivity as a result of the cumulative effects of the Project including noise.

6.6.2 Goals and Objectives

The goal of noise abatement is to minimize or reduce potential effects of noise disturbance to wildlife VECs. This will include mitigation for the effects of noise during the construction and operations phases of the Project. Objectives include the following:

- limit functional habitat loss and habitat degradation for wildlife VECs due to Project noise; and
- reduce disturbance to wildlife due to noise generation as a result of Project activities.

6.6.3 Mitigation and Management

The FEIS evaluated the potential for wildlife to be disturbed due to Project noise. This section describes noise management activities to be conducted by the Project.

Triggers for Management

Noise management for wildlife will be conducted during the life of the Project. Additional mitigation may be triggered by monitoring programs, including:

- Noise Monitoring (Section 7.2.10);
- Wildlife-Vehicle Interactions (Section 7.2.7); and
- Incidental Wildlife Monitoring (Section 7.2.9).

Management Actions

Mitigation measures to minimize disturbance to wildlife as a result of Project noise include those listed in Section 6.2, Wildlife Construction and Operations Management; Section 6.4, Road Management for Wildlife; Section 6.5, Aircraft Management for Wildlife, and Section 6.10, Mitigation and Management for Caribou, in addition to the following:

- ensuring equipment is fitted with appropriate mufflers and silencers;
- ensuring equipment is well maintained;
- identifying enclosures, berms, acoustic screening and shrouding where stationary sources require control;
- Strategic placement of waste rock piles to block plant sources of noise;
- housing stationary sources of noise in buildings;
- other possible general noise abatement measures that can be implemented on-site to minimize static noise due to generators, vehicles, and other sources; and
- management of aircraft to reduce disturbance to wildlife is described in Section 6.5, Aircraft Management for Wildlife.

6.7 WILDLIFE POLICIES

6.7.1 Project-specific Issues

The FEIS identified several potential effects on wildlife related to wildlife policies, including:

- Attraction and problem wildlife, particularly bears and wolverines, and;
- Indirect mortality to wildlife from hunting.

6.7.2 Goals and Objectives

The goals and objectives of the wildlife policies are to:

- Minimize any attractants to site through animal feeding, and protect worker safety from wildlife incidents as a consequence;
- Minimize any litter or waste on the tundra that may attract wildlife, or cause a wildlife incident, and;
- Prohibit hunting on the Project site.

6.7.3 Mitigation and Management

Triggers for Management

These wildlife policies will be in effect for the duration of the Project. Additional mitigation may be triggered by monitoring programs, including:

- Human Activity Monitoring (Section 7.2.2), and;
- Incidental Wildlife Monitoring (Section 7.2.9).

6.7.3.1 No Feeding of Wildlife Policy

Wildlife may be attracted to Project areas by natural curiosity or because of the resources that Project areas provide. Management strategies to minimize human-wildlife interactions will include:

- A policy of no feeding and no intentional attraction of wildlife.

6.7.3.2 No Littering Policy

Management strategies to minimize littering will include:

- A policy of no littering.

6.7.3.3 No Hunting Policy

In addition to a policy prohibiting hunting and trapping by all Project and contractor employees throughout the life of the Project, management strategies to restrict hunting will include:

- Prohibition of hunting from roads, and, to ensure human safety, prohibition of hunting within a buffer area along roads;
- Reporting procedures for any poaching or evidence of illegal hunting and trapping to government authorities, and;
- Prohibition of all Project and contractor employees from carrying personal firearms except in the case of a certified wildlife monitor who is carrying a firearm for the safety of workers in the field when a problem bear has been identified.

6.8 GRIZZLY BEAR AND WOLVERINE MANAGEMENT

6.8.1 Project-specific Issues

Although mitigation measures can greatly reduce the likelihood of negative wildlife interactions, animals may still be attracted to a Project site. Grizzly bear and wolverine management addresses potential effects of the Project including:

- Features acting as attractants, and;
- Mortality (direct and indirect).

This section provides guidance on the types of responses available to manage grizzly bear and wolverine activity near the Project, including potential responses should a grizzly bear or wolverine become habituated or otherwise pose a risk to itself, mine personnel, or Project infrastructure.

6.8.2 Goals and Objectives

The goal of monitoring and managing grizzly bear and wolverine activity at the Project site is to minimize grizzly bear-human interactions, ensure the safety of Project employees, and prevent avoidable wildlife mortalities. The objectives of the grizzly bear and wolverine management section include:

- Provide measures to reduce the chance of adverse human-wildlife interactions;
- Provide a response plan for dealing with grizzly bear and wolverine when they are observed;
- Prevent habituation of wildlife to Project facilities and people;
- Provide a response plan for dealing with adverse human-wildlife interactions, and;
- Avoid destruction of grizzly bears and wolverine.

6.8.3 Mitigation and Management

6.8.3.1 General Mitigation and Management to Reduce Human-Wildlife Interactions

The FEIS evaluated the potential for wildlife to interact with the Project. Personnel can be put at risk by wildlife. In addition, both grizzly bears and wolverine can become habituated to camps, become problem animals and suffer from management activities to remove them. Several management activities are available that have been shown to reduce the chance of poor wildlife-human interactions at industrial sites. These are described further below.

Triggers for Management

Management of facilities and site operations to avoid the potential for problem wildlife will occur throughout the life of the Project. Additional mitigation measures may be triggered by observations from various monitoring programs, including:

- Waste Management Monitoring (Section 7.2.5);
- Infrastructure Monitoring (Section 7.2.6), and;
- Incidental Wildlife Monitoring (Section 7.2.9).

Management Actions

General mitigation and management measures to reduce the likelihood of poor wildlife-Project interactions include:

Facilities Management:

- Facilities design and maintenance to exclude grizzly bears and wolverines, as described in Section 6.2, Wildlife Construction and Operations Management, and;
- Management of attractants, particularly wastes, as described in Section 6.3, Wildlife Attractant Management.

Policies and Education for Project Personnel:

- Adhere to no littering policies (Section 6.7);
- Disseminate protocol for Human-Wildlife Interactions to all employees and contractors as part of their orientation;
- Lead management responses undertaken by identified supervisors, wildlife biologists and conservation officers;
- All field and outdoors staff will receive training on responding to grizzly bear and wolverine encounters, including identification grizzly bear behaviour and the use of deterrents;
- Identify and communicate to all staff the protocol for responding to observations of grizzly bear and wolverine (Section 6.8.3.2);
- Identify and communicate to all staff an emergency communications protocol for radio traffic to report grizzly bears and wolverine;
- Do not disturb wildlife that avoid humans and show normal feeding behaviour;
- Inform employees about and enforce disciplinary consequences of disregarding measures taken to manage problem wildlife (e.g., area closures);

- Identify appropriate personnel (i.e., environmental monitor, wildlife biologist) to monitor and evaluate human-wildlife conflicts using the protocol for Human-Wildlife Interactions to determine whether animal should be considered a problem animal and to identify an appropriate course of action, and;
- Avoid destruction of wildlife unless no other recourse is possible. Grizzly bears or other wild animals that cause injury to humans as a result of natural defensive or protective behaviour (e.g., protecting its young during a startling encounter) should not be destroyed or translocated.

6.8.3.2 Protocol for Responding to Observations of Grizzly Bear and Wolverine

This section provides guidance to Project personnel for responding to possible grizzly bear, and to a lesser extent wolverine by Project personnel should they be observed on or near site.

The philosophy of responding to grizzly bear and wolverine can be summarized as:

1. Reduce risk to Project personnel through training and immediate response to possible grizzly bear/wolverine interactions;
2. Dissuade grizzly bears and wolverines from the Project site through management activities (waste management, wildlife attractants, maintaining skirting and fencing, etc.) to make the site less appealing to wildlife; and
3. Only if #2 above has been implemented and grizzly bear or wolverine persistently approach the site would any action towards the animal be taken (discussed in Section 6.8.3.3).

<u>Triggers for Management</u>

Incidental observations of grizzly bears, and wolverine (Incidental Wildlife Monitoring, Section 7.2.9) will trigger this protocol.

<u>Management Actions</u>

- All incidental observations of grizzly bears and wolverine (Section 7.2.9) from pilots, drivers, on-site and field personnel will be immediately reported to the Environmental Department.
- The Environmental Department will keep a log of all grizzly bear and wolverine sightings (see Section 7.2.9, Incidental Wildlife Monitoring) and will communicate these sightings to field and on-site crews immediately if there is a safety concern or daily as part of morning toolbox safety meetings. Information on bear and wolverine observations will also be posted and made available to all staff.
- All field crews will scan the immediate area, either by helicopter or from the ground, prior to leaving the safety of helicopters or vehicles to conduct work.
- If field crews (i.e., those working without a vehicle or helicopter) observe a grizzly bear, they will contact the Environmental Department and immediately arrange the removal of the field crew. Note: if a grizzly bear is visible to field crew, then the bear is already sufficiently close that procedures should be taken to remove/protect the field crew.
- If personnel working on-site, or near vehicles, aircraft or buildings observe a grizzly bear, personnel will immediately remove themselves from danger (e.g., take shelter in a vehicle, in a building, or leave the site) and then contact the Environmental Department to report the sighting.
- If personnel working in the field or on-site observe a wolverine, the crew will immediately communicate the observation to the Environmental Department and either a) remove

themselves from the area if the animal appears aggressive, or there is a problem animal reported on-site, or b) continue to observe the animal if it does not appear aggressive and there are no reports of problem or habituated wolverine on-site.

- If a grizzly bear or wolverine is observed in camps, or are repeatedly observed near camps (e.g., twice or three times within a week), then this will trigger:
  - a review of waste management activities to ensure that these animals are not being attracted to site;
  - a review of camp facilities management to ensure that skirting and fencing are in good order, and fixing any structures that may allow access to these animals;
  - an update to all personnel that a potential habituated animal may occur on-site and that appropriate safety protocols should be implemented (e.g., post warnings, conduct area closure, etc.).
- If a grizzly bear or wolverine is observed routinely at camp, or animals are behaving in a habituated or aggressive fashion, then the Protocol for Management of Problem Wildlife (Section 6.8.3.3) will be triggered.

6.8.3.3 Protocol for Management of Problem Wildlife

Once an animal has been identified as a "problem animal", then this protocol is triggered. The Protocol is written to address problem bears and wolverine, however it can be modified to address other problem wildlife, if necessary.

Triggers for Management

Observations of grizzly bears or wolverine on-site should have already triggered on-site waste management monitoring (Section 7.2.5), a review of wildlife attractants (waste) management (Section 6.3), and infrastructure monitoring (Section 7.2.6) to remove any attractants for bears or wolverine. If these measures fail to dissuade a grizzly bear or wolverine from visiting the Project site, or if there has been a report of a habituated or aggressive animal, then the protocol for management of problem wildlife would be triggered. A suspected habituated grizzly bear or wolverine will be reported to GN DOE for direction and support for implementing an appropriate response.

Management Actions

The following management options are meant to ensure the safety of personnel, and dissuade habituated or aggressive grizzly bears or wolverines from visiting the site. Ideally, this list of options would be followed sequentially as a situation develops, but managers may choose to escalate the actions taken in response to an aggressive, predatory, or injured animal as described in Table 6.8-1. Options include:

1. Monitoring: report and record wildlife sightings and signs;
2. Post warning: provide accurate and current information of all potentially dangerous wildlife in the area;
3. Area closures: restrict worker access to areas with problem wildlife, pending suitable controls;
4. Adverse conditioning (AVCD): apply AVCD activities to problem wildlife to prevent or reverse habituation; and
5. Destruction: undertake (with authorization from appropriate wildlife management authority) only when an animal is determined to pose an unacceptable hazard to human safety.

Table 6.8-1. Protocol to Determine Appropriate Management Responses to Human-Animal Interactions

Type of Human-Animal Interaction	Management Response Options				
	Monitor	Post Warning	Area Closure	AVCD	Destroy
1. Animal sighting or sign reported	X	X			
2. Animal showing normal feeding behaviour and avoids people	X	X			
3. Animal reacting defensively following surprise or provoked encounter (defensive aggression)	X	X	X		
4. Animal tolerates people but ignores them and their facilities (no threat present)	X	X	X	X	
5. Animal shows repeated interest in people and/or human facilities, which will likely result in food-conditioning or close approaches (habituated)	X	X	X	X	
6. Animal receives minimal or low-level reinforcement to unnatural food sources (mildly food-conditioned)	X	X	X	X	
7. Animal is heavily habituated to people and has repeatedly obtained unnatural foods (food-conditioned)	X	X	X	X	
8. Animal has previously been relocated and is unlikely to change its behaviour		X	X	X	X
9. Animal displays aggressive, offensive, or predatory behaviour and is an imminent threat to human safety.		X	X	X	X

The measures taken, and their efficacy, will be evaluated and reported to the GN DOE on an on-going basis until the situation has been resolved, and summarized in the annual WEMP report.

The objective for this section is to result in zero injuries or mortalities to grizzly bear or wolverine. Exceedance of this objective will result in a thorough review of on-site waste management (wildlife attractant management, Section 6.3), waste management monitoring (Section 7.2.5), infrastructure monitoring (Section 7.2.6), wildlife policies (Section 6.7), and employee wildlife education (Section 6.9) programs.

It should be noted that a wildlife injury or mortality is not required to trigger the review of these programs. As discussed above, a review of wildlife attractant and infrastructure monitoring policies is also triggered by the repeated observation of grizzly bear or wolverine on-site.

6.9 EMPLOYEE WILDLIFE EDUCATION

6.9.1 Project-specific Issues

Employee wildlife education addresses potential effects of the Project on wildlife including: habitat loss, disturbance (to feeding, nesting, denning or breeding habitats), attraction to Project infrastructure and activities, and mortality, both directly due to Project activities and indirectly as a result of increased hunting access.

Employees and contractors will be educated on basic local wildlife ecology (including wildlife information from TK) and possible Project-related effects on wildlife and biodiversity. All Project personnel will be encouraged to promote stewardship activities. Employees and contractors will also be expected to comply with the management provisions in the WMMP.

6.9.2 Goals and Objectives

The goal of Employee Wildlife Education is to create employee and contractor awareness for the potential effects of Project operations on wildlife, minimize disturbance and disruption to wildlife, and ensure safety of all employees. The objectives of Employee Wildlife Education include:

- Providing an accessible and comprehensible wildlife awareness program;
- Ensuring awareness and understanding for the recommended mitigation measures and procedures outlined throughout this document, and;
- Promoting compliance with mitigation measures through education and enforcement.

6.9.3 Mitigation and Management

Triggers for Management

The employee education program for wildlife was described in the FEIS and will be triggered in all Project phases where personnel are on-site conducting work.

Management Actions

All contractors and employees working on the Project will participate in the Employee Wildlife Education program in conjunction with Project orientation. Mandatory annual refresher courses will ensure ongoing employee awareness of wildlife concerns and mitigation procedures for the Project. This program will be supported by standard operating procedures, reporting forms, information sheets, and awareness posters and signage. The education program will include training in the following areas:

- Access road restrictions and operating protocols (e.g., wildlife right-of-way, speed limits, check-ins, road-wildlife reporting programs);
- Awareness of wildlife-sensitive locations (e.g., movement corridors, breeding areas) and wildlife-sensitive periods;
- Local wildlife species of concern and threats to native biodiversity;
- Wildlife Attractant management;
- No feeding of wildlife policy;
- No harassment of wildlife;
- No-hunting policies;
- Bear-aware training for relevant staff who work outside;
- Wildlife incidental observation reporting;
- Wildlife incident/accident reporting and response procedures;
- Anonymous reporting system for employees to voice concerns and inform management of non-compliance, and;
- Compliance requirements and disciplinary action that will be enforced by Project management.

6.10 MITIGATION AND MANAGEMENT FOR CARIBOU

6.10.1 Project-specific Issues

This section describes monitoring and management of caribou to minimize potential effects of the Project on caribou, primarily the disturbance of female and calf caribou during the important calving and post-calving periods, but also applies during other seasons.

The Project will undertake both long-term monitoring of the location of the calving and post-calving grounds, and site-specific monitoring. Long term monitoring will be used to plan a suit of site-specific monitoring and management activities (including potential shutdowns), while site-specific monitoring will trigger on-site programs.

Mitigation and Management for caribou is divided into two sections – long term and short term mitigation:

1. The first section (Monitoring the Caribou Range and Planning Mitigation Activities, Section 6.10.3.1) describes the long term monitoring of caribou usage of tundra habitats and uses this information to trigger planned alterations or reductions in work in subsequent years.

Long term monitoring of caribou habitat usage will be used to determine what portion of the year, caribou are using the Project site, and therefore how sensitive they may be to disturbance. Currently, the Bathurst herd does not utilize the Project site during the calving period, but if that were to change, then planned alterations of activity would be instituted for subsequent years. It is important to note that this long-term monitoring program using collar data is intended to trigger planned activities for subsequent years, not within a single year.

2. The second section (On-site Monitoring and Mitigation Activities, Section 6.10.3.2) describes the monitoring and triggered mitigation actions should caribou be observed near the project site within a particular year.

In addition to the long term monitoring and planned mitigation, on-site monitoring will also be conducted to trigger mitigation activities should caribou be observed near or on the Project site within any one particular year. The monitoring and mitigation to be carried out on-site will be based on three important variables:

- The time of year;
- The number and type of animals, and;
- The distance from the Project site.

The time of year is important because it defines the life-stage of caribou (i.e., spring migration, calving, post-calving, summer, fall, winter). TK and scientific information indicate that caribou are more sensitive to disturbance during the calving and post-calving periods than during other times of the year. Hence, different levels of monitoring and mitigation are planned for different times of year.

TK and scientific information also report that the number and type of animals influences how sensitive caribou are to disturbances. For instance, large groups of females with calves are more sensitive to disturbance than small groups of males. Hence, the mitigation response will depend on the number of caribou observed.

Finally, TK and scientific information report the distance to disturbances also alters how sensitive caribou are to those disturbances. Hence, the mitigation response will also depend on the distance to observed groups of caribou.

6.10.2 Goals and Objectives

The goal of monitoring and management of caribou on-site is to minimize any disturbance that caribou, particularly those of the Bathurst herd, may experience if they use areas of the tundra near the Project site. The objectives include:

- Monitoring the long-term trends in habitat usage by caribou to enable the Project to plan mitigation activities year to year;
- Provide an accessible and comprehensible list of monitoring and mitigation techniques for on-site personnel to follow, and;
- Minimize disturbance to caribou.

6.10.3 Mitigation and Management

Triggers for Management

The triggers for management are discussed in the following sections, and are specific to the time of year (and how sensitive caribou are to disturbance), the activity being conducted, and identify of the observer.

6.10.3.1 Monitoring the Caribou Range and Planning Mitigation Activities

The purpose of this monitoring is to determine the location of the calving, post calving and summer ranges of the Bathurst herd in each year. Long range monitoring of the caribou range will be conducted in collaboration with the GNWT and GN using collar data from the Bathurst Herd. These data will allow for the planning of long-term mitigation activities, possibly including the suspension of certain types of work, or work at particular sites.

During winter, the Bathurst caribou are largely below treeline (Figure 6.10-1). During spring migration, they travel north, largely via Contwoyto Lake (Figure 6.10-1). The calving grounds are 100-150 km to the west of the Project (Figure 6.10-2).

The post-calving range the Bathurst herd overlaps the eastern edge of the RSA, but not with the footprint of the Project (Figure 6.10-2). The caribou section of the FEIS compares the distribution of the calving and post-calving ranges relative to the Project when the herd was at a high population size (1996-2006) and low population size (2009-2015) (Volume 5, Chapter 5, Section 5.1.2.5). This analysis indicates that the post-calving range of the Bathurst was larger when the population was higher, and covered more of the RSA, but did not cover the project PDAs. The calving and post-calving area for the Beverly/Ahiak herd does not overlap with the Project RSA.

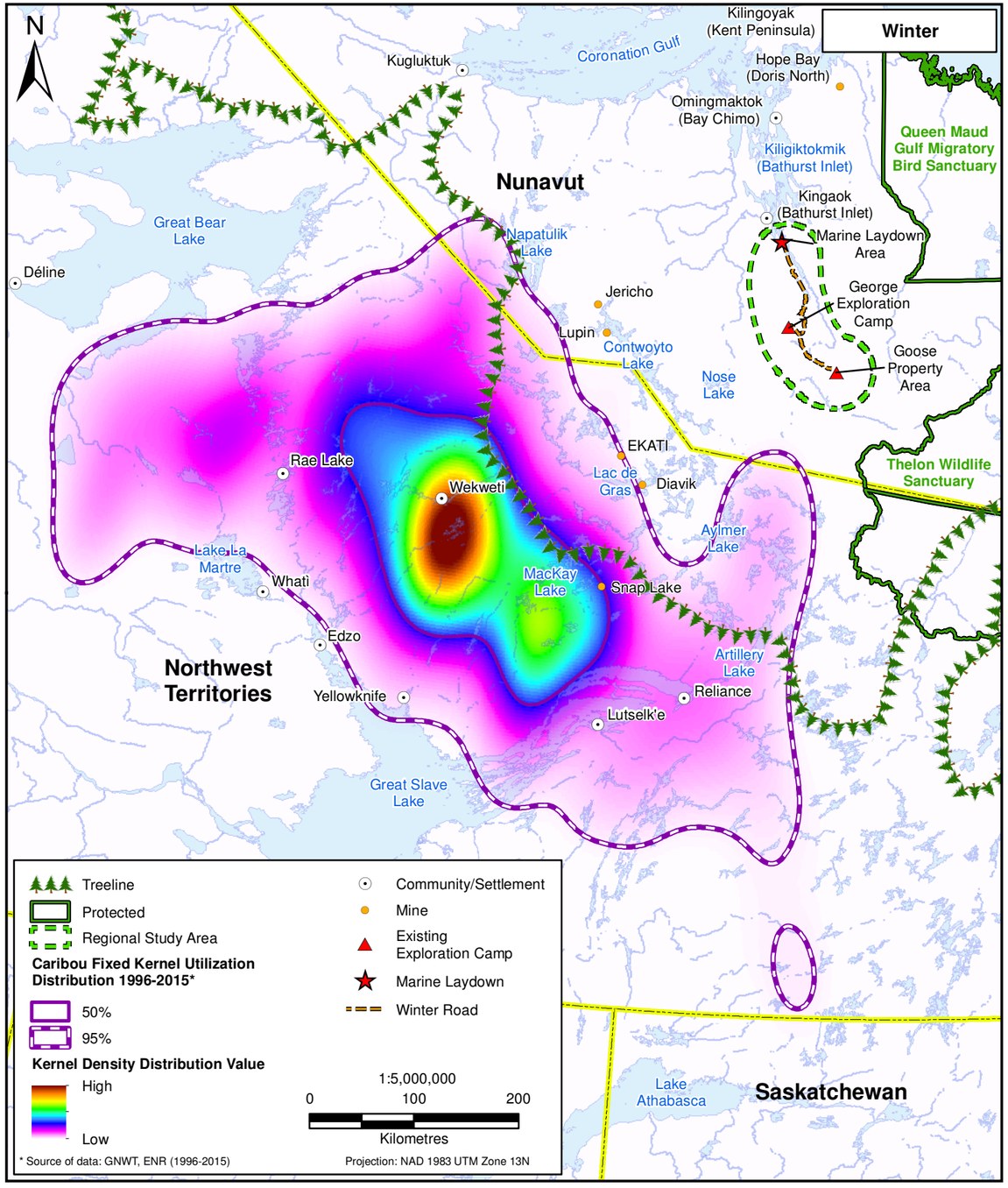
The summer range of the Bathurst herd does not overlap with the Project RSA (Figure 6.10-3), while during the fall, the herd spreads out both north and south and interacts with the southern edge of the RSA (Figure 6.10-3).

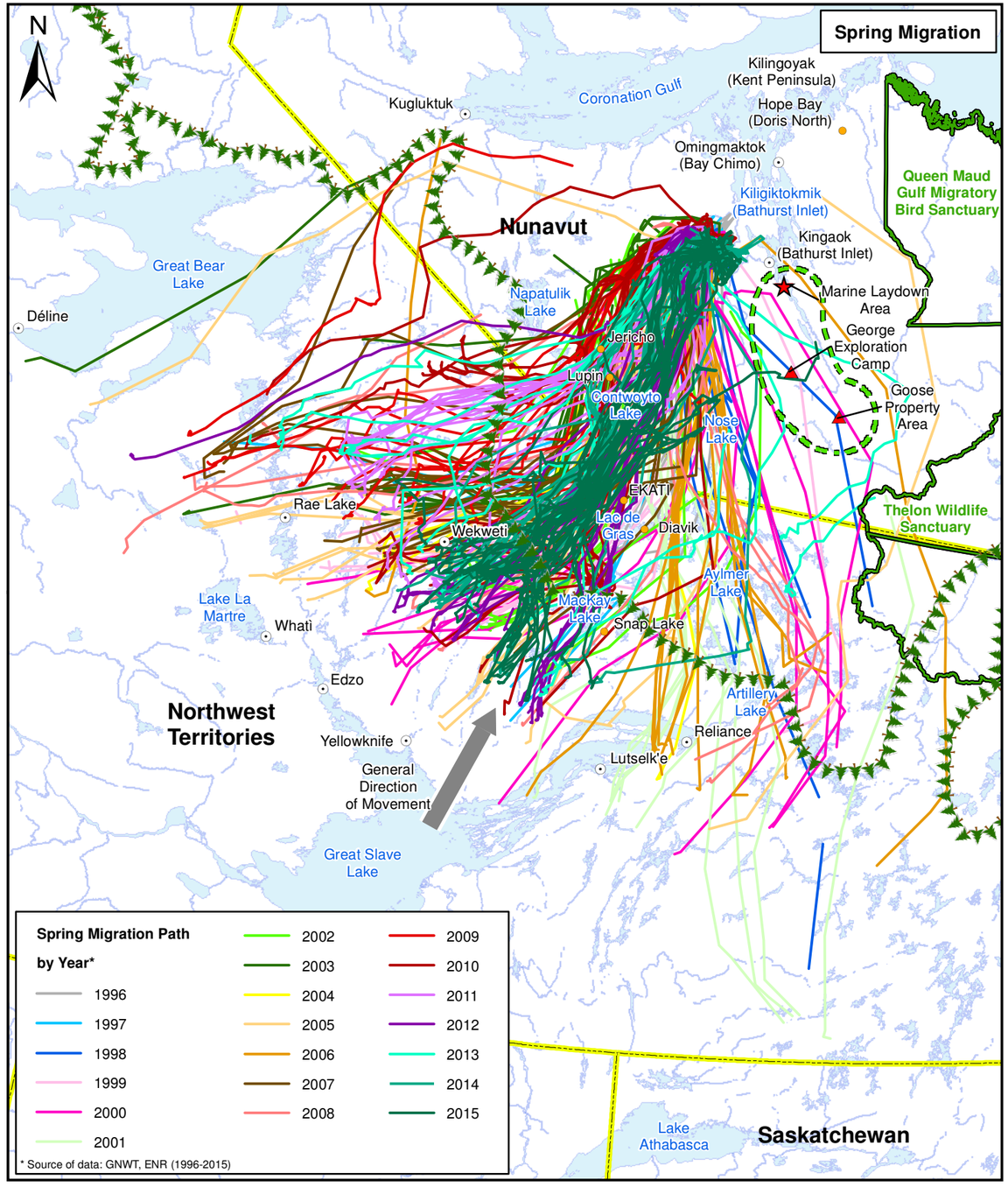
During the DEIS review, the GNWT and GN requested a plan that would manage Project activities should the locations of these seasonal-use areas change in the future. Caribou seasonal ranges were defined during baseline studies using GPS collar information to define areas of active use (95% kernel utilization distribution (UD)) and core use areas (50% kernel UD). The 50% kernel UD represents an area with a 50% probability that an animal (or group of animals) is inside that area; the same is true for the 95% kernel UD.

This plan will use collar data collected each year to map the 50 and 95% kernel density of each seasonal range for the Bathurst Herd, and allow for mitigation to be planned for the following year (Table 6.10-1).

Table 6.10-1. Monitoring Caribou Range and Planned Mitigation Activities

Timing	Analysis	Trigger	Triggered Activity in Year n + 1
Calving Range	Yearly examine location of the Bathurst calving range using collar data	Project components are all outside of 50 and 95% kernel density	1) Standard mitigation listed in Table 6.10-2
		Project component is outside of 50%, but inside 95% kernel density	1) Standard mitigation listed in Table 6.10-2 2) Conduct review of mitigation measures to ensure that appropriate mitigation is planned. 3) Trigger wildlife monitors to be on-site and monitoring 4) Alert site to plan for likely helicopter, blasting, and site road shutdowns
		Project component is inside both 50 and 95% kernel density	1) Plan for shutdown of that site component 2) Conduct review of mitigation measures to ensure that appropriate mitigation is planned. 3) Trigger wildlife monitors to be on-site and monitoring 4) Alert site to plan for likely helicopter, blasting, and site road shutdowns
Post-Calving Range	Yearly examine location of the Bathurst post-calving range using collar data	Project components are all outside of 50 and 95% kernel density	1) Standard mitigation listed in Table 6.10-2
		Project component is outside of 50%, but inside 95% kernel density	1) Standard mitigation listed in Table 6.10-2 2) Conduct review of mitigation measures to ensure that appropriate mitigation is planned. 3) Trigger wildlife monitors to be on-site and monitoring 4) Alert site to plan for likely helicopter, blasting, and site road shutdowns
		Project component is inside both 50 and 95% kernel density	1) Standard mitigation listed in Table 6.10-2 2) Conduct review of mitigation measures to ensure that appropriate mitigation is planned. 3) Trigger wildlife monitors to be on-site and monitoring 4) Alert site to plan for likely helicopter, blasting, and site road shutdowns
Summer Range	Yearly examine the location of the Bathurst summer range using collar data	Project components are all outside of 50 and 95% kernel density	1) Standard mitigation listed in Table 6.10-2
		Project component is outside of 50%, but inside 95% kernel density	1) Standard mitigation listed in Table 6.10-2 2) Conduct review of mitigation measures to ensure that appropriate mitigation is planned. 3) Trigger wildlife monitors to be on-site and monitoring 4) Alert site to plan for likely helicopter, blasting, and site road shutdowns
		Project component is inside both 50 and 95% kernel density	1) Standard mitigation listed in Table 6.10-2 2) Conduct review of mitigation measures to ensure that appropriate mitigation is planned. 3) Trigger wildlife monitors to be on-site and monitoring 4) Alert site to plan for likely helicopter, blasting, and site road shutdowns



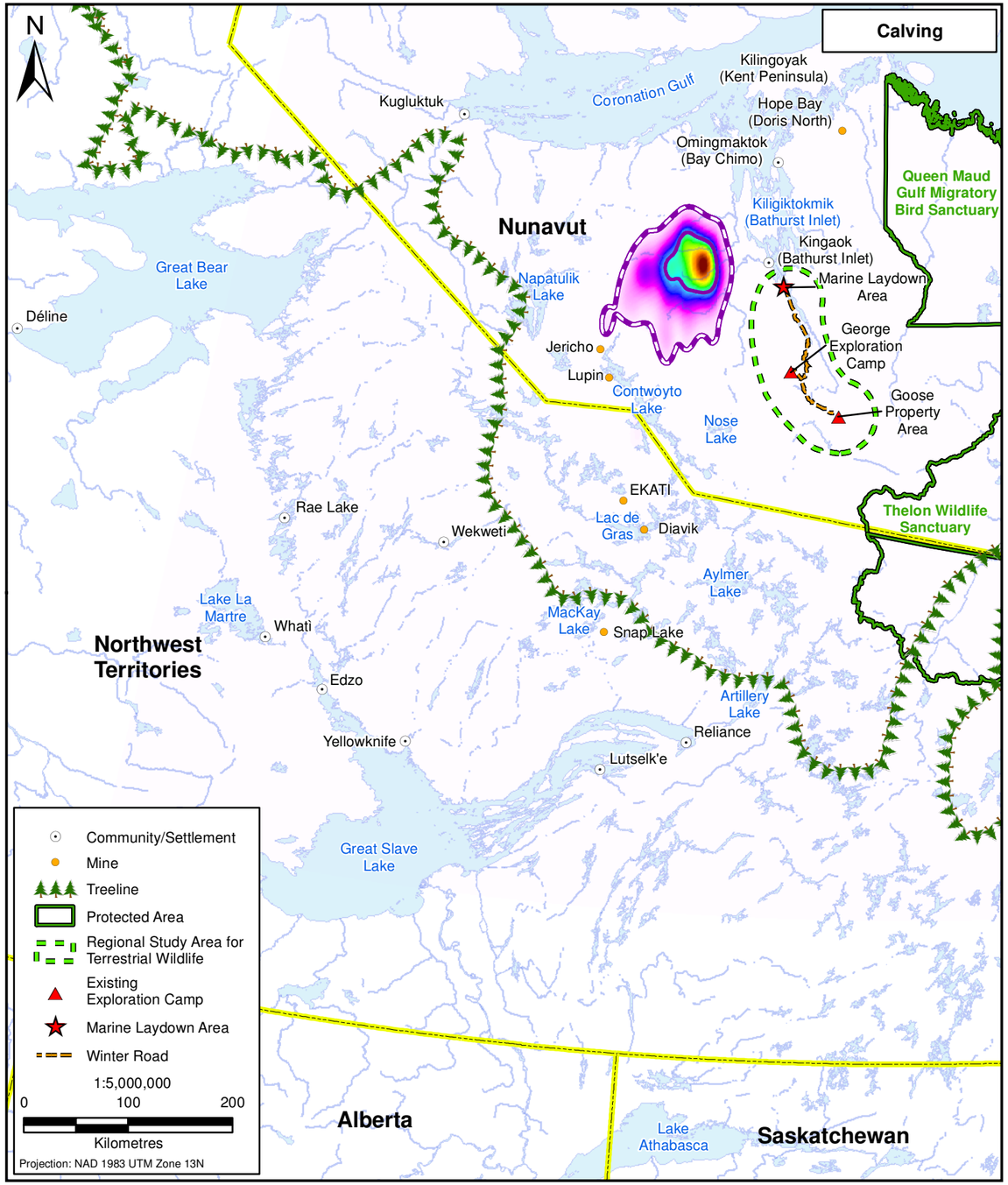


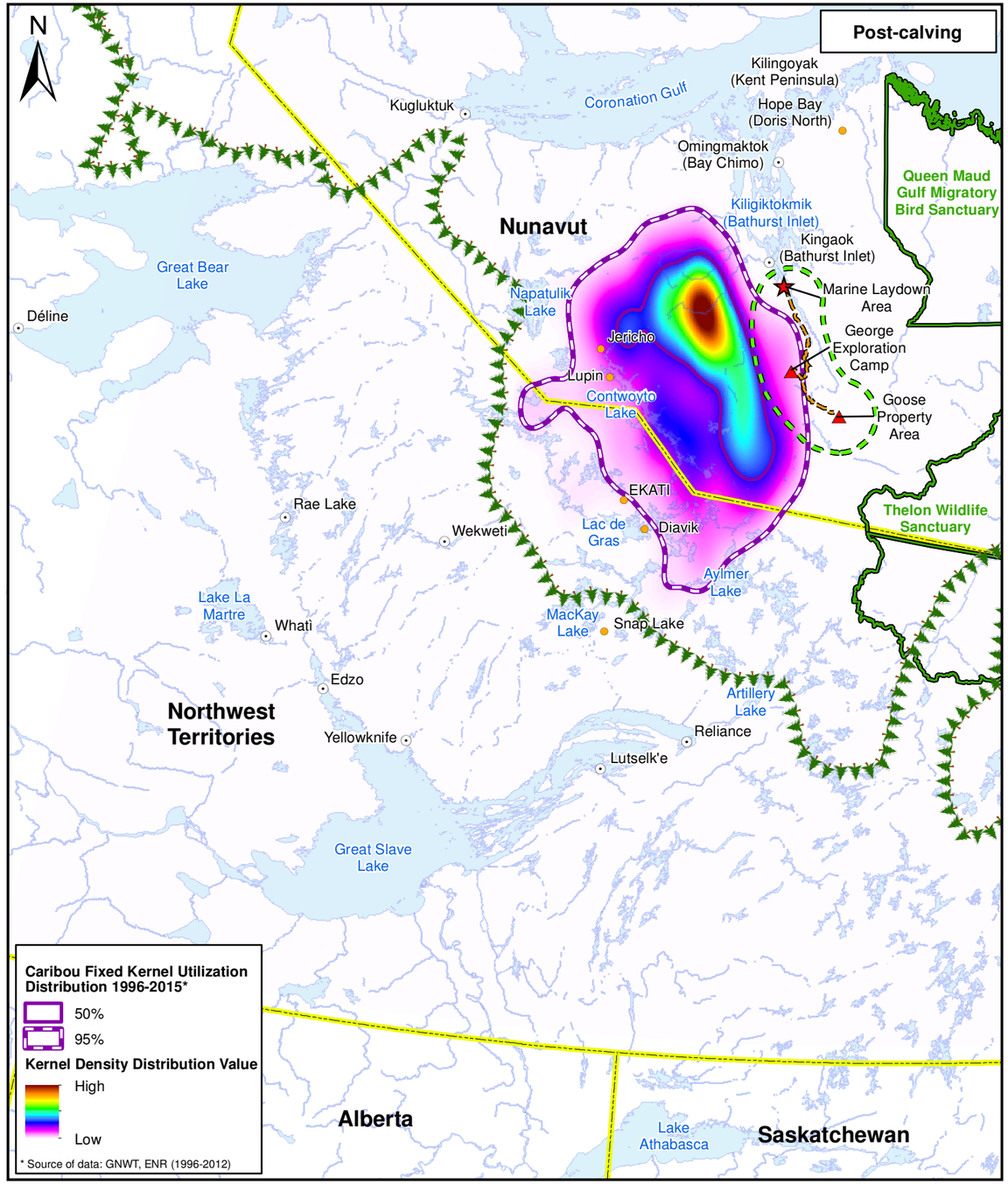
Sabina GOLD & SILVER CORP.

Range of Satellite-collared Bathurst Caribou during Winter (1 November to 14 April) and Spring Migration (15 April to 4 June), 1996 to 2014/2015

Figure 6.10-1

Rescan an ERM company





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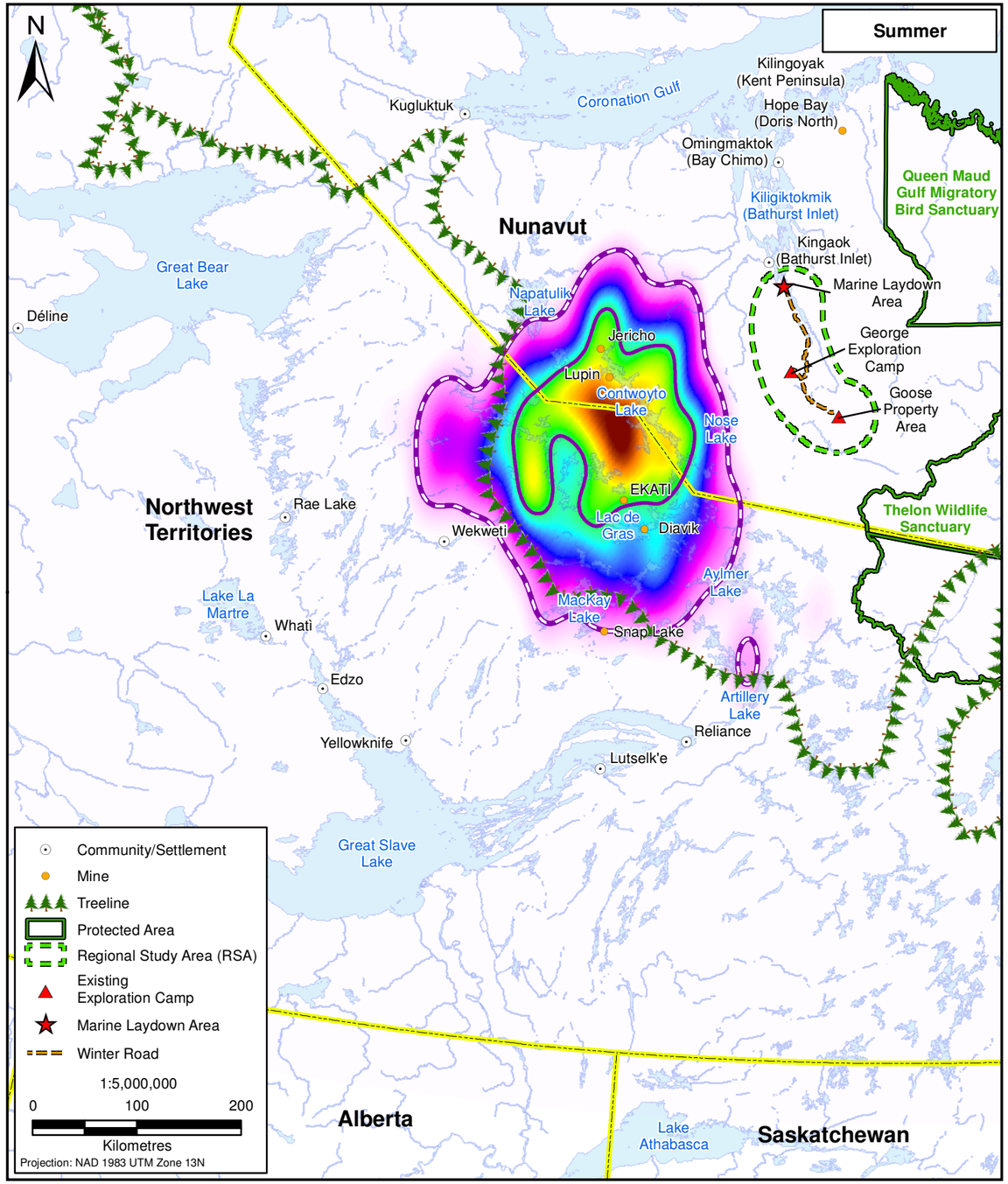
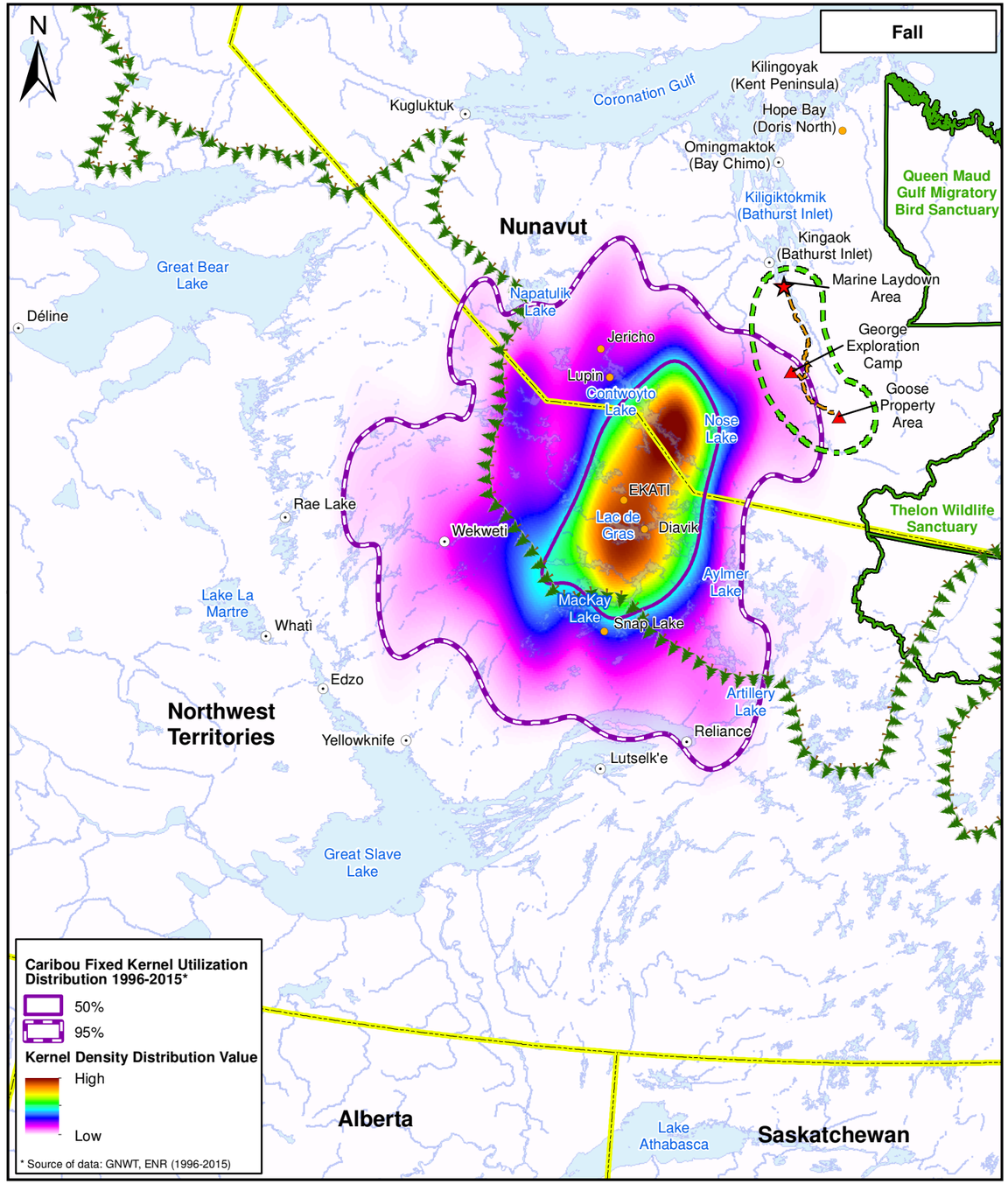
Range of Satellite-collared Bathurst Caribou during Calving (5 June to 15 June) and Post-calving (16 June to 20 July), 1996 to 2014/2015

Figure 6.10-2

Rescan
an ERM company





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Range of Satellite-collared Bathurst Caribou during Summer (21 July to 31 August) and Fall (1 September to 31 October), 1996 to 2014

Figure 6.10-3

Rescan
an ERM company

Table 6.10-2. Seasonal Monitoring and Mitigation Activities for Caribou

Activity	Monitoring Method	Trigger # of Animals	Dist.	Mitigation
Calving & Post Calving				
1) >10 km monitoring	Collar reports from Bathurst caribou	Any	<25 km	1) Triggers monitors to scan for caribou 2) Alert pilots
	Collar reports from Bathurst caribou	Any	<15 km	1) Triggers monitors to scan for caribou 2) Alert pilots 3) Call site alert
2) Aircraft	Pilots	A) 3-50 animals		See, report and avoid by 1 km horizontally and/or 610 m vertically
		B) >50 animals		See, report and avoid by >2 km horizontally and/or 610 m vertically
3) Vehicles on ice road	*No Ice roads at this time*			
4) Above ground blasting	1) Drivers 2) Monitors - line of sight 3) Other options	A) 3-50 ♀ with calves	2 km	1) Call site alert 2) Trigger wildlife monitors to conduct focal monitoring 3) Active monitoring during all blasting to monitor response 4) Should animals respond significantly to blasting, consideration for cessation of blasting until animals more off
		B) >50 ♀ with calves	2 km	1) Call site alert 2) Trigger wildlife monitors to conduct focal monitoring 3) Cessation of blasting until animals move off
5) On-site roads	1) Drivers 2) Monitors - line of sight 3) Other options	A) 3-50 ♀ with calves	2 km	1) Call site alert 2) Trigger wildlife monitors to conduct focal monitoring 3) Stop all heavy equipment traffic within 500m of the observed caribou, except at plant site
		B) >50 ♀ with calves	2 km	1) Call site alert 2) Trigger wildlife monitors to conduct focal monitoring 3) Stop all heavy equipment traffic, except at plant site
6) Indoor/underground	As above	N/A	N/A	Indoor and underground mining can continue
Summer				
1) >10 km monitoring	Collar reports	Any	<25 km	1) Triggers monitors to scan for caribou 2) Alert pilots

(continued)

Table 6.10-2. Seasonal Monitoring and Mitigation Activities for Caribou (continued)

Activity	Monitoring Method	Trigger # of Animals	Dist.	Mitigation
***Summer** (cont'd)*				
1) >10 km monitoring *(cont'd)*	Collar reports	Any	<15 km	1) Triggers monitors to scan for caribou 2) Alert pilots 3) Call site alert
2) Aircraft	Pilots	A) 3-50 animals		See, report and avoid by 1 km horizontally and/or 610 m vertically
		B) >50 animals		See, report and avoid by >2 km horizontally and/or 610 m vertically
3) Vehicles on ice road	*No Ice roads at this time*			
4) Above ground blasting	1) Drivers 2) Monitors - line of sight 3) Other options	A) 3-50 ♀ with calves	500 m	1) Call site alert 2) Trigger wildlife monitors to conduct focal monitoring 3) Active monitoring during all blasting to monitor response 4) Should animals respond significantly to blasting, consideration for cessation of blasting until animals more off
		B) >50 ♀ with calves	500 m	1) Call site alert 2) Trigger wildlife monitors to conduct focal monitoring 3) Cessation of blasting until animals move off
5) On-site roads	1) Drivers	A) 3-50 ♀ with calves	500 m	1) Call site alert 2) Trigger wildlife monitors to conduct focal monitoring 3) Standard wildlife right of way rules
		B) >50 ♀ with calves	500 m	1) Call site alert 2) Trigger wildlife monitors to conduct focal monitoring 3) Stop all heavy equipment traffic within 500m of the observed caribou, except at plant site
6) Indoor/underground	As above	N/A	N/A	Indoor and underground mining can continue.
Fall and Winter				
1) >10 km monitoring	Collar reports	Any	<25 km	1) Triggers monitors to scan for caribou 2) Alert pilots
	Collar reports	Any	<15 km	1) Triggers monitors to scan for caribou 2) Alert pilots 3) Call site alert

(continued)

Table 6.10-2. Seasonal Monitoring and Mitigation Activities for Caribou (completed)

Activity	Monitoring Method	Trigger # of Animals	Dist.	Mitigation
Fall and Winter *(cont'd)*				
2) Aircraft	Pilots	A) 3-50 animals		See, report and avoid by 1 km horizontally and/or 610 m vertically
		B) >50 animals		See, report and avoid by >2 km horizontally and/or 610 m vertically
3) Vehicles on ice road	Drivers	Any	<250 m	See, report and slow to 40 km/hr
		>10 animals	20 m	See, report and stop until move off
		Any crossing		See, report and stop until finished crossing.
		<10 resting on road		See, report and stop for at least 20 min to allow animals to move off road. If animals do not move, then proceed on road at <15 km/hr until animals have moved off the road.
		>10 resting on road		See, report and stop until animals move off road
4) Above ground blasting	1) Drivers 2) Monitors – if triggered 3) Other options	A) 3-50 animals	500 m	1) Call site alert 2) Trigger wildlife monitors to conduct focal monitoring
		B) >50 animals	500 m	1) Call site alert 2) Trigger wildlife monitors to conduct focal monitoring 3) Cessation of blasting until animals move off
5) On-site roads	1) Drivers	A) 3-50 animals	250 m	1) Call site alert 2) Trigger wildlife monitors to conduct focal monitoring 3) Standard wildlife right of way rules
		B) >50 animals	250 m	1) Call site alert 2) Triggers wildlife monitors 3) Stop all heavy equipment traffic within 250m of the observed caribou, except at plant site
6) Indoor/underground	As above	N/A	N/A	Indoor and underground mining can continue

The Bathurst use the calving and post-calving ranges at predictable times of year, allowing the Project to plan for specific activities at these times of year. Should the calving and post-calving ranges overlap with the Project site in future years, the Project can plan for staged reductions in outdoor work or the cessation of particular activities that may disturb caribou, such as helicopter support of exploration drills (should this activity be undertaken in future).

On-site monitoring and mitigation includes on-site monitoring and mitigation when caribou are observed, is addressed in Section 6.10.3.2.

6.10.3.2 On-site Monitoring and Mitigation Activities

The previous section described monitoring for long term changes in the distribution of seasonal ranges for the Bathurst caribou herd, and the types of planned activities that would be implemented in subsequent years.

This section describes the immediate on-site monitoring and mitigation activities that will occur if a group of caribou are observed on or near the Project site. On-site monitoring and mitigation activities are summarized in Table 6.10-2.

The first step monitoring and mitigation for caribou is a series of long-term, planned mitigation activities (e.g., the planned cessation of work activities) which are discussed in Section 6.10.3.1. For instance, it is known that the Bathurst herd is closest to the Project site during the post-calving period. Hence, during the post-calving period, additional mitigation will be planned, such as increased employee awareness, enacting an alert on-site to prepare for the arrival of caribou and mobilizing caribou monitors into the field.

In addition to these planned activities, there are six types of monitoring and mitigation activities planned for on-site. These activities are arranged roughly by the geographic scope of the likely effects of each Project activity and the corresponding monitoring method. For instance, the potential effects of helicopters disturbing wildlife can occur at a greater distance from the Project site than on-site vehicles.

The intensity of monitoring, the sensitivity of triggers for mitigation, and the mitigation actions are organized by season and the relative sensitivity of caribou to disturbance. Sensitivity is considered highest during the calving and post-calving periods, a medium level during the summer, and lowest during the fall and winter.

On-site monitoring and mitigation activities include:

<u>1) >10 km Monitoring</u>

Planning – The first step in mitigation for Bathurst caribou is planning for their approach. The timing for when the Bathurst caribou are at their nearest approach to the Project site is well understood, being during the post calving period, when they approach to within ~50 to the south west of the Project. Planned mitigation includes: 1) bringing environmental monitors to site to scan for caribou, 2) alert pilots and 3) alert on-site staff.

Monitoring - The >10 km monitoring system is the widest-reaching monitoring system, is similar to that already enacted at producing mines such as Ekati and Diavik in NWT. It will entail receiving data from government biologists on the near real-time movement of the Bathurst herd using GPS collars.

Triggers - These data, once received from government biologists, will allow for mitigation activities to be triggered prior to the arrival of caribou at the Project site, or adjustments to planned mitigation activities if the movement of the Bathurst herd is atypical in a particular year (Table 6.10-2).

Mitigation – In most years, the caribou will follow the standard movement patters and the planned mitigation activities will be sufficient. If caribou collars indicate that caribou are early or late arriving near site, mitigation will be triggered to: 1) bringing environmental monitors to site to scan for caribou, 2) alert pilots and 3) alert on-site staff.

2) Aircraft

Note that more information is available in Section 6.5, Aircraft Management for Wildlife.

Several types of aircraft may be at site over the course of Project including helicopters and fixed wing aircraft. Fixed wing aircraft typically fly at an elevation where possible disturbance effects on the ground are minimized. Hence, management of aircraft focuses here on helicopters. Depending on the activity, helicopters are likely the source of wildlife disturbance that travels the furthest from the Project site.

Planning – As part of pilot training, pilots will be informed of the seasons when caribou are more sensitive to disturbance (e.g., calving and post calving). As these seasons approach, pilots will be reminded of their responsibilities to monitor, report, and avoid groups of caribou. Should the >10 km monitoring program indicate that caribou are behaving atypically in any particular year, pilots will be informed.

Monitoring - Pilots will monitor the area through which they are flying for caribou (and other wildlife) and immediately report any sightings to the Environmental Manager, who will, in turn disseminate this information to other pilots and Project personnel.

When observed, caribou will be classified as i) individuals or ii) groups of A) 3-50, and B) >50 animals. If the pilots or passengers can classify males from females at a distance, then this information will be recorded, however, pilots will not be encouraged to approach and classify males from female groups since approaching the animals is the opposite of the intended mitigation.

Triggers - Observations of groups of caribou of A) 3-50, and B) >50 animals will trigger mitigation.

Mitigation - Observations of individuals or groups of caribou will trigger avoidance by pilots, as described in Table 6.10-2.

3) Vehicles on Ice Road

Note that more information is available in Section 6.4, Road Management for Wildlife.

Planning – The ice-road will be active from approximately December to April. Bathurst caribou are not expected to be in the Project area during this time, but small groups of Dolphin and Union, and Bathurst/Ahiak caribou may be present. Drivers will be trained on the importance of reducing disturbance to caribou and on their monitoring and mitigation responsibilities.

Monitoring – Drivers will monitor the area through which they are driving for caribou (and other wildlife) and immediately report any sightings to the Environmental Department, who will, in turn disseminate this information to other drivers and Project personnel.

Caribou will be classified as individuals or groups of A) 3-50, and B) >50 animals. If drivers can discern males from females while driving, then this information will be recorded.

Triggers - Individual and groups of caribou within 250 m or on the road will trigger mitigation.

Mitigation - Any animals within 250 m of the road will trigger the driver to slow to 40 km/hr. If >10 animals are <20 m from the road, crossing the road or on the road, the driver will stop until the animals have moved off. If small groups of <10 animals are resting on the road, the driver will stop up to ~20 minutes, and may then proceed slowly to encourage the animals off of the road. If it is a group of >10 animals resting on the road, then the driver will wait indefinitely.

4) Above Ground Blasting

Planning – Blasting in the pits will typically be conducted year-round. Mitigation, in the form of planned reductions/suspensions of above-ground blasting will be planned based on the historical number of caribou present at the site at a particular time of year and the season/ sensitivity of caribou at that time (See Section 6.10.3.1.). Currently, Bathurst caribou are closest to the Project site during the post-calving period. As a consequence, and until that changes, deployment of environmental monitors will be triggered during the calving and post-calving periods.

Monitoring – All personnel, including pilots, drivers and environmental monitors, will report any observations of caribou to the Environmental Department, who will, in turn disseminate this information to the Project personnel. Environmental monitors will conduct ground-based scans of the Project area for caribou. In addition, other options for monitoring will be considered, such as drones, wireless cameras, etc. The use of other monitoring options will be considered and implemented as they become feasible and operable technologically and from a regulatory perspective.

When observed, caribou will be classified based on the season. During the calving and post-calving periods, when environmental monitors are on-site and animals are easy to separate into i) non-breading females and males and ii) females with calves, then caribou will be classified as i) individuals and groups of males or ii) groups of A) 3-50, and B) >50 females animals.

During the summer when environmental monitors are on-site, caribou will also be classified as i) individuals and groups of males or ii) groups of A) 3-50, and B) >50 females animals.

During the third period, fall and winter, the animals spend a prolonged period where it can be difficult for incidental observers to separate males from females. As such, groups will be separated as males and females if possible, or simply as i) individuals or ii) groups of A) 3-50, and B) >50 animals.

Triggers -The distance at which mitigation is triggered for groups of caribou is dependent on the time of year/ sensitivity of caribou. During calving and post-calving, the trigger distance will be 2 km. The remainder of the year 500 m will be used. The mitigation conducted within the trigger distance will depend on the size of the group.

Mitigation – If small groups of 3-50 are reported within the trigger distance, then a Project site alert will be called and environmental monitor(s) will be moved to the location to monitor the animals and their response to blasting. If animals are observed to respond to blasting, then consideration will be given to cessation of blasting for small groups of animals as well.

If groups larger than 50 animals are present within the trigger distance, then a site alert will be called, monitor(s) will be moved in, and all aboveground blasting will be ceased within the trigger distance until such time as the caribou move away.

5) On-site roads

Note that more information is available in Section 6.4, Road Management for Wildlife.

Planning – On-site road will be active year round, with large machinery hauling waste rock from the pits, hauling ore from the pits to stockpiles, and smaller vehicles conducting crew changes, maintenance, etc. Currently, there are no times of year where the seasonal range of Bathurst caribou overlaps the Project site. However, should this change, a planned reduction or cessation of vehicles using on-site roads may be planned.

Monitoring – Drivers will monitor the area through which they are driving for caribou (and other wildlife) and report any sightings to the Environmental Department, who will, in turn disseminate this information to other drivers and Project personnel. If monitors are on-site, or other monitoring methods are being used, then information from these monitoring programs can also be used to trigger mitigation.

When observed, caribou will be classified based on the season. During the calving and post-calving periods, when environmental monitors are on-site and animals are easy to separate into i) non-breading females and males and ii) females with calves, then caribou will be classified as i) individuals and groups of males or ii) groups of A) 3-50 females with calves, and B) >50 females with calves.

During the summer when environmental monitors are on-site, caribou will also be classified as i) individuals and groups of males or ii) groups of A) 3-50, and B) >50 females animals.

During the third period, fall and winter, the animals spend a prolonged period where it can be difficult for incidental observers to separate males from females. As such, groups will be separated as males and females if possible, or simply as i) individuals or ii) groups of A) 3-50, and B) >50 animals.

Triggers – The distance at which mitigation is triggered for groups of caribou is dependent on the time of year/ sensitivity of caribou. During calving and post-calving, the trigger distance will be 2 km. The remainder of the year 500 m will be used. The mitigation conducted within the trigger distance will depend on the size of the group.

Mitigation – During the calving and post calving seasons, the observation of small (3-30) groups of females with calves within 2 km will trigger a site alert and cessation of on-site traffic within 500 m of the caribou.

During the calving and post calving seasons, the observation of large groups (>50) females with calves will trigger a site alert and cessation of all on-site traffic except within the immediate plant site.

During the summer season, smaller groups (3-50) of females with calves within 500 m will trigger a site alert and standard right of way rules for wildlife, while larger groups of females with calves will trigger a site alert and cessation of traffic within 500 m of the caribou except within the immediate plant site.

During the winter, smaller groups (3-50) of caribou within 250 m will trigger a site alert, while larger groups (>50) of caribou within 250 m will trigger a site alert and cessation of traffic within 250 m of the caribou except within the immediate plant site.

6) Indoor/underground

Note that more information is available in Section 6.1, Wildlife Construction and Operations Management

Planning – Under certain circumstances, indoor and underground work activities may be shut down as a planned response to a shift in the Bathurst caribou range (See Section 6.10.3.1). Ceasing indoor activity at an active mine site is a can only be conducted with considerable advance notice. Generators, heaters, water pipes, etc. can only be shut down as part of a planned change in work schedule. See Section 6.10.3.1 for more information on the process of planned shut downs of Project components based on changes in Bathurst caribou calving range.

Hence, there is no plan to conduct short term shutdowns of indoor or underground activities if caribou are observed.

Monitoring – Monitoring will occur as part of Sections 1-5.

Triggers - See Section 6.10.3.1 for triggers for planned cessation of activities.

Mitigation – See Section 6.10.3.1 for triggers for planned cessation of activities.

Notes

Note 1: Mitigation activities are focussed on groups of females and calves. Individual caribou, and groups of males, will not trigger mitigation, except where animals are on the road, in which case standard wildlife right-of-way mitigation will apply.

Note 2: In some cases, individual or groups of caribou will identify a mine site as preferred habitat. It is unclear why this occurs, but caribou may see the mine site as a refuge from predators such as wolves, who are less likely to approach human occupation. Structures, such as the airstrip may provide relief from insects or as scratching posts. Alternatively, animals may be curious and want to investigate the lights, sounds and activity on-site. Most mining camps and actives mines report caribou conducting this behaviour for periods during some years.

Allowances will be made for these Project-tolerant animals such that they don't repeatedly trigger mitigation actions. On first observation of groups of caribou, mitigation will be carried out as indicated above. However, should the environmental monitors identify an animal or group of animals that are observed repeatedly on-site, then mitigation actions will be relaxed for these animals. Standard helicopter and vehicle mitigation, however, will still apply.

6.11 SHIPPING MITIGATION FOR WILDLIFE

6.11.1 Project-specific Issues

Shipping mitigation for wildlife addresses potential effects of the Project on wildlife identified in assessments for ringed seals (Volume 7, Chapter 7), seabirds and seaducks (Volume 7, Chapter 6), and the Shipping Sensitivity Report. Environment Canada and the Government of Nunavut requested several commitments during the DEIS review to reduce potential effects on waterbirds, and this management program addresses those commitments.

6.11.2 Goals and Objectives

The goal of marine shipping mitigation for wildlife is to reduce any potential effects on wildlife due to shipping, including:

- Shipping during the open water season to reduce potential effects of icebreaking on Dolphin and Union caribou and Peary caribou herds, and;
- Reducing the chance of collisions with marine birds by avoiding known colonies.

6.11.3 Mitigation and Management

Triggers for Management

Management of shipping activities was a commitment in the FEIS and is triggered whenever shipping is taking place to the Project through the Northwest Passage. Onboard monitors for marine mammals and seabirds may trigger avoidance of observed animals

Management Actions

Mitigation and management actions to reduce potential effects on wildlife due to shipping include:

- Shipping through the Northwest Passage during the open water season to reduce the potential for ice breaking to affect caribou who may be using the sea ice to migrate (Dolphin and Union caribou and Peary caribou herds), except where the safety of the ship is in concern;
- Avoiding any large groups of birds observed on the ocean surface except where the safety of the ship is in concern;
- Avoiding any groups of marine mammals observed on the ocean surface except where the safety of the ship is in concern;
- Avoiding any known colonies of marine birds by a buffer distance to reduce the chance of ship-bird collisions, except where the safety of the ship is in concern;
- If monitoring indicates that ships are striking a significant number of birds or marine mammals, then adaptive mitigation will be triggered, and;
- Avoiding the large colony of marine birds on King Leopold Island by a buffer distance of 30 km, except where the safety of the ship is in concern.

7. Wildlife Effects Monitoring Program (WEMP)

7.1 INTRODUCTION

7.1.1 Overview

A Wildlife Effects Monitoring Program (WEMP) is proposed to evaluate the effectiveness of mitigation and management in reducing potential effects of the Project on identified wildlife VECs (Table 7.1-1) and to monitor the regional populations of selected species. The proposed WEMP is presented as a draft framework for 1) facility-specific monitoring, and 2) wildlife-specific monitoring.

1. Facility-specific (e.g., road traffic measures, problem wildlife, waste management) monitoring will focus on effectiveness of mitigation measures to minimize disturbance and effects of the Project on wildlife and guide adaptive management.

2. Focal species monitoring (i.e., VEC species) is outlined with a focus on wildlife abundance, movement, and distribution relative to the Project activities and facilities. In some cases, the proposed monitoring program may be combined with monitoring related to other projects or the Nunavut government where cumulative or range-wide monitoring is deemed appropriate at the behest of the Nunavut government.

Table 7.1-1. List of VEC Wildlife Species Included in Facility and Focal-Species Monitoring

VEC	Facility-specific Monitoring	Focal Species Monitoring
Caribou	X	X
Grizzly Bear	X	X
Muskox	X	X
Wolverine/Furbearers	X	X
Migratory Birds	X	X
Raptors	X	X
Seabirds and Seaducks	X	X
Ringed Seals	X	X

A draft framework for the proposed WEMP is outlined in the following sections, with the caveat that a formal and detailed program will be developed prior to initiation of works associated with the proposed Project. The framework identifies each monitoring component, methodology to be used, spatial extent, frequency and duration of monitoring, monitoring objective (quantify impact or assess mitigation), and parameters measured.

7.1.2 Goals and Objectives

The goal of the WEMP is to assess interactions between the Project and wildlife populations in order to modify operations if it is found that the Project is having a measurable negative effect on specific wildlife populations in the monitored area. The objectives of the WEMP are split into two groups: i) facilities monitoring, and ii) focal species monitoring.

Facilities Monitoring is designed to:

- Monitor wildlife interactions with Project infrastructure;
- Monitor mitigation actions and their efficacy, and;
- Identify opportunities for adaptive management.

Focal Species Monitoring is designed to:

- Evaluate impact predictions in the effects assessment;
- Continuously reduce uncertainty of Project effects on wildlife, and;
- Collaborate with other industry parties, government, and Inuit peoples in the event that long term wildlife monitoring programs are initiated in the Kitikmeot region of Nunavut.

7.1.3 Planning and Updating the WEMP

This conceptual WEMP will be updated by Sabina prior to construction of the Project to include the detailed study designs of programs as well as Standard Operating Procedures and sent to the GN, GNWT and KIA for comment prior to use.

7.1.4 Liaising with Government and the KIA

As part of the WEMP, Sabina will liaise with government and the KIA in several ways as part of the WMMP and WEMP planning and reporting.

1. Sabina will produce and send the WEMP Plan for comment as needed. The WEMP Plan may be updated in response to government or KIA comments, updates to monitoring methods, or due to changes in species biology.
2. Sabina will distribute the annual WEMP report to government and the KIA as appropriate.
3. Sabina will meet regularly (at least annually) with government and the KIA to discuss the collaborative programs where Sabina is contributing to GN-led monitoring programs for caribou, muskox and grizzly bear.
4. When possible, Sabina will send a representative to participate in GNWT-led meetings that formally include the GN and relevant aboriginal groups when the content of these meetings include issues that are related to potential project interactions (e.g., the Bathurst Range Planning Meetings being held by the GNWT).
5. Where the government and relevant Aboriginal groups are formally working together to monitor and manage wildlife populations (particularly caribou, but also including grizzly bear, muskox and wolverine), Sabina will participate in meetings for these initiatives as part of the commitment to contribute to government-led monitoring initiatives (see also section 7.1.5).

As part of on-site monitoring and mitigation activities, Sabina will communicate with the GN DOE and KIA when certain species are observed on-site, when mitigation is planned to exclude wildlife, and as a result of wildlife incidents. Records of these observations and actions will also be reported in the WEMP Report:

1. If raptors are observed in the pits (Section 7.2.4, Pit and Quarry Wall Nest Monitoring) and mitigation is planned to remove nesting materials or exclude the raptor from the pit or quarry using deterrents as described in Section 6.2, Construction and Operations Management.
2. If wildlife are observed accessing project infrastructure, as described in Section 7.2.6, Infrastructure Monitoring, and mitigation to exclude wildlife, such as skirting and fencing, is planned, as described in Section 6.2, Wildlife Construction and Operations Management.
3. If wildlife mortality is reported, as described in Section 7.2.7, Wildlife-Vehicle Interactions, and require mitigation including removal of the carcass, as described in Section 6.4, Road Management for Wildlife.
4. If observations of wildlife, particularly grizzly bears and wolverines, are recorded accessing waste management facilities as described in Section 7.2.5, Waste Management Monitoring, and triggers mitigation, as described in Section 6.3, Wildlife Attractant Management.
5. If waterbirds in are observed using on-site ponds which contain water which has tested above wildlife guidelines, as described in Section 7.2.11, Waterbird Monitoring in Ponds, may in turn trigger mitigation to exclude waterbirds from on-site ponds, as described in Section 6.2, Wildlife Construction and Operations Management.
6. If problem wildlife (particularly grizzly bears and wolverine) are observed on-site, and are deterred from site, as described in Section 6.8, Grizzly Bear and Wolverine Management.

7.1.5 Contributions to Government-Led Regional Monitoring Programs

As part of the DEIS review, Sabina committed to collaborating with GN-led wildlife monitoring programs for caribou, grizzly bear, muskox and wolverine, to replace Project-specific monitoring by Sabina. These programs are to be population-level monitoring programs and will replace any Project requirement to monitor for regional effects of the Project on these wildlife species. Sabina also committed to be involved in regional monitoring programs where the GNWT is taking the lead, and with the approval and participation of the GN. This section provides a framework for Sabina's involvement in these programs.

These contributions to regional programs for these four species will replace the monitoring programs proposed in Section 7.3 of the WEMP in the FEIS (using cameras as a monitoring tool). It should be noted that these contributions do not replace the planned on-site monitoring programs for wildlife, as described in Section 7.2 (Part I: Facility-Specific Wildlife Monitoring).

The first step in the process will be production and distribution of a monitoring plan for each species by the GN. Since these monitoring plans will be led by the GN, it will be the GN's responsibility to solicit comment from the KIA. Sabina will then review the monitoring plan to confirm that it is applicable to the Sabina Project geographic area. Sabina and the GN will then agree on a contribution method and timescale before proceeding.

In some cases, the GNWT has taken the logistical lead for monitoring a particular species or population (e.g., for monitoring the Bathurst caribou herd). In these cases, and where the GN has directed Sabina that the GNWT is the logistical lead for a particular monitoring program and this program is supported by the KIA, then Sabina will review the monitoring plan supplied by the GNWT and if applicable will agree with the GNWT on a contribution method and timescale. It should be noted that Sabina will not make contributions to both governments in a given year for a particular wildlife species.

The type, duration, and amount of contributions will depend on the proposed monitoring plan for each species. It should be noted that as of 2015, no plans have been provided by the GN or the GNWT for review by Sabina. The preferred contribution type is in-kind or material support; e.g., renting helicopter or aircraft time for aerial surveys, purchasing GPS collars for deployment by government biologists, support for meetings or conferences, or technical support by Sabina's technical team.

In lieu of material or in-kind support Sabina may also conduct monitoring work itself should the government-led program be structured as collaboration between projects. For example, the plan for monitoring the grizzly bear population could include multiple industrial projects, each being responsible for a portion of a larger DNA mark-recapture grid. In this example, Sabina would be responsible to conduct DNA mark-recapture for bears within a portion of the greater grid and then share data with the other projects/government partners.

During the DEIS review, the KIA requested that Sabina propose a backup monitoring plan should the GN not produce a monitoring plan for a given species. The first option in this case, where the GN does not have a plan for a particular species, but the GNWT has produced such a plan, then Sabina would (with the permission of the GN) review and contribute to the GNWT monitoring plan instead. Where neither government group has produced a monitoring plan for a particular species, then Sabina would default to a backup regional monitoring program. These programs are described in Section 7.3 (Part II: Focal Species Monitoring).

Sabina will report to the GN and the KIA on its activities as part of these population-level monitoring programs as part of the annual WEMP reporting (Section 11: Environmental Reporting).

7.1.6 Study Area

For terrestrial wildlife, including ungulates (caribou and muskox), carnivores (grizzly bears, wolverine and furbearers), raptors and migratory birds, the Regional Study Area (RSA) encompasses the Marine Laydown Area (MLA), the Goose Property, the winter road connecting the Goose Properties and the MLA, and a 30 km buffer on either side of all proposed Project infrastructure, covering an area of 12,620 km^2 (Figure 7.1-1). The LSA encompasses a 1 km buffer around all proposed Project infrastructure and the winter roads connecting these Properties, covering 1,344 km^2 (Figure 7.1-1).

For marine wildlife including marine mammals (ringed seals) and seabirds/seaducks, the marine RSA encompasses the marine areas of Bathurst Inlet from the southern-most tip of the Inlet to approximately 15 km north of Omingmaktok and is approximately 75 km in width, covering an area of 34,000 ha within Bathurst Inlet (Figure 7.1-2). The marine LSA encompasses a 1 km buffer around the shoreline of the MLA and 500 m on either side of the winter road where it crosses the inlet covering an area of 2,700 ha (Figure 7.1-2).

Facilities monitoring will largely be conducted on and adjacent to the Project footprint and winter roads within the LSA. Focal species monitoring will be conducted largely within the RSA. If a collaborative approach to wildlife monitoring is taken with other stakeholders, some of the monitoring work may occur outside of the RSA, particularly for species like caribou which range over a wider area.

7.1.7 Reporting

The results of the facilities monitoring and focal species monitoring will be reported regularly in the WEMP and distributed to regulatory agencies and the Kitikmeot Inuit Association (see Section 11, Environmental Reporting).

Should periods of temporary closure or care and maintenance occur, some facilities monitoring will continue, which will be summarized in a memo to regulators. The periodicity of reporting for the closure and post closure phases will be agreed upon prior to closure commencing.

7.2 PART I: FACILITY-SPECIFIC WILDLIFE MONITORING

Section 6, Environmental Protection Measures, describes the mitigation and management activities planned for the Project site. Facility-specific wildlife monitoring will be conducted to trigger and monitor the efficacy of management actions.

The facility-specific monitoring programs and their corresponding environmental protection measures are listed in Table 7.2-1. The facility-specific monitoring program is then summarized in Table 7.2-2.

Table 7.2-1. Facility-Specific Monitoring Programs and their Corresponding Environmental Protection Measures

Facility-Specific Monitoring	Environmental Protection Measures
7.2.1 Footprint Monitoring	6.2 Wildlife Construction and Operations Management
7.2.2 Human Activity Monitoring	6.4 Road Management for Wildlife
7.2.3 Pre-Clearing Surveys for Nests	6.2 Wildlife Construction and Operations Management
7.2.4 Pit and Quarry Wall Nest Monitoring	6.2 Wildlife Construction and Operations Management
7.2.5 Waste Management Monitoring	6.3 Wildlife Attractant Monitoring
7.2.6 Infrastructure Monitoring	6.2 Wildlife Construction and Operations Management

(continued)

Table 7.2-1. Facility-Specific Monitoring Programs and their Corresponding Environmental Protection Measures (completed)

Facility-Specific Monitoring	Environmental Protection Measures
7.2.7 Wildlife-Vehicle Monitoring	6.4 Road Management for Wildlife
7.2.8 On-Ice Monitoring at the MLA	6.2 Wildlife Construction and Operations Management
7.2.9 Incidental Wildlife Monitoring	6.2 Wildlife Construction and Operations Management 6.3 Wildlife Attractant Monitoring 6.4 Road Management for Wildlife 6.5 Aircraft Management for Wildlife 6.7 Wildlife Policies 6.8 Grizzly Bear and Wolverine Management 6.10 Mitigation and Management for Caribou
7.2.10 Noise Monitoring	6.6 Noise Abatement for Wildlife
7.2.11 Waterbird Monitoring in Ponds	6.2 Wildlife Construction and Operations Management
7.2.12 Pre-Clearing Surveys for Bear Dens	6.4 Road Management for Wildlife
7.3.1.4 Ground-Based Visual Monitoring	6.10 Mitigation and Management for Caribou

Facility-specific wildlife monitoring will be conducted by on-site environmental staff or by designated professionals. This ensures that wildlife monitoring will be conducted by personnel who are familiar with:

- Predicted wildlife-project conflicts;
- Wildlife mitigation commitments;
- Site history of wildlife interactions and conflicts, and;
- The evolving adaptive management process.

This facility-specific monitoring program enables effective data collection and the implementation of a consistent adaptive management process. The Environment Team, in collaboration with security staff, can also play a role in managing wildlife safety issues (i.e., problem bears) from a position of site-specific wildlife knowledge.

The results of facility-specific monitoring will be reported in the WEMP Report (see Section 11, Environmental Reporting).

7.2.1 Footprint Monitoring

7.2.1.1 Background and Trigger for Monitoring

Construction of the infrastructure for the Project will result in both short and long term reduction of a small area of existing wildlife habitat and may, in some instances, create new habitat. The FEIS evaluated the effects of habitat loss on wildlife and describes one of the primary forms of mitigation as the reduction of the size of the Project footprint wherever possible. Planning of infrastructure, progressive reclamation during operations, and reclamation of the areas affected by mining activities following closure will limit the area of disturbance to the greatest degree possible and provide alternative, functional habitats for wildlife in the future. Effects on wildlife were rated as negligible or low magnitude as a consequence of the small footprint size. This monitoring program track the as-built size of the Project, compared to the size presented in the FEIS. Monitoring will occur in each year of the Project, including Reclamation/Closure and as needed in Post-Closure to track the reclamation of the site.

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October 27 2015

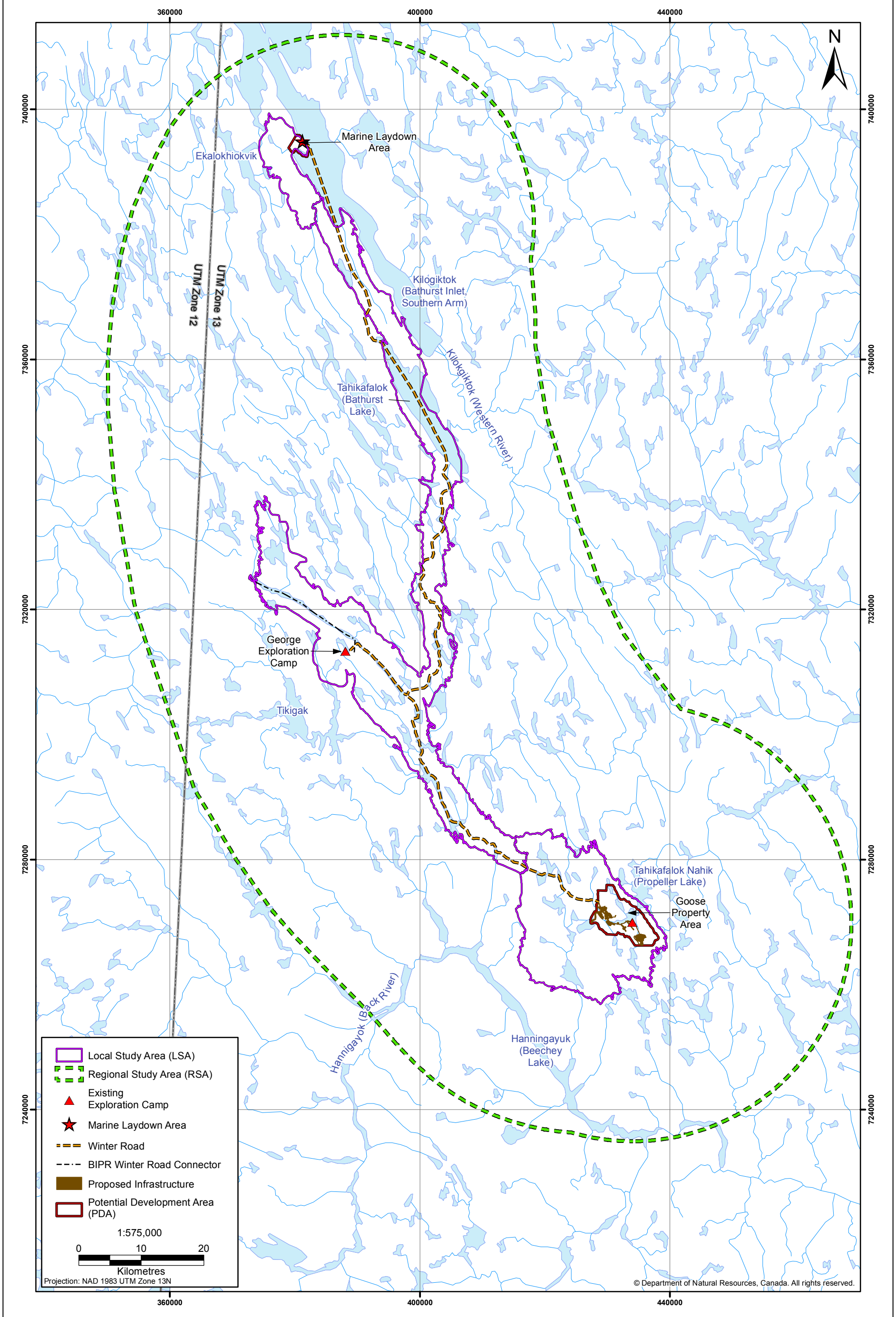

Figure 7.1-1

Local and Regional Study Areas for Terrestrial Wildlife

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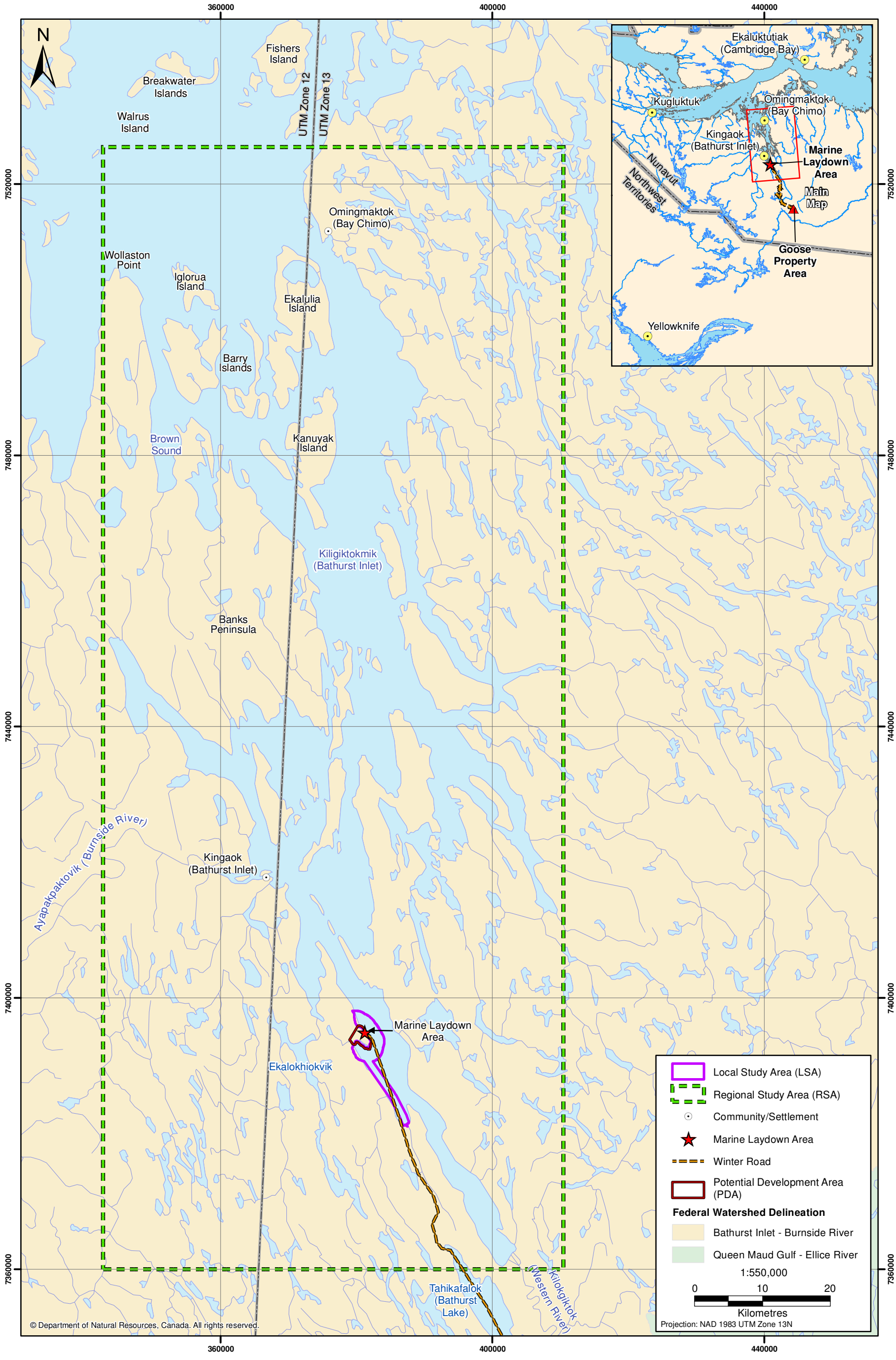

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Figure 7.1-2

Local and Regional Study Areas for Marine Wildlife

Rescan an ERM company

Table 7.2-2. Facility-Specific Wildlife Monitoring Program and Project Phases

Facilities Monitoring Sub-Programs	Baseline/ Pre-Construction	Mobilization and Construction	Operations	Temporary Closure*	Care and Maintenance*	Reclamation/ Closure*	Post-Closure
Section 7.2.1 - Footprint Monitoring *Mapping Project Footprint (as-built surveys)*		Yearly	Yearly	--	--	Yearly	As needed to track reclamation
Section 7.2.2 - Human Activity Monitoring *Reporting Hunting and Fishing on the Project site*	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	--
Section 7.2.3 - Pre-Clearing Surveys for Nests *Area to be cleared for new Project infrastructure in the nesting season will be pre-surveyed for nesting birds*	--	If triggered, In Spring	If triggered, In Spring	--	--	--	--
Section 7.2.4 - Pit and Quarry Wall Nest Monitoring *During spring, observations will be made of pits to determine if raptors are nesting and appropriate mitigation will be enacted*	--	Yearly, In Spring	Yearly, In Spring	--	--	--	--
Section 7.2.5 - Waste Management Monitoring *Monitoring waste storage areas for misdirected waste or signs of wildlife*	Weekly	Weekly	Weekly	--	Weekly	Weekly	--
Section 7.2.6 – Infrastructure Monitoring *Fence inspections and wildlife observations*	--	Monthly	Monthly	--	Monthly	Monthly	--
Section 7.2.7 - Wildlife-Vehicle Interactions *Observations of wildlife and wildlife incidents along the site roads and winter roads*	--	Ongoing	Ongoing	--	Ongoing	Ongoing	--
Section 7.2.8 – On-Ice Monitoring at the MLA *Survey area of sea ice prior to on-ice works if construction occurs during Feb 15-March 15*	2 years baseline	If triggered	If triggered	--	--	--	--

(continued)

Table 7.2-2. Facility-Specific Wildlife Monitoring Program and Project Phases (completed)

Facilities Monitoring Sub-Programs	Baseline/ Pre-Construction	Mobilization and Construction	Operations	Temporary Closure*	Care and Maintenance*	Reclamation/ Closure*	Post-Closure
Section 7.2.9 - Incidental Wildlife Reporting *Incidental Wildlife Observations*	Ongoing	Ongoing	Ongoing	--	Ongoing	Ongoing	--
Section 7.2.10 - Noise Monitoring *Monitor noise levels outside the footprint*	One time during Baseline	One time during Construction	One time every three years during operations	--	--	One time during Reclamation and Closure	--
Section 7.2.11 - Waterbird Monitoring in Ponds Monitor waterbird usage of Project ponds if water quality does not meet wildlife guidelines	--	Weekly (May through October)	Weekly (May through October)	--	Weekly (May through October)	Weekly (May through October)	--
Section 7.2.11 – Pre-Construction Surveys for Bear Dens Conduct surveys to identify potential bear dens prior to construction of the ice road		If triggered	If triggered			If triggered	

** Monitoring is dependent on personal being present at site.*

7.2.1.2 Objectives

The objective of footprint monitoring is to quantify habitat losses due to construction and clearing of areas for Project infrastructure, site roads, mine sites, and camps. By overlaying any changes in the project footprint on baseline habitat maps, the amount of habitat altered each year can be calculated.

7.2.1.3 Monitoring Methods

The footprint will be overlain on previous years footprints, the planned footprint, and wildlife habitat maps on a yearly basis. The yearly footprint will be taken from engineering drawings for the site, provided by the Project engineering staff. Areas available for progressive reclamation will be identified and recorded separately.

7.2.1.4 Data Analysis

A GIS analysis will be conducted to overlay the constructed footprint area with the habitat suitability mapping for each VEC species conducted during baseline studies. Maps and a table of habitat areas will be produced.

7.2.1.5 Triggers for Adaptive Mitigation

The results of footprint monitoring will be provided to managers to guide additional mitigation to limit and constrain the footprint, as described in Section 6.2, Wildlife Construction and Operations Management. If the constructed footprint exceeds the planned PDA area, then this area will be reported in the WEMP report.

7.2.1.6 Reporting

Footprint monitoring will be reported in the annual WEMP report during years that the footprint has increased in size as maps of the Project and the areas of habitat removed.

7.2.2 Human Activity Monitoring

7.2.2.1 Background and Trigger for Monitoring

The FEIS evaluated the potential for effects of new access to the Project site along the winter road from the MLA and determined there was a negligible potential for increased access. As part of the mitigation measures to minimize additional access to the areas surrounding the Project, all winter roads will be closed to the public. Road use will be restricted only to persons required for Project construction, operations, and maintenance. Human activity monitoring will evaluate whether people are using the ice road and whether measures to control access have been effective. Human activity monitoring will occur in each year that the ice road is active. The results of human activity monitoring will be used for adaptive management of measures to prevent usage of the ice road, as described in Section 6.2, Wildlife Construction and Operations Management.

7.2.2.2 Objectives

The objective of human activity monitoring is to evaluate if measures to prevent persons from using the ice road have been successful.

7.2.2.3 Monitoring Methods

All winter roads, site roads, and emergency shelters will be monitored for human activity by Project staff during all project phases where the ice road is active. Monitoring will be through incidental

observations of persons using the ice road. If evidence of use is observed along the Project roads and infrastructure the following will be documented:

- Type of vehicles of access (e.g., snowmobile, quad, truck, etc.);
- Number of individuals;
- Purpose of access (e.g., hunting, recreational use), and;
- Outcome of any interactions with project personnel.

Prior to construction of the Project, a detailed SOP will be produced. The SOP will include training requirements for staff, methods for monitoring, and data sheets.

7.2.2.4 Data Analysis

Any observations of persons and the data collected on location, purpose of visit, etc. will be collated into a database and tracked for changes from year to year.

7.2.2.5 Triggers for Adaptive Mitigation

Observations of persons using the ice road will immediately lead to the local manager/team leader contacting the person and explaining the use policy. Should more than five persons be seen in a calendar year, the policies for Road Management for Wildlife (Section 6.4) will be updated in the WMMP.

7.2.2.6 Reporting

Observations of persons using the ice road, and the corrective action taken will be reported in the annual WEMP report.

7.2.3 Pre-Clearing Surveys for Nests

7.2.3.1 Background and Trigger for Monitoring

The FEIS evaluated the potential effects of mortality and disturbance due to construction on birds. The Migratory Birds Convention Act (1994) prohibits destruction of the nests of migratory birds and their contents. To prevent potential effects, mitigation has been proposed, included avoiding vegetation clearing within the bird breeding season. If clearing was required in the bird breeding season, then pre-clearing surveys for nests would be triggered. If a nest were discovered, then appropriate work setbacks would be implemented, as described in Section 6.2, Wildlife Construction and Operations Management. With mitigation, potential effects on birds were not expected. Pre-clearing surveys would be triggered whenever vegetation clearing is planned during the bird breeding season.

7.2.3.2 Objectives

The objective of pre-clearing surveys for nests is to identify active bird (raptor, waterbird, and upland breeding bird) nests at risk of disturbance from vegetation clearing and thereby trigger appropriate work setbacks (Section 6.2).

7.2.3.3 Monitoring Methods

Pre-clearing surveys for bird nesting activity will:

- Document birds nesting in areas slated for clearing;

- Document locations and habitat where active nesting is occurring, and;
- Identify opportunities for protecting established nests.

During the DEIS review, the Canadian Wildlife Service (CWS) requested that disturbance due to nest searches be reduced to a minimum. This will be accomplished in three ways: 1) clearing work will avoid the bird breeding season, as stated in the FEIS, 2) should clearing work be required in the bird breeding season it will be focused (where possible) in vegetation communities that support lower densities of birds (thereby removing the need to conduct surveys in higher density nesting areas), and 3) survey methods that minimize disturbance to nests will be used.

Baseline surveys indicated that wetland and shrubby vegetation communities supported approximately 50% higher densities of nesting birds than did upland, dry lichen habitats. Where there are options, work will avoided in wetland and shrubby areas and focused on dry upland areas. Thus, the higher density of nests in wetland and shrubby areas can be preserved without the need for nesting surveys.

Nest surveys will be conducted within an appropriate period (suggested 14 days) in areas scheduled to be cleared for construction using standard observation techniques by qualified personnel (i.e., biologists trained in bird ecology and behaviour). Several survey methods are available for nest searching which trade off accuracy and the amount of disturbance to nesting birds. The choice of methods will be left to the discretion of the surveyors based on the habitat type, season, and topography with the proviso that they will reduce disturbance to birds as much as possible. As a guide, surveyors will walk transects through the area slated for clearing, each following a transect 15 m apart from the adjacent surveyor. Observers will stop every 25 m and note all birds within a 50 m radius.

To be as non-intrusive as possible, observers will record all evidence of potential breeding behaviour for all species observed; this could include observations of singing males, territorial and courtship displays, copulation, alarm calls, or detections of birds carrying nest material or food. Observers will note the approximate location of the nest taking precautions to not approach the nest as much as possible, and trigger the applicable work setback distances. Observers will not mark the nest with flags or tape, such that predators are not alerted to the presence of the nest. Observers will use a GPS to mark bird territories and nest sites.

Species-specific buffers will follow best management practices. When raptor nests are encountered, a species-specific buffer will be assigned, as described in Section 6.2, Wildlife Construction and Operations Management. Surveys will be repeated if clearing activities do not occur within approximately 14 days of the original survey. Records will be kept of all nest survey effort and findings. Reports of active nests will be provided to the appropriate regulators on a case-by-case basis to advise on the management response, if necessary.

Prior to construction of the Project, a detailed SOP will be produced. The SOP will include training requirements for staff, methods for monitoring, and data sheets.

7.2.3.4 Data Analysis

Records of pre-clearing surveys conducted (e.g., the locations, date, GPS track of surveyors, etc.) and the results of the surveys (birds observed, status, evidence of nests) along with any mitigation that has been triggered will be collated into a database.

7.2.3.5 Triggers for Adaptive Mitigation

The observation of a nesting bird in an area slated for development will trigger communications with the GN DOE or CWS, depending on the species, and will trigger adaptive management, in the form of setting a work buffer around the nest, as described in Section 6.2, Wildlife Construction and Operations Management.

7.2.3.6 Reporting

The results of pre-clearing surveys for nests and the corrective action taken will be reported in the annual WEMP report.

7.2.4 Pit and Quarry Wall Nest Monitoring

7.2.4.1 Background and Trigger for Monitoring

Raptors can, when there are limited cliffs for nesting in the local area, choose to nest on the walls of open pit mines and quarries. The FEIS evaluated a potential effect of injury or mortality to raptors as a consequence of blasting in the pit as a residual effect with low magnitude with mitigation. The Nunavut Wildlife Act also provides prohibits the destruction of birds eggs and disturbance to wildlife. Setback buffers are often applied to raptor nests to prevent destruction or disturbance to the nests. Pit and Quarry wall nest monitoring is intended to identify raptors who are attempting to nest in the pits and quarries and trigger mitigation to deter them. The net result of this mitigation is to avoid harm to the raptor while maintaining operability of the site.

7.2.4.2 Objectives

The objective of the pit and quarry wall nest monitoring is to identify active raptor nests at risk of disturbance from blasting activities. Nest monitoring at pit and quarry sites will be conducted during the raptor nesting period if blasting is planned to ensure that incubating adults and young are not disturbed and no work setbacks are triggered.

7.2.4.3 Monitoring Methods

Nest surveys will be conducted in pit and quarry areas scheduled for blasting during the raptor breeding period by qualified personnel (i.e., biologists trained in bird identification and behaviour). Visual surveys for nesting activity will be conducted in open pits on a weekly or bi-weekly basis. Standard methods will include a two person team. One member of the team will scan the pit walls for evidence of roosting raptors or nest-building. The other member of the team will scan the sky for flying raptors.

Observations of birds, nests, and nesting activity such as nest construction, copulations, incubation, perching, food deliveries, and territorial displays will trigger deterrents and additional monitoring to confirm that the raptor has left the pit, or to trigger additional deterrents.

Deterrents such as bear banger, “bear screamers”, air cannons, and call playback device may be triggered if the raptor appears to be attempting to nest. In addition, or alternatively, fencing may be placed over a nesting site to exclude raptors if deterrents are not successful, and/or to permanently exclude raptors from a particular location. Additional information on deterrents is located in Section 6.2 Wildlife Construction and Operations Management.

If nest building is observed, but the raptors have yet to lay an egg, then the nest materials will be removed and the site will be monitored. The preference at these locations is to also mitigate using fencing to exclude further attempts to nest.

Additional monitoring may be triggered when raptors are observed that return to the pit after deterrents have been used. Monitoring may then be conducted several times per day.

The GN DOE will be contacted and informed when a raptor has been observed in the pit and deterrents have been used.

In all instances, environment staff will identify opportunities for protecting established nests. In some cases, raptors may attempt to nest in areas of the pit sufficiently removed from blasting locations that there is little chance of raptor injury or disturbance by blasting. In these cases, and after informing GN DOE, the raptors may be left to nest in the pit or quarry location. These raptors would then be monitored until the chicks have fledged the nest.

Prior to construction of the Project, a detailed SOP will be produced and distributed to the NIRB and the KIA for review and comment. The SOP will include training requirements for staff, methods for monitoring, and data sheets.

7.2.4.4 Data Analysis

Records of pit nest monitoring, including the dates monitored, the identity of the crew, the results of monitoring, any management actions taken and the success of these methods will be collated into a database.

7.2.4.5 Triggers for Adaptive Mitigation

Observations of raptors attempting to nest in the pit will trigger adaptive management measures, as listed in the methods section above, and in Section 6.2, Wildlife Construction and Operations.

7.2.4.6 Reporting

Results of monitoring, including the dates, personnel, observations, use of deterrents and effectiveness of deterrents, will be recorded and reported in the annual WEMP report.

7.2.5 Waste Management Monitoring

7.2.5.1 Background and Trigger for Monitoring

Some wildlife species can be attracted by wastes to camps and other Project infrastructure. The FEIS evaluated the potential effects of attractants on wildlife, particularly grizzly bears and wolverine, and determined the need for waste management to reduce the attractiveness of the Project. Preventing wildlife attraction and habituation is important to ensure both wildlife and worker safety.

A waste management program will be implemented during all phases of the Project except post-closure, as described in Section 6.3, Wildlife Attractant Management. This section describes the on-site monitoring program that triggers and evaluates the efficacy of waste management Waste management monitoring will be conducted in all phases of the Project except post-closure.

7.2.5.2 Objectives

The objectives of waste management monitoring are to record wastes on-site and thereby trigger waste management, and to evaluate the efficacy of ongoing waste management.

7.2.5.3 Monitoring Methods

Waste monitoring is divided into four parts:

1. Incidental observations of wastes;
2. Regular surveys of waste facilities;
3. Recording observations of wildlife at waste facilities, and;
4. An annual audit of waste management and camps.

All staff will be responsible for recording incidental observations of mis-directed or waste storage not meeting the objectives of Wildlife Attractant Management (Section 6.3). All personnel will report to the Environmental Department when they observe waste disposed of in a manner that could attract wildlife (i.e., littering, misdirected waste, uncontained waste, wildlife accessing waste).

Waste disposal facilities will be monitored weekly by environmental or operations staff to ensure that wastes are being properly disposed of. Waste facilities will be inspected for signs of wildlife activity (e.g., chew marks on waste, wildlife mediated waste dispersion, wildlife scat or tracks).

Cases of misdirected waste or wildlife-waste interaction will be recorded in a waste inspection log, which may include the following information:

- Location, date, and time;
- Type and amount of waste, and;
- Any damage to mine property.

Any incidents where wildlife has been observed to interact directly with wastes, or observations of habituated wildlife (particularly bears and wolverine) will be reported to Project environment staff and appropriate regulatory agencies and authorities. Problem wildlife may be evaluated by Environment Team and corrective measures implemented in consultation with the Nunavut Department of Environment. The following information will be collected (See also Section 7.2.9, Incidental Wildlife Monitoring):

- Species, number of animals, age, and sex (if possible);
- Behaviour (e.g., feeding), and;
- Condition (e.g., limping, wounded, salivating).

In addition, an annual audit will be conducted of the various camps and facilities to evaluate any opportunities for improvement in the handling of wastes and wildlife attractant management (Section 6.3).

Prior to construction of the Project, a detailed SOP will be produced. The SOP will include training requirements for staff, methods for monitoring, and data sheets.

7.2.5.4 Data Analysis

The results of the regular waste management measures and the annual audit of the site will be collated into a database and tracked for changes between years and whether any changes are related to specific activities or mitigation actions.

7.2.5.5 Triggers for Adaptive Mitigation

- Waste management activities may be triggered by observations of misdirected wastes, as described in Section 6.3, Wildlife Attractant Management;
- Incidental observations of grizzly bears, wolverines or foxes on the site will trigger waste management monitoring; and
- Repeated observations of grizzly bears, wolverines or foxes, which are known to be attracted to camps and facilities, will trigger waste management monitoring (including a site audit if there are several observations in a month) and a review of the Wildlife Attractant Management policies (Section 6.3).

7.2.5.6 Reporting

Results of regular waste monitoring, the annual audit, any mitigation that has been conducted, and the success of that mitigation will be reported in the annual WEMP report.

7.2.6 Infrastructure Monitoring

7.2.6.1 Background and Trigger for Monitoring

Some wildlife species can be attracted to camps and other Project infrastructure by wastes or as a habitat to be used for foraging or denning/nesting. The FEIS evaluated the potential effects of attractants on grizzly bears and wolverine and some bird species and determined the need to exclude wildlife from the camps and other infrastructure. Skirting and fences play a key role in preventing wildlife-human interactions at project facilities. Regular inspections of facility fencing and skirting will ensure that fences are operational and effective at excluding wildlife without causing them harm.

Preventing wildlife attraction and habituation is important to ensure both wildlife and worker safety.

Section 6.2, Wildlife Construction and Operations Management, describes a series of activities that will be used to exclude wildlife, including skirting around all buildings to exclude wildlife from under buildings and potentially fencing surrounding some facilities on an as-needed bases (e.g., waste management facilities). This section describes the on-site monitoring program that triggers and evaluates the efficacy of skirting, fencing and other wildlife exclusion measures.

7.2.6.2 Objectives

The objectives of infrastructure monitoring are to record the status of wildlife exclusion measures, such as skirting and fencing.

7.2.6.3 Monitoring Methods

Environmental staff will monitor skirting and fencing on a monthly basis. Monitors will walk the perimeter of the skirting/fencing looking for damage, downed fencing, animals, or animal sign inside the fence. Cases where the fence/skirting has been damaged or breached will be recorded in an inspection log, and may include the following information:

- damage to the fencing or materials that may be causing the fence to be ineffective (i.e., snow, vegetation); and
- any wildlife observed accessing through the fencing/skirting.

Prior to construction of the Project, a detailed SOP will be produced and distributed to the NIRB and the KIA for review and comment. The SOP will include training requirements for staff, methods for monitoring, and data sheets.

7.2.6.4 Data Analysis

The results of the regular infrastructure monitoring and any management actions taken will be collated into a database and tracked for changes between years and whether any changes are related to specific activities or mitigation actions.

7.2.6.5 Triggers for Adaptive Mitigation

Damaged skirting and fencing will be reported to maintenance staff and trigger either immediate repair or installation of new/additional skirting and fencing. Implementation of skirting and fencing is described in Section 6.2, Wildlife Construction and Operations Management.

7.2.6.6 Reporting

Results of regular infrastructure monitoring, any mitigation that has been conducted, and the success of that mitigation will be reported in the annual WEMP report.

7.2.7 Wildlife-Vehicle Interactions

7.2.7.1 Background and Trigger for Monitoring

The FEIS evaluated the potential for effects on wildlife due to disturbance from vehicles, and mortality from vehicle-wildlife collisions and commits Sabina to conducting road management for wildlife (Section 6.4). Wildlife activity along the Project site roads and winter roads will be recorded during all Project phases when they are active.

Observations of caribou on the roads will trigger vehicles to slow their speed or give caribou the right of way, depending on their distance from the road, as described in Section 6.10, Mitigation and Management for Caribou. Observations of other wildlife on the road will trigger management, including giving wildlife the right of way, as described in Section 6.4, Road Management for Wildlife. Observations of wildlife mortality will trigger the removal of roadkill and additional reporting and adaptive management, as described in Section 6.4, Road Management for wildlife.

7.2.7.2 Objectives

The objectives for collecting this information are to:

- document wildlife observations along roads;
- document wildlife-vehicle collisions;
- identify sections of the road that might be at risk of collisions (e.g., adjacent to high quality forage and near movement corridors);
- identify opportunities for reducing risks; and
- assess effectiveness of mitigation measures over time.

7.2.7.3 Monitoring Methods

As part of incidental wildlife monitoring (Section 7.2.9), all Project personnel, including drivers, will be required to report and act on observations of wildlife near the road. Personnel will report observations to the Environment Team.

Environment staff will also survey the Project site to record wildlife or wildlife sign whenever they drive the road, and note areas that may pose potential wildlife hazards (e.g., high snow banks or good forage in road verge). In addition to opportunistic monitoring by environment staff, all site personnel will be asked to report any observations or incidents involving wildlife species near or on the roads. All traffic along the site roads and winter roads will be equipped with radios, which will allow timely reporting of wildlife-vehicle and wildlife-road interactions to the Environment Team.

Wildlife activity along the road will be recorded in a road wildlife log. When VEC wildlife or wildlife carcasses are observed along the access road, a wildlife log will be filled in that includes relevant information, such as:

- location (nearest 1 km road marking or landmark, or GPS location), date and time;
- weather (e.g., light snow fall, rain) and road conditions (e.g., ice on road);
- species, number of animals, sex and age;
- cause of death (if a mortality);
- behaviour (e.g., travelling along road, grazing at road edge);
- condition;
- description of any potential wildlife attractants along the road (e.g., food resources); and
- any potential wildlife hazards along the road (e.g., 2 m snow banks along road preventing caribou crossing).

Prior to construction of the Project, a detailed SOP will be produced. The SOP will include training requirements for staff, methods for monitoring, and data sheets.

7.2.7.4 Data Analysis

The results of observations of animals on the roads and any incidents or mortalities will be collated into a database and tracked for changes between years and whether any changes are related to specific activities or mitigation actions.

7.2.7.5 Triggers for Adaptive Mitigation

Observations of wildlife using the road will trigger:

- Caribou - vehicles to slow their speed or give caribou the right of way, depending on their distance from the road, as described in Section 6.10, Mitigation and Management for Caribou; and
- Other wildlife - management including giving wildlife the right of way, as described in Section 6.4, Road Management for Wildlife.

Observations of wildlife incidents or mortalities on the roads will trigger:

- personnel to fill in a sightings log (described above);

- the Project to contact the GN DOE and the KIA to report the incident or mortality, as described in Section 7.1.4, Liaising with Government and the KIA; and
- carcasses to be removed to avoid attraction of carrion feeders to the road as described in Section 6.4, Road Management for Wildlife. Carcass removal will be tasked to road maintenance crews. Carcasses will either be incinerated or moved to a location away from any traffic activity (> 2 km from the road). Vehicle-caused mortality for all VEC wildlife species will be immediately reported to the appropriate regulatory authorities.

7.2.7.6 Reporting

All incidental observations of wildlife on the road, along with observations or incidents or mortality, management actions taken and their success will be reported in the annual WEMP report.

7.2.8 On-Ice Monitoring at the MLA

7.2.8.1 Background and Trigger for Monitoring

During March and April, ringed seals create lairs under pressure ridges and snow drifts on sea ice to have their pups. The FEIS evaluated the risk of on-ice operations at the MLA that may result in the damaging of lairs and the injury or mortality of ringed seals through construction of the ice road to the Goose PDA or through construction of a landing strip for aircraft. The preferred mitigation to avoid seal lairs is to avoid construction of the ice road across sea ice ridges or large snow drifts. If this is not possible, then monitoring for ringed seals will be triggered prior to construction.

7.2.8.2 Objectives

The objective of on-ice monitoring is to determine the location of, and avoid, seal lairs when constructing the ice road and airstrip on the sea ice at the MLA.

7.2.8.3 Monitoring Methods

Monitoring methods will include pre-construction surveys prior to on-ice operations using suitable methods (e.g., working with Inuit hunter or thermal-vision camera).

Prior to construction of the project, a detailed SOP will be produced. The SOP will include training requirements for staff, methods for monitoring, and data sheets.

7.2.8.4 Data Analysis

Records of the monitoring actions (location, methods, personnel, etc.) and the results of on-ice monitoring will be collated into a database and tracked for changes between years and whether any changes are related to specific activities or mitigation actions.

7.2.8.5 Triggers for Adaptive Mitigation

On-ice operations will be moved based on locations of lairs to provide a 50 m buffer between on-ice operations and lairs as described in Section 6.2, Wildlife Construction and Operations Management.

7.2.8.6 Reporting

All incidental observations of wildlife on the road, along with observations or incidents or mortality, management actions taken and their success will be reported in the annual WEMP report.

7.2.9 Incidental Wildlife Monitoring

7.2.9.1 Background and Trigger for Monitoring

Several wildlife mitigation actions are to be triggered by incidental observations of wildlife. This section describes the various types of incidental monitoring and the various mitigation actions to be triggered by observations of wildlife.

7.2.9.2 Objectives

Objectives for keeping this log include:

- recording general wildlife activity in the Project area;
- identifying unexpected conflicts or potential conflicts posed by existing Project facilities for wildlife;
- triggering additional monitoring and mitigation; and
- identifying opportunities for adaptive management if a new risk to wildlife is identified.

7.2.9.3 Monitoring Methods

Incidental observations of wildlife can be divided into several types, based on the situation in which wildlife are observed:

1. Incidental observations by persons working on-site;
2. Incidental observations by pilots and aircrew; and
3. Incidental observations by drivers on the ice road or on-site roads.

Methods for Incidental Observations

General wildlife observations of interest (e.g., species of conservation concern, migratory birds, raptors) made by environment staff and other mine personnel will be recorded in a wildlife observation log. Staff will be trained to fill in the wildlife observation log and report their observations to the Environment Department.

All personnel will be asked to report observations of wildlife species interacting with Project facilities to the Environmental Department. Environment staff will routinely inspect all Project facilities to check for signs of wildlife interaction or conflict. Additional areas that wildlife may show interest in include:

- storage facilities and buildings that may serve as refuge;
- areas where chemicals may have been applied (e.g., dust suppressants); and
- lighting or power poles that may be used for nesting.

When wildlife are observed the following information may be recorded:

- location, date, and time;
- type of interaction (e.g., attraction, nesting);
- species, number of animals, age, and sex (if possible);
- behaviour (e.g., feeding, resting);

- condition (e.g., limping, wounded, salivating); and
- any damage to or interaction with mine property.

Prior to construction of the project, a detailed SOP will be produced. The SOP will include training requirements for staff, methods for monitoring, and data sheets.

7.2.9.4 Data Analysis

Records of the monitoring actions (location, methods, personnel, etc.) and the results of on-ice monitoring will be collated into a database and tracked for changes between years and whether any changes are related to specific activities or mitigation actions.

7.2.9.5 Triggers for Adaptive Mitigation

Incidental observations can trigger several different management actions based on 1) which animal is observed, 2) where the animal is located, and 3) the Project activity at that site. Triggers are organized by the identity of the observer for clarity.

Incidental Observations by Pilots and Aircrew

Incidental observations of wildlife by pilots and aircrew will trigger pilots to avoid wildlife, as described in Section 6.5, Aircraft Management for Wildlife.

If caribou are observed by pilots or aircrew, additional mitigation is triggered, as described in Section 6.10, Mitigation and Management for Caribou.

Incidental Observations by Drivers

Incidental observations of wildlife by drivers on the ice road or on-site roads is described in further detail in Section 7.2.7, Wildlife-Vehicle Interactions, and will trigger mitigation (e.g., reduced speeds or stopping to give wildlife the right of way, as described in Section 6.4, Road Management for Wildlife.

If caribou are observed by drivers, additional mitigation is triggered, as described in Section 6.10, Mitigation and Management for Caribou.

Incidental Observations by On-Site Personnel

Incidental observations of wildlife by on-site personnel can trigger several different mitigation actions:

1. Observations of caribou on-site will trigger the Environment Team to deploy caribou monitors, as described in Section 7.3.1.4, Local-Scale and Facilities Monitoring for Caribou, and may in turn trigger management of the site in response to caribou presence, as described in Section 6.10, Mitigation and Management for Caribou.
2. Observations of wildlife accessing project infrastructure is also described in Section 7.2.6, Infrastructure Monitoring, and may in turn trigger additional mitigation to exclude wildlife, such as skirting and fencing, as described in Section 6.2, Wildlife Construction and Operations Management.
3. Observations of raptors in the pits or quarries will trigger Pit and Quarry Wall Nest Monitoring (Section 7.2.4) and may in turn trigger mitigation to exclude the raptors, as described in Section 6.2, Wildlife Construction and Operations Management.

4. Observations of wildlife mortality is also described in Section 7.2.7, Wildlife-Vehicle Interactions, and may in turn trigger mitigation including removal of the carcass, as described in Section 6.4, Road Management for Wildlife.
5. Observations of wildlife (particularly grizzly bears and wolverines) accessing waste management facilities is described in more detail in Section 7.2.5, Waste Management Monitoring, and may in turn trigger mitigation, as described in Section 6.3, Wildlife Attractant Management.
6. Observations of waterbirds in on-site ponds will trigger additional monitoring, as described in Section 7.2.11, Waterbird Monitoring in Ponds, and may in turn trigger mitigation to exclude waterbirds from on-site ponds, as described in Section 6.2, Wildlife Construction and Operations Management.
7. Observations of grizzly bear on-site will trigger immediate mitigation, as described in Section 6.8, Grizzly Bear and Wolverine Management.
8. Observations of feeding wildlife, littering, hunting equipment or hunting activity on-site will trigger mitigation described in Section 6.7, Wildlife Policies.

Wildlife in Poor Condition

Wildlife in poor condition, that may be diseased, or that may have been harmed by mine structures or processes will be reported to the Project environment team, who will in turn inform regulatory authorities.

7.2.9.6 Reporting

All incidental observations of wildlife on the road, along with observations or incidents or mortality, management actions taken and their success will be reported in the annual WEMP report.

7.2.10 Noise Monitoring

7.2.10.1 Background and Trigger for Monitoring

Under certain circumstances, wildlife can avoid industrial sites due to noise. The FEIS evaluates the potential effect of disturbance due to noise, and resulting indirect habitat loss for each wildlife VEC and proposes several forms of mitigation to reduce noise on-site. This noise monitoring program evaluates the level of noise surrounding the site. This section describes the noise monitoring that has taken place already (baseline survey) as well as outlining the plan for future noise monitoring on-site.

7.2.10.2 Objectives

Objectives for noise monitoring are:

- to validate the predictions of the FEIS;
- measure noise for human receptors; and
- measure noise for wildlife receptors.

7.2.10.3 Monitoring Methods

Schedule

It is proposed to conduct the Noise Monitoring Program as follows:

- one time during baseline conditions;

- one time during construction;
- one time every three years during operations; and
- one time during reclamation and closure.

Noise baseline monitoring was undertaken at ten locations in March and June of 2012. Noise monitoring will continue at appropriate sites where noise is predicted to be high.

The March and June time periods were chosen to include the bird nesting period and a portion of the caribou migration in June. These two periods also encompass a wide range of environmental variation, the first being conducted during winter conditions, with cool air and snow cover on the ground while the second occurred during summer.

Locations for Monitoring

The locations of the ten noise monitoring sites were selected to characterize the range of baseline conditions in the region, based on their proximity to known deposits and sensitive wildlife receptors.

Research on caribou in Nunavut and the NWT using both aerial surveys and GPS collar information has reported a zone of influence (ZOI) of 12 to 14 km radius around operating mines (Boulanger 2009). Research on raptors in the NWT, using similar methods to those at the Project have reported a zone of influence, with reduced productivity (successful chicks in August per occupied nest in June) within 1 km of operating mines (Rescan *in prep*). Hence, noise monitoring points during both the spring and summer sampling periods will measure sound within, beyond and at the ZOI boundary for both groups.

The specific distances where noise levels will be monitored relative to project activities at the Goose Property are as follows:

1. to address potential effects on birds: along the 45 dBA contour, 1 km and 3 km; and
2. to address potential effects on caribou: 1 km, 3 km, 5 km, and 14 km.

The predominant wind directions will be used to choose the direction from the site activities that each of the stations will be sited. The monitoring locations are based on the assumption that the Locale 2 Pit and the Main Pit are operational. The exact locations of the sites will be determined based on the final Project specifications.

There will also be one additional monitoring site located between the Goose Property Area, away from the project activities, in order to measure background noise levels.

Methodology

Equipment

Baseline noise samples were collected using a Brüel & Kjaer (B&K) Model 2250 sound level meter capable of logging data. The sound level meter samples in decibels using the "A" standardized frequency rating (dBA, designed to match the frequency response of the human ear) for both average and maximum peak sound levels. The meters were equipped with sound recording capabilities to capture audible noises in the area and were calibrated before each measurement. Noise measurements were made once every minute for 24 consecutive hours at a height of 1.5 m above ground. The B&K Model 2250 sound level meter is a Type 1 instrument that has a suitable operating range that captures low sound levels that are typical for an undisturbed wilderness area. Sound level meters were enclosed in a weather-proof case during monitoring.

Weather data from one of the two on-site weather stations were used to validate data collected.

Noise Data Collection

The following overall noise levels were and will continue to be measured every minute over a 24-hour sample period:

- L_{Aeq} (equivalent continuous sound pressure level in dBA);
- L_{Amax} (absolute maximum in dBA);
- L_{Amin} (absolute minimum in dBA); and
- L_{Ceq} (the C weighted equivalent continuous sound pressure level in dBC).

A-weighting is the most commonly used parameter when a single-number overall sound level is needed. Results are expected to indicate human perception or the effects of sound on humans. A-weighting accounts for the reduced sensitivity of humans to low-frequency sounds, especially at lower sound levels. C-weighting is used to evaluate sounds containing strong low-frequency components. It was originally devised to approximate human perception of high-level sounds.

Often a single overall sound level is not sufficient to evaluate or specify the noise environment fully. This is especially the case for steady sounds of long duration. In such cases it is usually desirable to ensure that the quality of the sound matches the normal expectation in the environment. Evaluating both aesthetic appeal and speech interference requires knowledge of the frequency content of the sound. Octave band curves have been used for evaluating outdoor noise. Therefore, 1/3 band octave data will be collected once per Project stage. Octave band data will also be collected if levels exceeding project criteria are found, in order to locate the primary source requiring mitigation.

Two, 24-hour logging periods will be conducted at each location, at a 1-minute logging rate. It should be noted that if longer monitoring periods at each location are required, the logging rate would need to increase. This may result in loss of definition in measurements, making it difficult to determine the influence of short-term noise events such as aircraft flyovers. Simultaneous sound recordings will also be collected during the measurement period to identify peak events and sources of sound.

Weather Conditions

The following weather parameters were and will continue to be documented for the time period of each noise measurement:

- temperature (degrees Celsius);
- relative humidity (%);
- wind speed (km/h or m/s);
- wind direction (degrees from true North); and
- precipitation (mm).

Weather data from one of the on-site stations were and will continue to be used. Preferred weather conditions for noise monitoring are:

- wind speeds less than 20 km/h;
- relative humidity less than 90%;

- no active precipitation (rain or snow); and
- temperatures such that the meter body can be maintained within manufacturer's specifications.

Field Notes

The following information was, and will continue to be, recorded in the field during the noise monitoring program:

- description of the monitoring site with sketch and pictures;
- time of set up and tear down;
- time of calibration;
- type of surface the meter is standing on;
- observed audible noise sources;
- distance from all obstacles in the area (cannot be closer than 3 m to any surface or obstacle except the ground);
- GPS location;
- type of meter being used; and
- weather conditions at each site at the time of set up and tear down including precipitation and cloud cover.

It is imperative that detailed field notes are recorded during the monitoring period. The site visits to collect the sound level data were, and will continue to be, conducted by experienced technicians to ensure that the proper documentation and field observations are made to identify audible noise sources and to check the equipment.

7.2.10.4 Logistics and Management

Logistics will have to consider the effects of the northern climate on the instrumentation. The noise meters cannot operate reliably at air temperatures below -20°C, therefore, if necessary, an insulated casing device will be used to keep the meter within its nominal temperature operating range. Such a device does not affect the microphone or the quality of noise measurements. Wildlife tampering is also a concern for the equipment, as some animals tend to eat cable wire and use objects such as these for scratching posts. To prevent this, a portable electric fence will be installed around the monitors when conditions allow for it. All equipment will be calibrated before and after each 24-hour survey to insure the noise meter and microphone are still properly operating. All information will be recorded by the field technician. QA/QC will be conducted on the downloaded data; field QA/QC of equipment operation is not practical as the climate and areas are not conducive for frequent checks.

7.2.10.5 Data Analysis

Analysis will follow standard noise monitoring methods.

7.2.10.6 Triggers for Adaptive Mitigation

Noise levels exceeding noise monitoring thresholds for human safety will trigger mitigation that will also act to reduce potential effects on wildlife receptors.

7.2.10.7 Reporting

Data collected from the Noise Monitoring Program will be reported regularly. The reports will generally include a summary of the methods and equipment, summary tables for the weather and noise data along with graphs of the raw noise data, a map showing the location of monitoring sites and photos of each site. Any noise sources that are causing criteria to be exceeded will be identified. Short-term source measurements may be conducted where necessary to allow appropriate mitigation design.

7.2.11 Waterbird Monitoring in Ponds

7.2.11.1 Background and Trigger for Monitoring

Under certain circumstances, waterbirds (ducks, geese, etc.) can use on-site ponds, particularly during spring migration when ponds can break up earlier than natural ponds elsewhere. The FEIS evaluates the potential for waterbirds to be harmed if the water quality in these ponds does not meet water quality guidelines. Section 6.2, Wildlife Construction and Operations Management, describes the steps to exclude waterbirds from these ponds as:

1. The water quality of on-site ponds will be monitored as outlined in the Site Water Monitoring and Management Plan (Chapter 7 of Volume 10 of the FEIS);
2. If the water quality of the ponds does not meet wildlife guidelines, then waterbird monitoring will be undertaken at these ponds; and
3. If water quality does not meet wildlife guidelines and waterbirds are using the ponds, then adaptive management will be used to exclude waterbirds from the ponds.

This section describes the objectives and methods for waterbird monitoring in on-site ponds. Monitoring in on-site ponds may be triggered by the results of water quality testing during Mobilization and Construction, Operations, Care and Maintenance, and Reclamation and Closure phases of the Project.

7.2.11.2 Objectives

The objective for waterbird monitoring in on-site ponds is to determine if waterbirds are using the ponds, and thereby trigger management to exclude waterbirds.

7.2.11.3 Monitoring Methods

Waterbird activity within the TSF and other Project water storage areas, such as open pits infilled with water or the Saline Water Pond, will be monitored for water quality. Should the water in these ponds not meet water quality standards for wildlife, then these ponds will be monitored for waterfowl during the staging and breeding periods, which spans from May through September. Monitoring frequency will be determined by the season, with more frequent monitoring during the spring migration, when the greatest risk of groups of waterfowl using the on-site ponds is present.

Waterbird monitoring at on-site ponds will be conducted daily during the spring migration (late May) and weekly during the rest of the waterbird season. Monitoring will be conducted by a qualified person (i.e., trained in bird ecology and behaviour). Surveys will be a fixed-duration scan sample using binoculars.

Prior to construction of the Project, a detailed SOP will be produced. The SOP will include training requirements for staff, methods for monitoring, and data sheets.

7.2.11.4 Data Analysis

Records of the monitoring actions (location, methods, personnel, etc.) and the results of pond monitoring will be collated into a database and tracked for changes between years and whether any changes are related to specific activities or mitigation actions.

7.2.11.5 Triggers for Adaptive Mitigation

Observations of waterbirds in Project ponds where the water quality does not meet wildlife water quality guidelines will trigger mitigation to exclude the wildlife from the Project ponds, as described in Section 6.2, Construction and Operations Managements.

7.2.11.6 Reporting

All incidental observations of waterbirds using Project ponds, management actions taken and their success will be reported in the annual WEMP report.

7.2.12 Pre-Construction Surveys for Bear Dens

7.2.12.1 Background and Trigger for Monitoring

During the DEIS review phase, the GNWT DOE requested that Sabina conduct pre-construction surveys along the winter road route to minimize potential direct mortality from winter road construction on bears. This section describes the objectives and methods for grizzly bear den monitoring along the proposed ice road route. Monitoring will be triggered by ice road construction during all phases of the Project.

7.2.12.2 Objectives

The objective of the bear den monitoring is to reduce the chance of direct mortality due to construction of the ice road on locations where bears may have built dens.

7.2.12.3 Monitoring Methods

Monitoring methods will follow a four-step process:

1. The types of places where grizzly bears choose to den are relatively well understood. Bears are thought to choose areas of deep, dry soil and woody vegetation to coalesce the roof of the den – such as the lower slopes of eskers. The first step in identifying dens will be to identify the locations where the proposed road overlaps areas most likely to support denning using terrain data from Terrestrial Ecosystem Mapping conducted in the Local Study Area for the DEIS.
2. During the detailed engineering and planning phase for the winter road to the MLA, engineers and biologists will use the data provided in step #1 and conduct a detailed field inspection of the road route. Field observations will be used to supplement the areas identified in #1 above.
3. Where possible, the road route will be altered to avoid these areas identified in #1 and #2 above to reduce the chance of affecting a bear den.
4. If it is not possible to avoid an area where grizzly bears may den, then pre-construction surveys will be conducted using Forward Looking Infrared (FLIR) or other applicable methods as technology and success of the program determines.

7.2.12.4 Data Analysis

Maps of higher likelihood denning sites, along with the results of pre-construction surveys will be recorded in a database and maintained through the life of the Project.

7.2.12.5 Triggers for Adaptive Mitigation

Observations of high quality denning habitat will trigger engineers to move the road, if possible, out of this area. If not possible to move the road, then monitoring will be triggered. If monitoring reports a bear den then an appropriate buffer will be set up around the den to limit disturbance, as described in Section 6.2, Construction and Operations Managements.

7.2.12.6 Reporting

All reports of bear dens will be reported in the annual WEMP report.

7.3 PART II: FOCAL SPECIES MONITORING

Focal species monitoring will be conducted in order to evaluate the health of the wildlife populations in the monitored area, and evaluate the predictions of Project-related effects on wildlife that were indicated in the FEIS. Surveys have been conducted for VEC groups during baseline studies including: caribou, grizzly bears, muskox, wolverine and furbearers, migratory birds (upland and waterbirds), raptors, seabirds/seaducks and ringed seals. The following wildlife VECs are included in the proposed focal-species monitoring:

1. Caribou;
2. Grizzly bear;
3. Muskox;
4. Wolverine/furbearers;
5. Migratory birds (waterbirds, upland breeding birds);
6. Raptors;
7. Seabirds/seaducks; and
8. Marine mammals (ringed seals).

The baseline program to date as well as the proposed focal-species monitoring programs are described in the following sections and outlined in Table 7.3-1.

7.3.1 Caribou

7.3.1.1 Introduction

Baseline survey data documenting the distribution of caribou during the winter, calving and post-calving, and summer periods suggest that the Regional Study Area (RSA) for the Project lies within the seasonal ranges of the Bathurst and Beverly herds while the marine study area overlaps the winter range of the Dolphin and Union caribou herd (Figure 7.3-1). The Bathurst caribou herd calves and spends the summer to the west of the study area. The Bathurst herd is found in the (RSA, primarily during spring migration, and post-calving, with a peak during the post-calving period. The calving range of the Beverly herd (previously the Ahiak) occurs to the east of the RSA in the Queen Maud Gulf Migratory Bird Sanctuary, but the Beverly herd may occur in the RSA during the late summer, early fall, and winter.

Table 7.3-1. Focal Species Monitoring Programs

Focal Species Monitoring	Baseline/ Pre-Construction	Site Prep/ Construction	Operations	Temporary Closure	Care and Maintenance	Reclamation/ Closure	Post-Closure
Caribou							
Regional Monitoring							
1) Aerial surveys	3 years	--	--	--	--	--	--
2) Analysis of collaring data	Yes	Every year	Every year	--	--	--	--
3) Motion-triggered cameras (regional)	2 years	--	--	--	--	--	--
4) Habitat suitability mapping	Baseline	--	--	--	--	--	--
5) Contribution to GN regional monitoring initiatives	--	TBD	TBD	TBD	TBD	TBD	--
6) Contribution to GNWT regional monitoring (Backup)	--	Backup	Backup	Backup	Backup	Backup	--
Local-Scale Monitoring (on-site)							
7) Ground-based monitoring by environmental team	--	Ongoing	Ongoing	--	Ongoing	Ongoing	--
8) Facilities monitoring with cameras	Baseline	Ongoing	Ongoing	--	Ongoing	Ongoing	1 year
9) Incidental Observations	Baseline	Ongoing	Ongoing	--	Ongoing	Ongoing	--
Grizzly Bear							
Regional Monitoring							
1) DNA-based mark-recapture pop estimates	2 years	--	--	--	--	--	--
2) Habitat suitability mapping	Baseline	--	--	--	--	--	--
3) Incidental obs. during monitoring dens for wolves	3 years	Concurrent with wolf den monitoring	Concurrent with wolf den monitoring	--	--	--	--
5) Contribution to GN regional monitoring initiatives	--	TBD	TBD	TBD	TBD	TBD	--
6) Contribution to GNWT regional monitoring (Backup)	--	Backup	Backup	Backup	Backup	Backup	--
Local-Scale Monitoring (on-site)							
7) Facilities monitoring with cameras	Baseline	Ongoing	Ongoing	--	Ongoing	Ongoing	1 year
8) Incidental Observations	Baseline	Ongoing	Ongoing	--	Ongoing	Ongoing	--
Muskox							
Regional Monitoring							
1) Aerial surveys	3 years	--	--	--	--	--	--

(continued)

Table 7.3-1. Focal Species Monitoring Programs (continued)

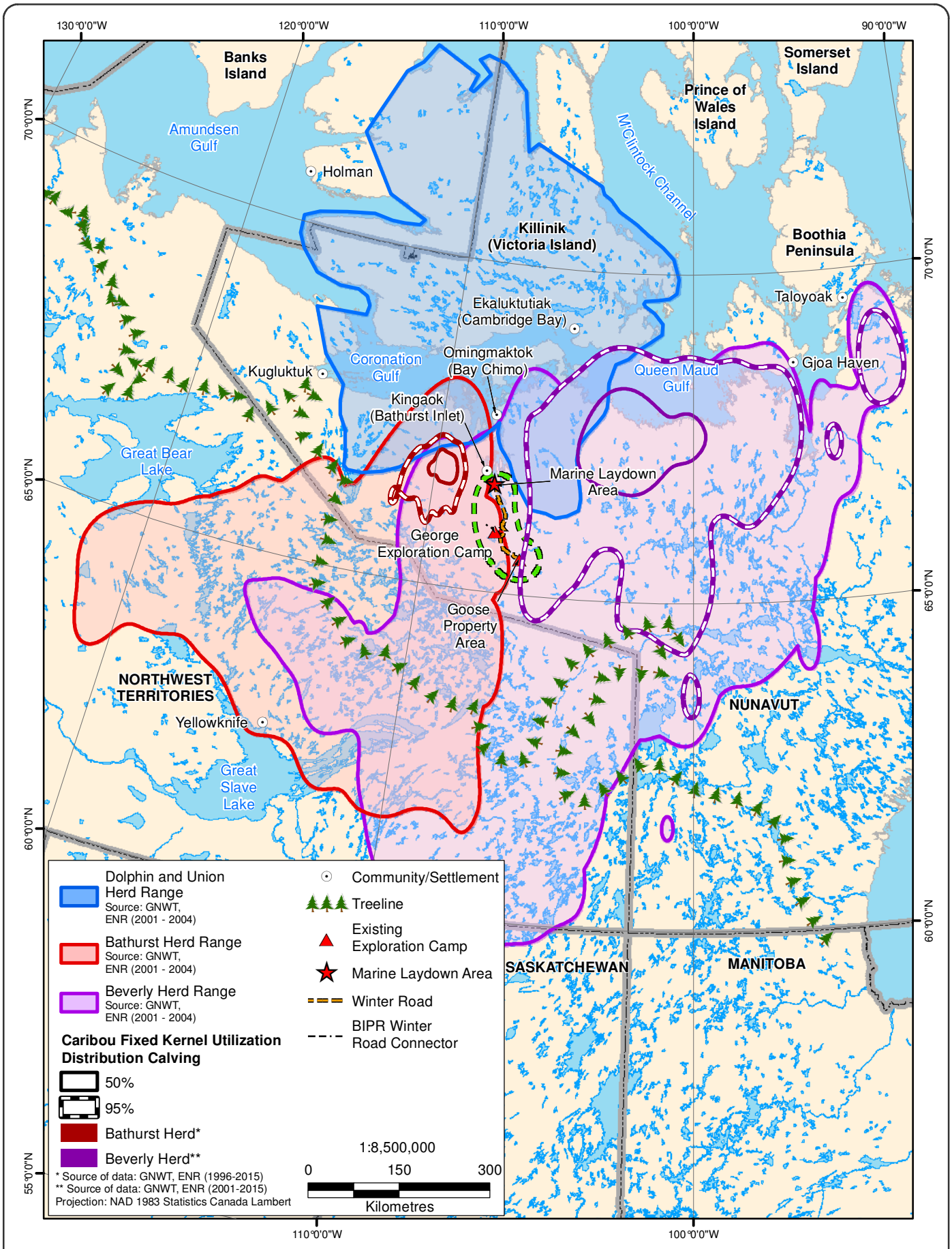
Focal Species Monitoring	Baseline/ Pre-Construction	Site Prep/ Construction	Operations	Temporary Closure	Care and Maintenance	Reclamation/ Closure	Post-Closure
Muskox *(cont'd)*							
2) Habitat suitability mapping	Baseline	--	--	--	--	--	--
3) Contribution to GN regional monitoring initiatives	--	TBD	TBD	TBD	TBD	TBD	--
4) No Program Planned (Backup)	--	--	--	--	--	--	--
Local-Scale Monitoring (on-site)							
5) Facilities monitoring with cameras	Baseline	Ongoing	Ongoing	--	Ongoing	Ongoing	--
6) Incidental Observations	Baseline	Ongoing	Ongoing	--	Ongoing	Ongoing	--
Wolverine/Furbearer							
Regional Monitoring							
1) DNA-based mark-recapture pop estimates for wolverine	2 years	--	--	--	--	--	--
2) Habitat suitability mapping	Baseline	--	--	--	--	--	--
3) Contribution to GN regional monitoring initiatives	--	TBD	TBD	TBD	TBD	TBD	--
4) Monitoring dens for wolves and foxes (Backup)	3 years	Backup 3 years survey (2 times yearly), 3 years no survey, repeated	Backup 3 years survey (2 times yearly), 3 years no survey, repeated	--	--	--	--
Local-Scale Monitoring (on-site)							
5) Facilities monitoring with cameras	Baseline	Ongoing	Ongoing	--	Ongoing	Ongoing	--
6) Incidental Observations	Baseline	Ongoing	Ongoing	--	Ongoing	Ongoing	--
Migratory Birds							
Regional Monitoring							
1) PRISM/ VRPC surveys for upland breeding birds	3 years	Every 2 years	Every 2 years	--	--	--	--
2) Aerial and ground surveys to measure breeding for waterbirds (waterfowl and seabirds)	3 years	Every 2 years	Every 2 years	--	--	--	--

(continued)

Table 7.3-1. Focal Species Monitoring Programs (completed)

Focal Species Monitoring	Baseline/ Pre-Construction	Site Prep/ Construction	Operations	Temporary Closure	Care and Maintenance	Reclamation/ Closure	Post-Closure
Migratory Birds *(cont'd)*							
3) Aerial surveys to examine staging areas for waterbirds	3 years	Every 2 years (2 times yearly)	Every 2 years (2 times yearly)	--	--	--	--
Local-Scale Monitoring (on-site)							
4) Pre-clearing surveys	--	As needed	As needed	--	--	As Needed	--
Raptor Monitoring							
Regional Monitoring							
1) Aerial monitoring to estimate productivity	3 years	Every 3 years	Every 3 years	--	--	--	--
2) Habitat suitability mapping for peregrine falcon and short-eared owl	Baseline	--	--	--	--	--	--
Local-Scale Monitoring (on-site)							
3) Pre-clearing surveys	--	As needed	As needed	--	--	As Needed	--
Seabirds/Seaducks*							
Regional Monitoring							
1) Aerial and ground surveys to measure breeding for waterbirds (waterfowl and seabirds)	3 years	Every 3 years*	Every 3 years*	--	--	--	--
2) Aerial surveys to examine staging areas for waterbirds	3 years	Every 3 years (2 times yearly)	Every 3 years (2 times yearly)	--	--	--	--
Local-Scale Monitoring (on-site)							
3) Pre-clearing surveys	--	As needed	As needed	--	--	As Needed	--
Seabirds/Seaducks Shipping Monitoring							
4) Marine Mammal/ Seabird Observer		Ongoing	Ongoing			Ongoing	
Marine Mammals							
Local-Scale Monitoring (on-site)							
1) On-Ice Monitoring at the MLA	--	As needed	As needed	--	--	As Needed	--
Marine Shipping Monitoring							
2) Marine Mammal Observer		Ongoing	Ongoing			Ongoing	

**Proposed monitoring for seabirds/seaducks and ringed seals would be conducted only when the MLA is active.*
Note: Survey frequency may change dependent on Project-related changes to population abundances and distributions or climate change or upon consultation with stakeholders.



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Annual Ranges of the Bathurst, Beverly and Dolphin and Union Caribou Herds

Figure 7.3-1

Rescan an ERM company

The Dolphin-Union herd winters on the coast, sometimes within the northern reaches of the Project RSA. This herd migrates north at the end of April through end of June to Victoria Island to calve and spend the summer, returning to the mainland during the fall when the sea ice has frozen; typically in early November. The Dolphin and Union herd was federally listed on Schedule 1 as a species of special concern in 2004 (Government of Canada 2013). The Bathurst and Beverly herds have not been assessed by COSEWIC.

The two objectives of the focal species monitoring for caribou are to:

1. Describe the existing baseline surveys that have been conducted to date in the RSA, including:
   - aerial surveys;
   - analysis of satellite collar data;
   - results of remote motion-triggered camera surveys;
   - habitat suitability modeling; and
   - resource selection function surveys for caribou.
2. Describe the monitoring work that is proposed for the focal-species monitoring portion of the WEMP, which includes:
   - monitoring use of the RSA and areas near proposed Project infrastructure by caribou using remote motion-triggered cameras; and
   - contributing to a regional habitat monitoring program for the Bathurst herd caribou to assess the quality of habitat on the post-calving and summer grounds.

7.3.1.2 Existing Baseline Surveys

Five separate types of surveys have been conducted for caribou in the RSA during baseline surveys including: i) aerial surveys during key periods; ii) analysis of satellite collar data to determine movement patterns and seasonal ranges; iii) the use of remote motion-triggered cameras for monitoring habitat use of certain habitat features and for determining detailed timing of when caribou use these features, iv) habitat suitability mapping for caribou in the RSA to determine the proportion of good quality habitat for caribou, and v) a resource selection study for caribou.

Aerial Surveys

Aerial surveys were conducted in 2001, 2002, 2007, 2008 and 2010 in the RSA (extending 30 km from all proposed infrastructure) using standard census techniques for caribou (Rescan 2002, 2007, 2008, 2011). Data from these surveys are summarized in the existing environment and baseline information section of the caribou effects assessment (Volume 5, Section 5.1). These surveys had three important results:

1. Few caribou (typically less than 20) were detected during the peak of calving for the Bathurst caribou herd – indicating that the RSA does not overlap the calving grounds;
2. The peak numbers of caribou were observed to the west of the Project during post-calving; and
3. Despite coordinating surveys with data from GPS collars to survey when the maximum number of caribou are typically in the RSA, surveys recorded few (typically less than 100) caribou.

Due to the low numbers of animals being recorded using aerial surveys, this monitoring technique is not planned to be extended into the WEMP in favour of collaborative monitoring programs with GN DOE.

Satellite Collar Program

The satellite collar program used data provided by the government of NWT and NU. These governments initiated satellite collaring programs in 1996 for the Bathurst herd and Beverly herd however, the number of collared Beverly caribou was minimal until 2006. Each year, satellite collars are fitted on a group of female caribou during the winter and to some males in 2015. The data generated from these programs allow researchers to investigate seasonal trends in habitat use as well as track real time movements of caribou herds.

Data analysis for the Project baseline surveys focused on the Bathurst and Beverly caribou herds from 1996 to present. However these data are biased towards later years (2008 to 2015) as GPS collars in later years resulted in six times the location positioning (or more) relative to previous years with the use of GPS collars with satellite uplink. As the data for the Dolphin and Union herd using GPS collars is fairly minimal and no GPS collars have functioned since 2006, satellite collar data used for the Dolphin and Union herd in baseline programs included that obtained between 1999 and 2004.

Caribou use of the land can broadly be classified into two groups: 1) migrations (spring) when the animals are moving quickly across the landscape, and 2) sedentary periods (calving, post calving, summer, and winter) when the daily movement rate of caribou is lower than migrations and the herd tends to occupy a distinct range of the landscape. In order to map habitat use by caribou during each season, two methods were used.

During the spring migration, the movement paths of individual collared caribou were plotted and used to evaluate whether there are key routes used by caribou on the tundra. During winter, calving, post-calving and summer, when caribou occupy a definable home range on the landscape, the extent of caribou range was calculated for each season using fixed kernel utilization distributions (UDs). This analysis used all available collar data from 1996 to September 2015 in order to provide an overview of caribou habitat use. Core use areas were calculated (termed 50% kernel UD) as well as areas of active use (95% kernel UD). The 50% kernel UD represents an area with a 50% probability that an animal (or group of animals) is inside that area; the same is true for the 95% kernel UD.

Data was analyzed by season/life history stage as described in the existing environment and baseline information section of the caribou assessment (Volume 5, Section 5.1). These data indicated that the Back River RSA occurs largely to the east of the Bathurst calving and post-calving ranges and north-east of the summer range.

Additional analysis were conducted for the FEIS that examines how the size and location of the Bathurst herd calving ground have changed as the herd has declined. These data are reported in the FEIS (Volume 5, Chapter 5, Section 5.1.2.5).

Analysis of data from collared caribou will be carried forward into the WEMP to monitor if the larger caribou herds are using the RSA, during what seasons, and if this pattern of use is changing.

Remote Motion-Triggered Cameras

In order to examine when caribou are using the Project PDAs, and examine their use of selected features on the landscape, motion-triggered cameras were deployed in the RSA and in an area adjacent to and west of the RSA in order to look at spatial trends on a larger scale (Rescan 2013c, 2014b).

Remote motion-triggered cameras are a reliable method for examining ungulate migratory timing and habitat associations given the landscape's short vegetation and features such as eskers and river

crossings that direct caribou movement through the landscape (Cutler and Swann 1999; Noel et al. 2006).

The camera study was conducted from 2012 to 2015 using an average of 60 cameras per year. Cameras were placed in four areas:

- in four transect lines, at key caribou areas and in the PDAs in the RSA;
- in the post-calving area to the west of the RSA;
- on the shoreline and islands of Bathurst Inlet (Marine RSA); and
- along a road route considered in the DEIS to connect the Goose PDA to the Tibbett to Contwoyto Road. This road route was removed from the FEIS.

A detailed overview of the experimental design and results of the camera study is provided in the caribou chapter of the FEIS (Volume 5, Chapter 5, Section 5.1.2.5). Additional detail on the camera program from each year is included in the baseline reports:

- Appendix V5-5C: Wildlife Baseline Report 2012;
- Appendix V5-5D: Wildlife Baseline Report 2011;
- Appendix V5-5F. Back River Project: 2013 Wildlife Baseline Report;
- Appendix V5-5G. Back River Project: 2014 Wildlife Camera Baseline Report; and
- Appendix V5-5H. Back River Project: 2015 Wildlife Camera Baseline Report.

The primary results from the camera program were:

- caribou are largely absent from the RSA during the calving period;
- caribou are most commonly observed in the RSA during summer (likely Bathurst/Ahiak caribou)
- caribou are most commonly observed to the west of the RSA the during the post-calving period (likely Bathurst caribou);
- caribou were observed in the Marine RSA (Bathurst Inlet) during spring migration (likely Beverly/Ahiak) and at very low numbers during the winter (either Beverly or Dolphin and Union caribou);
- caribou selected areas with more available forage (which correlates with their requirements for food during the post-calving and summer);
- several high value areas were identified for caribou by TK and confirmed by cameras, such as river crossings (none of which were <15 km from the PDAs); and
- caribou were less common on proposed project infrastructure sites, compared to controls (likely because some control areas included high value habitats for caribou, such as lake shore and crossing points on rivers).

Monitoring of infrastructure, key caribou habitats, and control areas with remote motion-triggered cameras will continue in the WEMP.

Habitat Suitability Modelling

Wildlife habitat suitability modelling was conducted within the LSA and RSA to inventory and rate the habitat types for caribou and quantify suitable habitat available for this species within the LSA and RSA (Rescan 2013a). Habitat suitability modelling methodology was guided by BC Resource Information Standards Committee standards (RIC 1999b). Results are presented in the existing environment and baseline information section for the caribou effects assessment (Volume 5, Section 5.1). The primary results from this analysis were:

- calving habitat within both the LSA and the RSA was evenly distributed between high, moderate, low and nil rated habitats;
- for the post-calving and summer season, the LSA contained proportionally less high value habitat relative to the RSA and both the LSA and RSA were dominated by moderate value habitat; and
- approximately half of the habitat in the LSA and RSA was rated as high value habitat for the fall season, while approximately a third was considered low in both of these study areas.

Resource Selection Function for Caribou

A Resource Selection Function (RSF) was conducted for the Bathurst caribou herd on the post-calving and summer range of this herd. RSFs are increasingly being used to provide information on essential resources needed to manage and conserve rare, threatened, and endangered species in complex socio-environmental landscapes (Johnson et al. 2006). RSFs provide an objective and explanatory framework to assess habitat selection and relative habitat quality at multiple scales and across individuals and populations (Johnson et al. 2006).

The development of RSFs for the Bathurst caribou herd will directly contribute to the implementation of Strategies #5 and #7 in the Barren Ground Caribou Management Strategy for the Northwest Territories 2011-2015. Strategy #5 aims to understand the effect of a broad suite of environmental conditions on caribou populations. Strategy #7 aims to assess cumulative impacts of land use activities and natural factors on caribou habitat and develop best management practices to mitigate and minimize these impacts.

During 2013, RSFs were developed for the Bathurst caribou herd. Satellite collar data was used from 2001 to 2011, based on the types of GPS collars available and additional base data. Habitat selection by caribou was modelled according to their seasonal ranges and by year in relation to factors, including: climate, changing habitat quality and productivity across regional scales, and the progression of development across the landscape. RSFs were developed across scales, including the assessment of important habitats within seasonal ranges and critical time periods (e.g., calving and winter) and at broader scales examining potential mechanisms for variations in migration routes over time.

7.3.1.3 Regional Caribou Monitoring for the WEMP

There are three regional monitoring programs proposed as part of the WEMP for caribou herds, including:

1. contributions to regional/collaborative programs with GN DOE;
2. GPS collar analysis; and
3. backup monitoring plan for caribou.

As part of their direction on caribou monitoring, both GN DOE and the Government of the Northwest Territories Environment and Natural Resources (GNWT ENR) have requested that mines conduct caribou monitoring at two scales: regional and local. Regional monitoring will be conducted through funding programs led by the GN and GPS collar analysis. As requested by the KIA, a backup program is also proposed, should a GN-led program not be available to contribute to.

Contributions to Regional/Collaborative Programs with GN DOE

During February 2013, meetings were held in Yellowknife at the invitation of GNWT ENR and included representatives from GN DOE and industry representatives, to decide the course of caribou research to investigate cumulative effects on the Bathurst caribou herd. The results of this meeting indicated that collaborative research projects between industry partners and government biologists were the path forward, in lieu of project-specific regional monitoring activities. During the DEIS review process, the GN also requested that Sabina contribute to GN-led regional monitoring programs for caribou.

To that end, Sabina has committed to work collaboratively with wildlife biologists from GN DOE and GNWT ENR (included because of the co-management of the Bathurst herd) to conduct collaborative regional research on cumulative effects. The type, duration, and amount of contributions will depend on the proposed monitoring plan for each species. It should be noted that as of 2015, no plans have been provided by the GN or the GNWT for review by Sabina. The preferred contribution type is in-kind or material support (e.g., renting helicopter or aircraft time for aerial surveys, purchasing GPS collars for deployment by government biologists, support for meetings or conferences, or technical support by Sabina's technical team). Additional information is available in Section 7.1.5 (Contributions to Government-Led Regional Monitoring Programs).

This proposed program of contributing and collaborating with GN DOE on regional monitoring of caribou, along with analysis of satellite collar data, will replace more traditional regional-scale monitoring such as aerial surveys.

GPS Collar Analysis

The analysis of satellite collar data during baseline studies revealed that the Back River RSA occurs to the north-east of the Bathurst post-calving and summer ranges and on the western edge of the Beverly summer range. Caribou herds have moved their calving and summer ranges over the past 30 years (e.g., the Bathurst caribou herd used to calve to the east of Bathurst Inlet in the 1980s) and may move again in response to climate, vegetation, or population triggers. The baseline satellite program used 50% kernel UD and 95% kernel UD measures to evaluate the location of the core habitat and areas of active use, respectively.

As part of the WEMP, this analysis will be repeated annually to evaluate whether the primary herds in the Project area (Bathurst and Beverly) have altered their use of the tundra and changed the timing or extent of use of the RSA. This analysis is also described in Section 6.10 (Planned Work Suspensions and On-site Mitigation for Caribou). Should the calving range of the Bathurst caribou coincide with the Project location, then planned work suspensions of certain project components or particular activities (including a full planned cessation of activities) may be undertaken. More detail on planned work suspensions is available in Section 6.10, Mitigation and Management for Caribou.

Backup Monitoring Plan for Caribou

During the DEIS review phase, the KIA requested that Sabina propose a backup plan for regional monitoring of wildlife VECs should a GN monitoring plan not be available to contribute to. In the case of caribou, the GNWT is responsible for leading the population monitoring activities for the Bathurst

caribou herd. Should the GN not have a monitoring plan available (or should the GN choose to direct Sabina to collaborate instead with the GNWT on the Bathurst herd), Sabina will collaborate with the GNWT to support regional monitoring, research, or management activities for the Bathurst herd.

7.3.1.4 Local-Scale and Facilities Monitoring for Caribou

Local-scale monitoring will evaluate how caribou interact with the Project and evaluate the efficacy of mitigation initiatives. Three forms of local-scale monitoring will be conducted for caribou:

1. ground-based visual monitoring;
2. remote motion-triggered cameras; and
3. incidental observations.

Ground-Based Visual Monitoring

Methods

Ground-based visual monitoring will be conducted by environmental monitors during periods when the Bathurst caribou herd are closest geographically to the Project site/ during the time of year when caribou are most sensitive to disturbance (calving and post-calving).

The first step in conducting ground-based visual monitoring is to determine when the monitoring will be conducted. Due to the sensitivity of caribou during the calving period, environmental monitors will be on-site at that time, despite the fact that the Bathurst herd does not calve in the Project area. Caribou are also sensitive to disturbance during the post-calving phase. The Bathurst herd passes the Project area approximately 100-200 km to the south-west during the post-calving period. Therefore, environmental monitors will also be on-site during the post-calving period.

Environmental monitors will conduct ground-based scans of the tundra area surrounding the Project site from high-points. Access will be by truck or snow machine, with use of the helicopter avoided due to the disturbance that helicopters can cause caribou.

Prior to construction of the Project, detailed SOPs will be produced that include the training for environmental monitors, equipment required, data forms, methods, data entry forms and analysis.

Data Analysis

Data analysis will summarize the dates when caribou are observed and compare these dates to historic and current data from caribou GPS collars to determine if there is any change in the timing or number of caribou observed at the site. These data will be used to supplement annual analysis of the GPS collar data to determine whether the location of the calving and post-calving areas are changing from year to year and whether they are coincident with the Project site.

Triggers for Adaptive Management

Ground-based visual monitoring will be used to trigger adaptive management of the Project site, which is described, in detail in Section 6.10 (Planned Work Suspensions and On-site Mitigation for Caribou).

Reporting

Data from ground-based visual monitoring, along with adaptive management triggered by the sighting of caribou, and analysis will be reported in the annual WEMP report.

Remote Motion-Triggered Cameras

Methods

Local-scale monitoring of wildlife interactions will also be monitored using remote motion-triggered cameras, including for caribou. Monitoring will take place every year of construction and operations using motion-triggered, all-weather cameras.

A camera-based monitoring program was conducted as part of regional-scale baseline studies in 2012 and 2013 with the deployment of 60 motion-triggered cameras (Reconyx PC800 HyperFire™ Professional Semi-Covert Infrared) in the RSA to document caribou (and other wildlife) activity around camp infrastructure, and on the tundra. Cameras were positioned at key proposed infrastructure locations, such as the proposed tailings impoundment area and at the various camp infrastructure locations of the Goose camp and proposed marine laydown area. Control areas were also be monitored, as well as areas predicted to be important for caribou were also monitored – such as river crossings, lake shores, eskers, and locations with abundant caribou trails on the tundra.

The regional-scale monitoring program conducted during baseline studies will cease and be replaced by a local-scale monitoring program that will monitor the timing and location of caribou interactions with the Project site and areas identified as important for caribou.

The objectives of this program are to:

1. monitor the Project site to examine how caribou interact with Project facilities (e.g., on roads, pits) particularly at locations which are not staffed for long periods of time (such as the marine laydown area);
2. monitor the Project site at areas with and without mitigation structures or activities to evaluate the efficacy of mitigation activities (e.g., at road-crossing structures vs. without);
3. monitor areas identified as important for caribou from land user knowledge (e.g., eskers, river crossings) and at points with high number of caribou identified during baseline studies (e.g., the river crossing at the east end of Beechey Lake), and;
4. record the times at which caribou use the RSA during the year.

The existing cameras in the RSA will be re-evaluated for how they address the four objectives above and re-deployed, if necessary. Cameras will be located at the following locations:

1. on and off of road crossing structures (10 cameras);
2. at camps (5 cameras);
3. waste management facilities (5 cameras);
4. the marine laydown area (5 cameras); and
5. at locations deemed important for caribou outside of the Project site (10 cameras).

Cameras will record one photo every 30 minutes and 10 photos whenever they are triggered by movement as they did during baseline surveys. Cameras will be checked twice per year at minimum by on-site environment technicians. Cameras may be repositioned as deemed necessary pending results of the photo data.

All methods will follow those reported in the 2015 Back River Camera Report. Prior to construction of the Project, a detailed plan will be produced that includes the training for environmental monitors, equipment required, data forms, methods, data entry forms and analysis.

Data Analysis

Data analysis will evaluate 1) the timing of caribou presence on the site and compared to data from previous years and that collected by on-site monitors and the results of GPS collar analysis to examine when and how caribou are using the Project site, 2) comparing on and off of road crossing structures, 3) compared between years at waste management, camp sites, and important caribou sites to determine if there is any change of use by caribou. Changes in usage at these sites can then trigger adaptive management.

Triggers for Adaptive Management

Ground-based visual monitoring will be used to trigger adaptive management of the Project site, which is described, in detail in Section 6.10 (Planned Work Suspensions and on-site Mitigation for Caribou).

Reporting

Data and analyses will be reported in the annual WEMP report.

Incidental Observations

Methods

Incidental observations of caribou will be recorded by all Project personnel, including environmental monitors, pilots, drivers on on-site and ice roads, and other Project personnel. More details are available in Section 7.2.6 (Incidental Wildlife Monitoring) and Section 7.2.7 (Wildlife-Vehicle Interactions).

Incidental observations of caribou will be recorded as described in Section 7.2.6 and will be analyzed to evaluate the timing of when caribou are on-site. Incidental caribou observations, along with reports from environmental monitors, will be used to trigger adaptive management, including altering helicopter, ice road and on-site driving, above-ground blasting and other site activities as described in Section 6.10 (Planned Work Suspensions and On-site Mitigation for Caribou).

Data Analysis

Data will be analyzed to identify important areas for caribou (crossing locations, etc.) and the timing of when caribou are on-site. Timing data will be combined with other forms of on-site monitoring and GPS collar monitoring to examine when caribou are using the Project site.

Triggers for Adaptive Management

Ground-based visual monitoring will be used to trigger adaptive management of the Project site, which is described, in detail in Section 6.10 (Planned Work Suspensions and On-site Mitigation for Caribou).

Reporting

Data and analyses will be reported in the annual WEMP report.

7.3.2 Grizzly Bears

7.3.2.1 Background

Baseline survey data and Inuit TK indicate that grizzly bears are found throughout the RSA, especially in association with major river systems, watersheds, and coastal areas (Gartner Lee Ltd. 2008; Rescan 2011; KIA 2012; Rescan 2012, 2013c). Grizzly bears are listed as a species of "Special Concern" (COSEWIC 2012); but are not yet listed under SARA. In the NWT and Nunavut, the Canadian Endangered Species Conservation Council lists grizzly bears as Sensitive (Working Group on General Status of NWT Species 2006; CESCC 2010). Grizzly bears are included as a VEC in the environmental assessment (Volume 5, Chapter 6) and thus, an assessment of potential local impacts from the Project on grizzly bear has been included in the WEMP.

The two objectives of this component of the WEMP are to:

1. describe the monitoring work that has been conducted to date in the RSA, including:
   - population-estimates using DNA mark-recapture;
   - carnivore den surveys;
   - Habitat Suitability modeling; and
   - incidental observations of grizzly bears using remote motion-triggered cameras.
2. describe the monitoring work that is proposed for the WEMP, which includes:
   - monitoring use of the areas near proposed Project infrastructure for grizzly bears using remote motion-triggered cameras.

7.3.2.2 Existing Baseline Surveys

The Project has conducted four types of baseline surveys for grizzly bears in the RSA including: i) population-estimation using DNA mark-recapture, ii) den surveys, iii) habitat suitability modelling, and iv) incidental observations during other environmental baseline surveys conducted in the RSA and via remote motion-triggered cameras.

DNA Mark-Recapture

The DNA based mark-recapture program was conducted in 2012 and 2013 in an area consisting of approximately 17,300 km^2 surrounding the Project (Rescan 2013b). The survey included a 120 cell grid of 12 X 12 km cells. Each cell contained a baited post to attract bears which would investigate the post and leave hairs on barbed wire wrapped around the post. The posts were checked 6 to 8 times during the summer, every 9 to 12 days. Bears were identified from their hairs and a population estimate was calculated from the proportion of bears that return to the posts during the summer. Overall results of the program generate a super-population estimate, spatial and temporal distribution, calculate demographic variables, and identify individuals outside of the RSA observed by other surveys. Results from these surveys are summarized in the existing environment and baseline information section of the grizzly bear effects assessment (Volume 5, Section 6.1). More information is included in the following reports:

- Appendix V5-6B. Back River Project: Grizzly Bear and Wolverine DNA Report, 2013

The main results indicate:

- a total of 111 grizzly bears were detected by mark-recapture in the grizzly bear study area in 2012. Of these bears, 61 individuals were detected in the RSA and only 12 bears were common to both the RSA and the adjacent western cells;
- grizzly bears were generally concentrated near major river systems in early spring and spread evenly throughout the RSA during summer; and
- female grizzly bears had smaller ranges and maximum distances travelled during the survey period relative to male bears, suggesting that females may have stronger site fidelity.

Den Surveys

Carnivore den surveys were carried out via low level aerial surveys in esker and glacial-fluvial habitat during the end of May/early June, and July of 2007, 2011, 2012, and 2013 (Gartner Lee Limited 2007; Rescan 2012, 2013c). During these surveys, any grizzly bear dens observed were recorded. See Carnivore Den Surveys in Section 7.3.4.2 for more information. Results indicated that:

- dens were difficult to find during aerial surveys although one den was observed during the July survey conducted in 2012; and
- two dens were observed incidentally during breeding bird surveys conducted in 2007 (Gartner Lee Limited 2007), and one den observed incidentally in June 2012 during other baseline surveys (Rescan 2013c).

Habitat Suitability Modeling

Wildlife habitat suitability modelling was conducted within the LSA and RSA to inventory and rate the habitat types for grizzly bear and quantify suitable habitat available for this species within the LSA and RSA (Rescan 2013a). Habitat suitability modelling methodology was guided by BC Resource Information Standards Committee standards (RIC 1999b). Results are presented in the existing environment and baseline information section for the grizzly bear effects assessment (Volume 5, Section 6.1) and in the following baseline report:

- Appendix V5-5A: 2013 Habitat Suitability Baseline

The primary results from this analysis were:

- high value denning habitat was very limited in both the LSA and RSA, as was moderate value habitat in either study area due to the limited extent of eskers and lacustrine deposits, and the dominance of boulder tundra and rocky areas;
- high value spring habitat was also limited in both the LSA and RSA, with moderate habitat comprising the majority of the of these study areas; and
- summer and fall habitat in the LSA and RSA was largely mapped as moderate and low value.

Remote Motion-triggered Cameras

Incidental observations of grizzly bears were recorded in the RSA via images captured by the 60 remote cameras distributed throughout the RSA for caribou surveys in 2012, 2013, 2014 and 2015. Images from these cameras were quality checked to remove duplicate images of the same individual and documented. Details of the methodology for remote cameras can be found in:

- Appendix V5-5C: Wildlife Baseline Report 2012;
- Appendix V5-5D: Wildlife Baseline Report 2011;

- Appendix V5-5F. Back River Project: 2013 Wildlife Baseline Report;
- Appendix V5-5G. Back River Project: 2014 Wildlife Camera Baseline Report; and
- Appendix V5-5H. Back River Project: 2015 Wildlife Camera Baseline Report.

7.3.2.3 Regional Grizzly Bear Monitoring for the WEMP

Two regional-scale monitoring programs are proposed for grizzly bear:

1. contributions to regional/collaborative programs with GN DOE; and
2. a backup monitoring plan for grizzly bear.

Contributions to Regional/Collaborative Programs with GN DOE

During the DEIS review, the GN DOE requested that Sabina contribute to a GN-led regional monitoring program for grizzly bear. Sabina has committed to contribute to a regional monitoring program when one is developed by the GN DOE as a replacement for regional monitoring of grizzly bears that Sabina had proposed in the FEIS. It should be noted that as of 2015, no plans have been provided by the GN or the GNWT for review by Sabina.

The format of a contribution is described in Section 7.1.5 (Contributions to Government-Led Regional Monitoring Programs).

Backup Monitoring Plan for Grizzly Bear

During the DEIS review phase, the KIA requested that Sabina propose a backup plan for regional monitoring of wildlife VECs should a GN monitoring plan not be available to contribute to. The GNWT has been collaborating with established mining projects in the NWT to conduct large-scale population monitoring of grizzly bear. In this program, a large sampling grid for DNA mark-recapture covers multiple projects. Each project conducts DNA mark-recapture within the portion of the grid which overlaps their project. This monitoring program is conducted every 5 years.

In the absence of a GN-led program for monitoring grizzly bear, or at the behest of the GN, Sabina will liaise with the GNWT ENR to discuss joining the large-scale, collaborative monitoring program being conducted in NWT to expand the monitoring grid north into Nunavut to the Project site.

The baseline population estimation for grizzly bear was conducted in concert with the Hackett River Project, and as such, the study area overlaps both Project areas and the marine laydown areas of both projects. If Sabina were to join the initiative being conducted out of the NWT, the study area would be shifted south from the baseline configuration, such that the southern edge of the study area will meet the NWT border and create a contiguous mark-recapture grid. Analysis and reporting will be in concert with the NWT industrial and government partners, and the GN.

7.3.2.4 Local-Scale and Facilities Monitoring for Grizzly Bear

Local-scale monitoring will evaluate how grizzly bears interact with the Project infrastructure and evaluate the efficacy of mitigation initiatives. Two forms of local-scale monitoring will be conducted for grizzly bear:

1. remote motion-triggered cameras; and
2. incidental observations.

Remote Motion-Triggered Cameras

Methods

The focal-species monitoring program will include monitoring grizzly bear by remote motion-triggered cameras.

The two objectives of this local-scale monitoring program are to:

1. monitor the Project site to examine how grizzly bear interact with Project facilities (e.g., camps and waste-management facilities); and
2. record the times at which grizzly bear use the RSA during the year.

The existing cameras in the RSA will be re-evaluated for how they address the two objectives above and re-deployed, if necessary. Cameras will be located at the following locations:

1. at camps (5 cameras);
2. waste management facilities (5 cameras); and
3. the marine laydown area (5 cameras).

Cameras will record one photo every 30 minutes and 10 photos whenever they are triggered by movement, as they did during baseline surveys. Cameras will be checked twice per year at minimum by on-site environment technicians. Cameras may be repositioned as deemed necessary pending results of the photo data.

All methods will follow those reported in the 2015 Back River Camera Report (Rescan 2015). Prior to construction of the Project, a detailed plan will be produced that includes the training for environmental monitors, equipment required, data forms, methods, data entry forms and analysis.

Data Analysis

Data analysis will evaluate 1) whether grizzly bears are sighted at camps and waste management facilities, 2) whether the rate of observations changes with mitigation (e.g., improvements in camp hygiene) and 3) comparisons between years at waste management, camp sites, and important caribou sites (where bears may predate caribou) to determine if there is any change of use by grizzly bears.

Triggers for Adaptive Management

Changes in usage at monitored sites can then trigger adaptive management to review possible sources of noise and disturbance that may cause shifts in bear habitat usage.

Reporting

Data and analyses will be reported in the annual WEMP report.

Incidental Observations

Methods

Incidental observations of grizzly bears will be recorded by all Project personnel, including environmental monitors, pilots, drivers on on-site and ice roads, and other project personnel. More details are available in Section 7.2.6 (Incidental Wildlife Monitoring) and Section 7.2.7 (Wildlife-Vehicle Interactions).

Incidental observations of grizzly bears will be recorded as described in Section 7.2.6 and will be analyzed to evaluate the location and timing of where and when grizzly bears are on-site and whether there is any relationship between Project and mitigation activities and the number of bears observed.

Data Analysis

Incidental reports will also be evaluated on a running basis by the environmental team to determine if there is a sudden spike in the number of observations of animals that may be attracted to camp.

Triggers for Adaptive Management

A spike in the number of bears observed at site will trigger adaptive management (See Section 6.3, Wildlife Attractant Management).

Reporting

Data, analyses and adaptive management will be reported in the annual WEMP report.

7.3.3 Muskox

7.3.3.1 Background

Baseline surveys conducted between 2001 and 2012 indicate that muskox are present in the study area. Muskox are designated as a VEC for the EIS. An assessment of potential local impacts from the Project on muskox has been included in the WEMP as muskox data have been collected in conjunction with the caribou monitoring program.

The two objectives of the focal species monitoring for muskox are to:

1. describe the monitoring work that has been conducted to date in the RSA, including:
   - aerial surveys; and
   - habitat suitability modelling.

7.3.3.2 Existing Baseline Surveys

Two types of surveys have been conducted for muskox in the RSA during baseline surveys including: i) aerial surveys conducted concurrently with the caribou aerial surveys; and ii) habitat suitability mapping for muskox in the RSA during summer and winter seasons to determine the proportion of good-quality habitat for muskox.

Aerial Surveys

In 2001, 2002, 2007, 2008, and 2010, data on muskox distribution and group composition were collected concurrently with the caribou aerial surveys and followed the same study design and field methods provided for caribou. Additionally, incidental observations of muskox were collected during baseline surveys conducted on other wildlife species in 2007, and 2011 through 2013.

Muskox have been observed in the RSA throughout the year, and in all years where baseline surveys have been conducted in the Project area (Volume 5, Section 7.1). However, muskox densities tend to be low and highly variable between years. Due to these low densities and high variability there is insufficient data to conduct a statistical analysis of the muskox population in the RSA – and therefore evaluate whether a ZOI exists around Project infrastructure during operations. Muskox appear to be more common during summer than during winter, and calf numbers are generally low.

Habitat Suitability Modelling

Wildlife habitat suitability modelling was conducted within the LSA and RSA to inventory and rate the habitat types for muskox and quantify suitable habitat available for this species within the LSA and RSA (Rescan 2013a). Habitat suitability modelling methodology was guided by BC Resource Information Standards Committee standards (RIC 1999b). Results are presented in the existing environment and baseline information section for the muskox effects assessment (Volume 5 Section 7.1). The primary results from this analysis were:

- approximately one third of the LSA and RSA was rated as high or moderate value summer habitat for muskox; and
- a little under one third of the LSA and RSA was rated as high or moderate value winter habitat for muskox.

7.3.3.3 Regional Muskox Monitoring for the WEMP

One regional-scale monitoring program and one backup program are proposed for muskox:

1. Contributions to regional/collaborative programs with GN DOE, and;
2. A backup monitoring plan for muskox.

Contributions to Regional/Collaborative Programs with GN DOE

During the DEIS review, the GN DOE requested that Sabina contribute to a GN-led regional monitoring program for muskox. Sabina has committed to contribute to a regional muskox monitoring program when one is developed by the GN DOE as a replacement for regional monitoring of muskox that Sabina had proposed in the FEIS. It should be noted that as of 2015, no plans have been provided by the GN or the GNWT for review by Sabina.

The format of a contribution is described in Section 7.1.5 (Contributions to Government-Led Regional Monitoring Programs).

Backup Monitoring Plan for Muskox

During the DEIS review phase, the KIA requested that Sabina propose a backup plan for regional monitoring of wildlife VECs should a GN monitoring plan not be available to contribute to.

At this time, Sabina is not proposing any proponent-led regional monitoring programs for muskox because the number of muskox observed during baseline aerial surveys is too small to detect a zone of influence (2-4 groups per survey) and thereby monitor for the predicted effects of the Project (avoidance of the Project footprint).

7.3.3.4 Local-Scale and Facilities Monitoring for Muskox

Local-scale monitoring will evaluate how muskox interact with the Project infrastructure and evaluate the efficacy of mitigation initiatives. Two forms of local-scale monitoring will be conducted for muskox:

1. remote motion-triggered cameras; and
2. incidental observations.

Remote Motion-Triggered Cameras

Methods

Local-scale monitoring was conducted as part of baseline surveys using remote-triggered cameras. The local-scale monitoring program will be continued into the WEMP using remote-triggered cameras. The three objectives of this local-scale monitoring program are to:

1. monitor the Project site to examine how muskox interact with Project facilities (e.g., on roads, pits);
2. monitor areas identified as important for muskox from landuser knowledge (e.g., eskers, windswept benches) and at points with high number of muskox identified during baseline studies (e.g., the hilly area west of the MLA); and
3. record the times at which muskox use the area near the Project during the year in order to guide mitigation activities.

Methods for data management and analysis and reporting will follow those for caribou.

Incidental Observations

Incidental observations of muskox will be recorded by all Project personnel, including environmental monitors, pilots, drivers on on-site and ice roads, and other project personnel. More details are available in Section 7.2.6 (Incidental Wildlife Monitoring) and Section 7.2.7 (Wildlife-Vehicle Interactions).

Data Analysis

Incidental observations of muskox will be recorded as described in Section 7.2.6 and will be analyzed to evaluate the location and timing of where and when muskox are on-site and whether there is any relationship between Project and mitigation activities and the number of muskox observed.

Triggers for Adaptive Management

Alterations in the number of muskox observed on-site may trigger a review of noise and disturbance mitigation to investigate if changes to Project activities may be altering muskox habitat usage.

Reporting

Data, analyses and adaptive management actions will be reported in the annual WEMP report.

7.3.4 Wolverines/Furbearers

7.3.4.1 Background

Arctic furbearers include wolverine, wolves, red and Arctic foxes, Arctic hare, and Arctic ground squirrels, and to a lesser degree lynx and marten which are found closer to the treeline. Wolverines and grey wolves are representative furbearer species with wolves acting as a proxy for foxes (both canids). Baseline survey data and Inuit TK indicate that wolverine and wolves are found throughout the RSA (Gartner Lee Ltd. 2008; Rescan 2011; KIA 2012; Rescan 2012, 2013c). The western Canada population of wolverine, including Nunavut, is listed as a species of special concern by COSEWIC (2007a). The Arctic grey wolf is federally listed as “Data Deficient” (COSEWIC 2007b), but is listed as secure in Nunavut (CESCC 2010). Wolverine and furbearers are included as a VEC in the environmental assessment and thus, an assessment of potential local impacts from the Project on wolverine and furbearers has been included in the WEMP.

The two objectives of this component of the WEMP are to:

1. describe the monitoring work that has been conducted to date in the RSA, including:
   - population-estimates using DNA mark-recapture for wolverine;
   - carnivore den surveys;
   - habitat suitability modeling for wolverine and wolves; and
   - incidental observations of wolverine and furbearers using remote motion-triggered cameras.
2. describe the monitoring work that is proposed for the WEMP, which includes:
   - carnivore den surveys; and
   - monitoring use of the RSA and areas near proposed Project infrastructure for wolverine and furbearers using remote motion-triggered cameras.

7.3.4.2 Existing Baseline Surveys

The Project has conducted four types of baseline surveys for wolverine and furbearers in the RSA including: i) population-estimation using DNA mark-recapture for wolverine, ii) carnivore den surveys, iii) habitat suitability modelling for wolverine and wolves, and iv) incidental observations of wolverine and furbearers during other environmental baseline surveys conducted in the RSA and via remote motion-triggered cameras.

DNA Mark-Recapture

A wolverine DNA mark-recapture study was conducted in 2012 and 2013 (Rescan 2013c). The survey area in 2012 for the wolverine DNA hair study was a 1,692 km^2 grid, roughly centered on the Goose camp, with no post closer than 5 km from either camp. The survey grid was divided into 49 cells, with each cell being 6 km x 6 km. In 2013 a second year of data collection for wolverine hair was repeated in this survey grid and an additional 2,000 km^2 survey grid consisting of 50 cells roughly centred on the proposed marine laydown area was initiated (Rescan 2014a). For both years, within each cell, a 1.5 meter post wrapped with barbed wire was set and secured with rocks. A long-distance (strong-smelling) lure was used to draw in wolverines and a piece of fish was used as a food reward to provide incentive for wolverines to climb the posts. Three checks to collect hair samples were conducted: these were spaced a minimum of 10 days and a maximum of 14 days apart. DNA extracted from samples went to a multi-locus analysis of individual identity. Details of the methods are reported in the 2012 Grizzly Bear and Wolverine Baseline Report (Rescan 2013b). Results from these surveys are summarized in the existing environment and baseline information section of the wolverine and furbearers effects assessment (Volume 5, Section 8.1) and in:

- Appendix V5-6B. Back River Project: Grizzly Bear and Wolverine DNA Report, 2013.

The main results indicate:

- a total of 12 wolverines were detected in the 2012 wolverine DNA study area, indicating that the RSA supports a moderately sized wolverine population;
- wolverines were concentrated in the southwest and central portion of the survey grid; and
- one wolverine detected in the 2012 study was previously detected in a DNA study area conducted approximately 225 km to the southwest of the Back River DNA study area, indicating that wolverines can have large home ranges.

Carnivore Den Surveys

For carnivores including wolverine and wolves, den surveys were conducted to identify the number and distribution of existing dens within the RSA, to identify dens that are active, and to identify resident carnivore species utilizing the RSA (Gartner Lee Limited 2007; Rescan 2012, 2013c). Two surveys were conducted, an occupancy survey (May/June) and a productivity survey (July). The occupancy survey identified that a den was "occupied" and used for breeding, while the productivity survey was conducted to examine if the den was successful (adults and young were present) or abandoned (suggesting the pups died and the den failed for that year).

These surveys were carried out via low level aerial surveys in esker and glacial-fluvial habitat. Occupancy surveys were carried out in 2007 (Gartner Lee Limited 2007), while both occupancy and productivity surveys were conducted in 2011 (Rescan 2012) and 2012 (Rescan 2013c) throughout the RSA. Surveys were flown at an altitude of 50 to 100 m above the terrain and at ground speeds between 30 to 80 km/h to minimize disturbance to carnivores in the area but to maintain an effective height and speed for observers to effectively discern dens and signs of activity (i.e. animals, scat, tracks, or prey remains). Full details of the carnivore den survey methods can be found in the 2011 and 2012 Wildlife Baseline Reports (Rescan 2012, 2013c). Results from these surveys are summarized in the existing environment and baseline information section of the wolverine and furbearers effect assessment (Volume 5, Section 8.1). The main results indicate:

- two active wolverine dens exist in rocky boulder areas located within 1 km of proposed site infrastructure, one of which was approximately 2 km away from Goose Camp in the "goose neck" of Goose Lake;
- two active wolf dens were recorded in esker habitat in the RSA in 2012 and five in 2007; and
- no denning activity was recorded at several historic wolf den sites during all years surveyed.

Habitat Suitability Modeling

Wildlife habitat suitability modelling was conducted within the LSA and RSA to inventory and rate the habitat types for wolverine and wolves and quantify suitable habitat available for this species within the LSA and RSA (Rescan 2013a). Methods were guided by BC Resource Information Standards Committee standards (RIC 1999b). Denning habitat was modeled for wolverine and wolves. Results are presented in the existing environment and baseline information section for the wolverine and furbearer effects assessment (Volume 5, Section 8.1). The primary results from this analysis were:

- less than half of the LSA and RSA contained habitat features that may offer denning opportunities for wolverine; however, these results are assumed to be a coarse assessment of denning potential in the area; and
- potential denning habitat for wolves in the LSA and RSA are not common as there is a limited number of eskers and other suitable terrain features within these areas. However, additional denning areas may exist near river and lake banks (lacustrine materials), which were not included in the modeling due to the inability to differentiate between suitable lake banks and open water.

Remote Motion-triggered Cameras

Incidental observations of wolverines and furbearers were recorded in the RSA via images captured by the 30 remote cameras distributed throughout the RSA for caribou surveys in 2012 and 60 cameras used in the RSA in 2013 (Rescan 2013c, 2014b). Fourteen cameras were located at and facing wolverine posts during DNA surveys to determine the success of Mark Recapture DNA methods – the number of

animals that visited the posts vs. the number of hair samples recovered. Remote cameras for the wolverine DNA study recorded observations from March to early May 2012 and cameras for the caribou baseline surveys recorded observations from late May to August 2012. Images from these cameras were quality checked to remove duplicate images of the same individual and documented. Details of the methodology for remote cameras can be found in the 2012 Wildlife Baseline Report (Rescan 2013c). Wolverines and wolves were frequently detected via remote cameras with a total of 51 observations captured by 30 cameras located in the RSA. However, several of these observations are likely re-counted individuals.

7.3.4.3 Regional Wolverine/Furbearer Monitoring for the WEMP

Two regional-scale monitoring programs are proposed for Wolverine/Furbearers:

1. contributions to regional/collaborative programs with GN DOE; and
2. a backup monitoring plan for wolverine/furbearers.

Contributions to Regional/Collaborative Programs with GN DOE

During the DEIS review, the GN DOE requested that Sabina contribute to a GN-led regional monitoring program for wolverine. Sabina has committed to contribute to a regional monitoring program when one is developed by the GN DOE as a replacement for regional monitoring of wolverine/furbearers that Sabina had proposed in the FEIS. It should be noted that as of 2015, no plans have been provided by the GN or the GNWT for review by Sabina.

The format of a contribution is described in Section 7.1.5 (Contributions to Government-Led Regional Monitoring Programs).

Backup Monitoring Plan for Wolverine/Furbearers

During the DEIS review phase, the KIA requested that Sabina propose a backup plan for regional monitoring of wildlife VECs should a GN monitoring plan not be available to contribute to.

The carnivore den surveys will be conducted as a backup plan, following a three year pattern. Surveys will be conducted for three consecutive years (surveyed two times yearly) and then not conducted for the following three consecutive years. This pattern will repeat throughout the Construction and Operation phases as part of the regional program to monitor the distribution of wolverine and furbearers in the RSA.

Methods for den surveys will follow those reported in the baseline studies. Data analysis will examine the occupancy of particular den sites through time. See the section on remote motion-triggered cameras for analysis of reproductive productivity.

7.3.4.4 Local-Scale and Facilities Monitoring for Wolverine/Furbearer

Local-scale monitoring will evaluate how wolverine/furbearers interact with the Project infrastructure and evaluate the efficacy of mitigation initiatives. Two forms of local-scale monitoring will be conducted for wolverine/furbearer:

1. remote motion-triggered cameras; and
2. incidental observations.

Remote Motion-Triggered Cameras

Methods

The three objectives of this local-scale monitoring program are to:

1. monitor the Project site to examine how wolverine and furbearers interact with Project facilities (e.g., waste management facilities) to determine the efficacy of mitigation activities (e.g., camp hardening and waste management procedures);
2. monitor dens identified from denning surveys; and
3. record the times at which wolverine and furbearers use the RSA during the year.

The purpose of den monitoring will be to evaluate the number and survival of pups, related to the activities of the Project.

Data Analysis

A time series analysis will be used to analyse productivity data.

Triggers for Adaptive Management

Alterations in den productivity will be compared to Project activities to investigate if there is a relationship between the two that may lead to alterations in Project activities as part of adaptive management.

Reporting

Data and analyses will be reported in the annual WEMP report.

Incidental Observations

Incidental observations of wolverine/furbearers (i.e., wolves) will be recorded by all Project personnel, including environmental monitors, pilots, drivers on on-site and ice roads, and other project personnel. More details are available in Section 7.2.6 (Incidental Wildlife Monitoring) and Section 7.2.7 (Wildlife-Vehicle Interactions).

Incidental observations of wolverine/furbearers will be recorded as described in Section 7.2.6 and will be analyzed to evaluate the location and timing of where and when wolverine/furbearers are on-site and whether there is any relationship between Project and mitigation activities and the number of wolverine/furbearers observed. Data and analyses will be reported in the annual WEMP report.

Incidental reports will also be evaluated on a running basis by the environmental team to determine if there is a sudden spike in the number of observations of animals that may be attracted to camp. A spike in the number of wolverine/furbearers observed at site will trigger adaptive management (see Section 6.3; Wildlife Attractant Management).

7.3.5 Migratory Birds

7.3.5.1 Background

The wildlife operations section within the Government of Nunavut's Department of Environment covers and enforces the territorial and federal laws protecting migratory birds including the *Migratory Birds Convention Act* and the *Nunavut Wildlife Act* (2003). The *Nunavut Wildlife Act* includes reference to the *Canadian Migratory Bird Convention Act* (1994c) that protects avian species that migrate between

countries. The Canadian Endangered Species Conservation Council (CESCC) produces a list of the conservation status ranks of birds for each province and territory and due to the migratory nature of upland breeding birds and waterbirds, particular attention was paid to each species in its breeding grounds (CESCC 2010).

Waterbirds

The lakes and wetlands of the tundra host a large number of migratory waterbird species, including tundra swans, loons, sandhill cranes, geese, and ducks. The breeding distribution of several species including the yellow-billed loon, tundra swan, and greater white-fronted goose is exclusive to the tundra region. Species richness of waterfowl is considered a valuable indicator of the quality of wetland habitats. Although predicted to be minor, indirect effects from mine-related activities, such as noise and dust, have the potential to change the distribution and species richness of waterbirds within the study area.

Identifying species of conservation concern is imperative to meet the obligations of the *Species At Risk Act* (SARA; 2002), which protects threatened and endangered species and their habitats. In Nunavut, several species of waterbird are listed as sensitive and occur in the Back River terrestrial RSA including: long-tailed duck, Arctic tern, and glaucous gull.

Upland Breeding Birds

Upland breeding birds include songbirds (passerines, with the exception of common raven, which is included under raptors), shorebirds, and ptarmigan. During the breeding period, natural and anthropogenic disturbances can be associated with changes in density and species richness of bird communities. For example, a recent eight-year study at the EKATI Diamond Mine indicated temporal changes in the diversity and density of bird species associated with landscape scale and population level effects (Smith et al. 2005).

Nine species of upland breeding birds recorded in the Back River RSA are listed by the Canadian Endangered Species Conservation Council (CESCC 2010) in Nunavut as "Sensitive," including the American golden plover, American pipit, American tree sparrow, Harris' sparrow, hoary redpoll, least sandpiper, red-necked phalarope, semi-palmated sandpiper, and white-crowned sparrow. There are no upland breeding bird species currently observed in the RSA that are SARA-listed species.

The two objectives of this component of the WEMP are to:

1. describe the monitoring work that has been conducted to date in the RSA, including:
    - staging and breeding surveys for waterbirds; and
    - PRISM Plot surveys for upland breeding birds.
2. describe the monitoring work that is proposed for the WEMP, which includes:
    - determining if the Project influences the species richness and density of waterbirds in the local and regional study areas during migration periods, establishment of nesting territories period, and brood rearing period; and
    - determining if the mine influences upland breeding bird density and species richness within the RSA using PRISM plot surveys.

7.3.5.2 Existing Baseline Surveys

The Project has conducted aerial surveys for waterbirds during staging and breeding periods in the terrestrial RSA, and two types of baseline surveys for upland breeding birds in the terrestrial RSA including: i) PRISM Plot surveys, and ii) point count surveys.

Aerial Surveys for Waterbirds

Aerial surveys were flown between 2011 and 2013 in the terrestrial RSA (Rescan 2012, 2013c, 2014b). Survey methodology followed established protocols described by the Canadian Wildlife Service (CWS) and the United States Fish and Wildlife Service (USFWS)(CWS and USFWS 1987). Flights were conducted by helicopter at speeds of 40 to 100 km/hour and at an altitude of approximately 45 m in five survey areas within the RSA. These areas include two survey blocks near Goose Property, two surveys blocks near to the west of the Goose Property and one larger survey block near the proposed Marine Laydown Area.

Survey blocks consisted of eight transects (16 km long and spaced 2 km apart) arranged latitudinally and were flown once for each aerial survey. One or two main observers and at least one data recorder were present in the helicopter in addition to the pilot. Observers searched lake surfaces and wetlands for waterbirds and/or waterbird broods and identified and recorded waterbirds within 400 m of either side of the aircraft during staging surveys and within 200 m of the aircraft during breeding surveys. Whenever waterbirds were observed they were identified to the species level, when possible. The timing of these surveys was planned to coincide with the staging periods in late May and late August and the breeding periods including pairing (mid-June) and brood-rearing (mid-July). Full detailed methodology can be found in the 2012 Wildlife Baseline Report (Rescan 2013c).

In 2011, two aerial surveys were conducted in the survey blocks near Goose Property, one in July (early breeding survey) and one in August (late breeding/early staging survey). Four aerial surveys were flown in the four survey blocks surrounding the Goose Property in 2012 and in the large survey block near the proposed MLA in 2013: one in late-May corresponding to spring staging, one in June corresponding to waterbird courting, one in mid-July to document breeding, and one in late-August corresponding to fall staging.

A summary of results of baseline waterbird monitoring can be found in the existing environment and baseline information section of the migratory birds chapter in the FEIS (Volume 5, Section 9.1) and detailed results are found in the annual baseline reports for 2011 and 2012 (Rescan 2012, 2013c). The primary results of this study indicate:

- a total of 24 waterbird species have been detected in the terrestrial RSA, five of which are species of conservation concern listed as “Sensitive” in Nunavut: long-tailed duck, Arctic tern, glaucous gull, common eider, and king eider;
- large flocks of geese and ducks move through the area during migration periods on their way to their breeding and/or wintering grounds;
- a greater number of flocks were observed in the southern half of the terrestrial RSA;
- flocks of waterbirds have been consistently documented in both spring and fall surveys on one small lake approximately 60 km northwest of the Goose Property, inside of the terrestrial LSA; and
- evidence of breeding during baseline surveys was minimal in the terrestrial RSA with confirmed breeding documented for three species including Canada geese, northern pintail, and sandhill crane. A small number of waterbird pairs, mostly long-tailed ducks, were documented in the terrestrial RSA during pair surveys.

PRISM Plot Surveys for Upland Breeding Birds

Surveys for upland breeding birds were carried out in June of 2011, 2012, and 2013 based on the rapid survey technique from The Program for Regional and International Shorebird Monitoring (PRISM) instituted by Canadian Wildlife Service (CWS) to monitor continental trends in shorebird populations. PRISM plots (each 12 ha or 300 x 400 m) are established at randomly selected locations throughout the study area, covering high, moderate and low quality shorebird habitats (Rescan 2012, 2013c, 2014b). Data were also collected in 2007 combining modified PRISM plots (400 m x 400 m) and transects (400 m – 800 m).

Full survey details can be found in the annual wildlife baseline reports (Rescan 2012, 2013c). Beginning in the southwest corner of each plot, observers slowly walked back and forth along six paired 400 m transects spaced 25 m apart. All upland breeding birds observed on the ground or flushed within 12.5 m on either side of each transect line were noted along with habitat data. Broad upland and lowland classifications consisted of three habitat types; dry, moist, and wet. Observers recorded nine micro-habitat types from dry to wet: Dry: beach, esker, rocky heath, heath lichen; Moist: heath hummock, short shrub, tall shrub; and Wet: sedge wetland, and water.

Baseline surveys for upland breeding birds focused on describing species density, diversity, and richness within the RSA and relating these to habitat associations. Surveys for upland breeding birds in the study area were conducted using Prism Plot surveys in a focused survey area roughly centered on the Goose Property and a nearby reference area (2011 and 2012) and in a survey area encompassing and radiating inland from the MLA (2012 and 2013).

A summary of results of baseline upland breeding bird surveys can be found in the existing environment and baseline information section of the migratory birds chapter in the FEIS (Volume 5, Section 9.1) and detailed results are found in the annual baseline reports:

- Appendix V5-5C: Wildlife Baseline Report 2012;
- Appendix V5-5D: Wildlife Baseline Report 2011; and
- Appendix V5-5F. Back River Project: 2013 Wildlife Baseline Report.

The primary results of this study indicate:

- a total of 22 upland breeding bird species (10 songbirds, nine shorebirds, and two ptarmigan) were observed during PRISM surveys including 10 species listed as “Sensitive” in Nunavut: American golden-plover, American pipit, American tree sparrow, dunlin, Harris’s sparrow, hoary redpoll, least sandpiper, red-necked phalarope, semipalmated sandpiper, and white-crowned sparrow;
- songbird territories were the dominant group of upland breeding birds territories observed representing 88% of all territories recorded;
- three communities of songbirds were recorded – one associated with wet habitat types such as wetlands and sedge meadow, the second associated with moist habitats with tall shrubs, and the third associated with upland heath habitat;
- shorebirds were most often associated with moist and wet habitat classifications; and
- ptarmigan were most often observed in the dry and moist habitat types.

Point Count Surveys for Upland Breeding Birds

In 2013, point count surveys were conducted for upland breeding birds based on established protocols for songbirds in forested and non-forested environments (Ralph et al. 1993; RIC 1999a; Environment Canada 2004). Point counts were conducted using a fixed radius of 100 m and were randomly distributed across upland habitats in the study area.

Surveys were conducted between 7:00 to 12:00 to capture the time when territorial male songbirds sing most frequently. Following a settling period of two minutes after arriving at each point count station (to allow bird activity to return to normal), all birds seen and heard within a five minute period were recorded, as well as their distance and location with respect to the observers. All birds were identified to species and to gender when possible; detections were noted as visual, song, or call, and any evidence of breeding (e.g., nests, territorial and mating displays) were also noted. Birds that were detected beyond the 100 m radius survey area, were flying over stations, or were detected after the five minute point count were also recorded. Observers also recorded the habitat type(s) present within the point count survey area, using ten broad habitat categories ranging from driest to wettest: esker, beach, bedrock lichen heath, dry heath tundra, mesic tundra, low shrub, tall shrub, hummocky sedge meadow, moist sedge meadow, wet sedge meadow.

Full survey details can be found in the annual wildlife baseline reports:

- Appendix V5-5C: Wildlife Baseline Report 2012;
- Appendix V5-5D: Wildlife Baseline Report 2011; and
- Appendix V5-5F. Back River Project: 2013 Wildlife Baseline Report.

Point count surveys for upland breeding birds focused on describing species density, diversity, and richness within the study area and relating these to habitat associations. Specifically, this methodology was instituted to describe the upland breeding bird community in habitats surrounding the proposed MLA. Point count surveys were conducted within a five kilometer area surrounding the proposed MLA, and in a similar reference site located approximately 20 km north of the MLA (Rescan 2014b).

7.3.5.3 Regional Waterbird and Upland Bird Monitoring for the WEMP

A biennial migratory bird monitoring program is proposed for the WEMP, including programs for:

1. waterbirds (staging and breeding surveys); and
2. upland breeding birds.

Waterbird Monitoring

Waterbird monitoring will consist of two types of surveys: i) surveys to assess Project-related changes in the distribution of waterbirds in the RSA during staging periods, and ii) surveys to assess the effect of the Project on resident breeding waterbirds in the RSA. Analyses will be conducted to determine trends over time in the distribution (i.e., a Zone of Influence [ZOI]), and productivity of waterbirds in relation to mine infrastructure.

At the moment, there is no consensus in the scientific literature or from CWS on the best way to measure a ZOI on waterfowl distribution during staging and breeding. As such, two monitoring programs will be conducted and compared for their power to detect change in the WEMP report. The two methods being trialed are 1) grid surveys, which are a continuation of the baseline survey methodology, and 2) total counts at individual ponds.

Grid surveys will follow a BACI study design, following the field design and methods conducted as part of baseline studies described in the 2012 and 2013 wildlife baseline reports (Rescan 2013, 2014). Baseline surveys used three survey blocks, 1) Goose block, 2) Goose control, 3) an MLA block. Monitoring surveys will use the Goose block and MLA blocks.

Staging Surveys

Aerial grid surveys will be conducted during spring and fall staging periods following established protocols described by the CWS and the USFWS (CWS and USFWS 1987) and will be continued on a three year schedule while the Goose PDA and MLA are active.

The second monitoring method will be ground-based counts of all wetlands within a 5 km radius of the Project infrastructure. Ponds will be surveyed on a biennial basis for staging waterfowl during the spring and fall staging periods from the ground. Detailed methods will be described in the WMMP Plan prior to construction of the Project.

Data analysis will focus on comparing the two methods for monitoring a ZOI (grid surveys vs. total counts at individual ponds/lakes. Following this analysis, and reporting of the results to CWS and the KIA, the method with the greater power to detect a ZOI will be chosen for future monitoring by the Project. Following selection of the monitoring methodology, surveys will be repeated every 3 years for the life of the Project.

Breeding Surveys

The survey plan for breeding surveys will parallel that of the staging surveys, with two possible methods being trialed and compared during the first year of migratory bird surveys. Aerial surveys will be conducted to record waterbird breeding in the terrestrial RSA as per the methods reported in Rescan 2013 and 2014. Data gathered during these baseline surveys indicated that evidence of breeding was low in the Project area. A limited number of broods were observed in the waterbird survey blocks in the terrestrial RSA in 2011 and 2012. However, it is not clear whether the limited number of broods detected in the RSA was a function of survey platform, or whether the Project area is an area which supports limited breeding for waterbirds.

The second method to be used will be ground-based surveys of ponds within 5 km of Project infrastructure in the Goose Property and the MLA. Detailed methods will be described in the WMMP Plan prior to construction of the Project.

Data analysis will focus on comparing the two methods for monitoring a ZOI (grid surveys vs. total counts at individual ponds/lakes. Following this analysis, and reporting of the results to CWS and the KIA, the method with the greater power to detect a ZOI will be chosen for future monitoring by the Project. Following selection of the monitoring methodology, surveys will be repeated every 3 years for the life of the Project.

Upland Breeding Bird Monitoring

For upland breeding bird monitoring, a combination of variable radius point count surveys and PRISM plots will be used to monitor potential effects of the Project on upland breeding birds annually, with continued focus on areas near Goose Property and the Marine Laydown Area. A suite of approximately 50 PRISM plots at varying distances from mine infrastructure within the RSA will be revisited and/or established. The plots will be distributed amongst representative cover types, and each plot will be located in a single cover type following standard CWS PRISM methods. Detailed methods will be described in the WMMP Plan prior to construction of the Project.

The number and locations of PRISM plots and point counts will be reviewed prior to each biennial survey, and they may change as data become available to ensure that changes in breeding bird density and species richness can be accurately assessed relative to the mine site. These surveys contribute data on density, richness, and diversity of other upland nesting species in the Arctic. Two trained biologists will conduct the survey according to established CWS guidelines. Incidental bird observations will also continue to be recorded on and near the mine site.

A review of all available upland breeding bird data collected to date via PRISM plot surveys will be conducted to assess differences from baseline patterns in species density and richness. This analysis will be based on the most current analytical techniques and based on advice from the CWS.

7.3.5.4 Local-Scale and Facilities Monitoring for Waterfowl and Upland Birds

Local-scale monitoring will be conducted during the construction process as pre-construction surveys. Pre-construction surveys are described in Section 7.2.3 (Pre-Clearing Surveys for Nests).

Local-scale monitoring will also be conducted as part of Waterbird Monitoring in Ponds, Section 7.2.11.

7.3.6 Raptors

7.3.6.1 Background

Raptors in the Project area include peregrine falcon, gyrfalcon, rough-legged hawk, golden eagle, bald eagle, short-eared owl, snowy owl, and northern harrier (Rescan 2013c). Common ravens are included as functional raptors in Nunavut because they compete for the same resources as the cliff-nesting raptors in the Project area (White and Cade 1971). The tundra peregrine falcon is federally listed on Schedule 3 as a population of Special Concern under the *Species at Risk Act* (SARA; Government of Canada 2012) and short-eared owl are listed on Schedule 1 as species of special concern (Government of Canada 2012), while the golden eagle, peregrine falcon, and the short-eared owl is listed on Schedule 1 as a species of Special Concern and are listed as sensitive in Nunavut (CESCC 2010). Golden eagle, gyrfalcon, and rough-legged hawk are also listed as "Sensitive" in Nunavut (CESCC 2010).

Raptor breeding activity is monitored as part of the WEMP because raptors were designated a VEC in the EIS and because raptors and their nests are legally protected under the Nunavut *Wildlife Act* (2003). Raptors are also considered valuable indicators of environmental change (Furness and Greenwood 1993). Peregrine falcon and short-eared owl were chosen for the environmental assessment as representative cliff-nesting and tundra-nesting raptor species, respectively.

The two objectives of this component of the WEMP are to:

1. describe the monitoring work that has been conducted to date in the RSA, including:
   - occupancy and productivity nest surveys; and
   - habitat suitability modeling for peregrine falcon and short-eared owl.
2. describe the monitoring work that is proposed for the WEMP, including:
   - occupancy and productivity nest surveys to determine if the mine influences the distribution, occupancy rate, nest success rate, or productivity of raptors nesting in the study area.

7.3.6.2 Existing Baseline Surveys

The Project has conducted two types of baseline surveys for raptors in the regional study areas including: i) raptor nest surveys, and ii) habitat suitability modelling for peregrine falcon and short-eared owl.

Raptor Nest Surveys

Surveys were conducted in 2002 (Rescan 2002), 2007 (Gartner Lee Limited 2007), 2011 (Rescan 2012), 2012 (Rescan 2013c) and 2013 (Rescan 2014b) to estimate the abundance, distribution, and breeding productivity of cliff-nesting raptor species within the RSA. Raptor surveys were conducted for cliff nesters from a helicopter with two observers. Nests of ground nesting raptors were recorded during the upland breeding bird surveys.

Aerial survey flights were flown at a minimum of 50 m from the cliff and flying speed was between 30 to 80 km per hour to prevent disturbing the nesting raptors and still maintain an effective height for distinguishing raptor species brood data. Nest sites were determined from previous datasets and surveys, while new nests were recorded and added to the dataset.

Two surveys were conducted each year: i) the spring occupancy survey to determine whether historical nests were occupied and if any new nests were built, and ii) the summer productivity survey to determine the proportion of occupied nests that were productive, and the productivity of these nests (number of chicks produced and fledged at each nest site) where possible.

The timing of the surveys was coordinated to best maximize observing all raptor species; however, due to the staggered timing of nesting and fledging of some species (for example: gyrfalcon fledge before peregrine falcon nestlings) this survey has some limitations. The spring survey occurred in late May/June and summer survey in late July/August. Full details of the survey methodology can be found in the 2007, 2011, and 2012 Wildlife Baseline Reports (Gartner Lee Limited 2007; Rescan 2012, 2013c).

During previous baseline surveys (2002 to 2012), 234 raptor nest sites were identified and monitored in the study area (Rescan 2002; Gartner Lee Limited 2007; Rescan 2012, 2013c, 2014b). This historical data set and subsequent surveys led to the identification of new potential and actual nesting sites in the study area. In addition, rough-legged hawks and ravens typically build new nests each year. The actual number of nesting sites monitored in each year varies as new nests are built and old nests fall apart or are not found in certain years.

Habitat Suitability Modeling

Wildlife habitat suitability modelling was conducted within the LSA and RSA to inventory and rate the habitat types for raptors and quantify suitable habitat available for these species within the LSA and RSA (Rescan 2013a). Habitat suitability modelling methodology was guided by BC Resource Information Standards Committee standards (RIC 1999b). Raptor nesting habitat was modeled for peregrine falcon and short-eared owl. Results are presented in the existing environment and baseline information section for the raptor effects assessment (Volume 5, Section 10.1). The primary results from this analysis were:

1. very little habitat in the LSA and RSA contained habitat features that offer suitable nesting habitat for raptors due to the limited amount of cliff habitat in these areas; and
2. approximately half of the LSA was considered to be suitable habitat for nesting for short-eared owl, while only about a third of the RSA was considered to be suitable, largely based on the portion of both study areas that contain tall or dense shrubby areas.

7.3.6.3 Regional Raptor Monitoring for the WEMP

Regional monitoring will evaluate if there is a ZOI surrounding the Project sites where raptors may have lower nesting success due to disturbances from Project activities. Regional monitoring will be conducted via raptor nest surveys.

Raptor Nest Surveys

A raptor monitoring program occurring every three years is proposed for the WEMP. Raptor breeding sites in the RSA will be monitored to determine distribution, occupancy, and productivity at nest sites that have been mapped in the study area. The survey methods will follow the methods used during baseline surveys (Rescan 2013 and 2014).

Surveys will include two groups of nests: 1) nests within 1.5 km of Project infrastructure (the test group) and 2) nests in undisturbed reference areas within 10 km of the Project site. The exact nests to be monitored will be determined during the first year of study. Surveyors will return to nests identified and monitored during baseline surveys and will evaluate each nest for safety of the survey crew. In some cases, baseline surveys indicated that nests were located on cliffs above lakes, which can be a safety concern for helicopter-based surveys. Surveyors will rate the safety of each nest and determine which nests to include in the long-term monitoring program. The number of nests will be determined through a power analysis to be conducted on existing baseline data prior to the first monitoring survey.

Detailed methods will be described in the WMMP Plan prior to construction of the Project. Data analyses will be conducted to determine trends over time in the distribution, occupancy rate, and productivity rate of raptors in test sites (within 1.5 km of mine infrastructure) and at control sites. An analysis will also be conducted to determine if a ZOI is detectible at various distances from the Project site. Data and the results of analyses will be reported in the annual WEMP report.

7.3.6.4 Local-Scale and Facilities Monitoring for Raptors

Local-scale monitoring will be conducted during the construction process as pre-construction surveys. Pre-construction surveys are described in Section 7.2.3 (Pre-Clearing Surveys for Nests). Local-scale monitoring will also be conducted should an incidental observation of a raptor nesting on Project infrastructure be reported. Where a raptor has chosen to nest on Project infrastructure, the on-site environmental monitors will monitor the nest and determine the nest success. Data will be reported in the WEMP report.

7.3.7 Seabirds and Seaducks

7.3.7.1 Background

Seabirds/seaducks include those waterbird species that are reliant on marine environments during various life history stages, such as foraging or staging (Gill et al. 1996). The Queen Maud Gulf Migratory Bird Sanctuary is approximately 200 km east of Bathurst Inlet. The sanctuary is an important bird area with about 60 goose colonies and more than 12 species of waterbirds breeding within the sanctuary. It is possible that in addition to locally breeding waterbirds some of the breeding species from the sanctuary could use Bathurst Inlet as a staging area prior to fall migration.

Seabirds/seaducks and their habitat are protected under several forms of federal legislation. Migratory marine bird species receive protection under the federal *Migratory Bird Convention Act (1994b)*, which includes regulations that prohibit the killing, capturing, injuring, taking or disturbing of migratory birds,

or the damaging, destroying, removing or disturbing of nests (Canadian Wildlife Service 1991). The federal *Species at Risk Act* (SARA; 2002) protects threatened marine bird species and their habitats.

Identifying species of conservation concern is imperative to meet the obligations of the *Species At Risk Act* (SARA; 2002), which protects threatened and endangered species and their habitats. In Nunavut, several species of waterbird are listed as sensitive and occur in the Back River marine RSA including: Arctic tern, glaucous gull, common eider, and king eider.

7.3.7.2 Existing Baseline Surveys

The Project has conducted aerial surveys for seabirds/seaducks during staging and breeding periods in the marine RSA using three survey methods including: 1) survey block transects; 2) shoreline transects; and 3) marine transects. In addition, ground surveys were conducted for seabirds/seaducks in the marine RSA in 2011.

Aerial surveys were conducted in 2010, 2011, 2012, and 2013 in Bathurst Inlet to document seabirds/seaducks using marine habitat near the proposed MLA. Two surveys were conducted in Bathurst Inlet during each of the years surveyed: one in July during the breeding season, and one in August during fall staging. In 2010, surveys were conducted in the southern portion of the marine RSA in two survey blocks totalling 75 km of overwater distance in each survey block. Flight altitude and speed during these flights was 45 m (150 ft) and 80 to 100 km/h, respectively. In 2011, 2012, and 2013, aerial surveys were conducted in the marine RSA along shoreline transects and along marine transects in 2011 only (Figure 8.3-10). Flight altitude and speed was similar to those in 2010 except for during the 2011 marine transect surveys where flight altitude was 150 m (500 ft). Observers noted all seabirds/seaducks within 500 m of either side of the aircraft during these surveys.

Ground Surveys for Seabirds/Seaducks

In 2011, ground surveys were conducted in the marine RSA during the breeding season to locate marine bird nests along the shoreline. Surveys were conducted within 100 m of the shoreline of Bathurst Inlet. Two observers spaced 25 m apart walked along the shoreline searching for nests of seabirds/seaducks. Surveys were conducted for 30 minutes; because shoreline topography was not consistent along transects, transect length varied between 1 and 1.8 km. When nests were detected, the observers recorded the location, species, nest contents, and observations of birds flying along shorelines and on the water. No nests or young were observed during this survey.

A summary of results of baseline seabird/seaduck monitoring can be found in the existing environment and baseline information section of the seabirds/seaducks chapter in the FEIS (Volume 7, Section 6.1) and detailed results are found in the annual baseline reports for 2010 (Rescan 2010), 2011 (Rescan 2012), 2012 (Rescan 2013c), and 2013 (Rescan 2014b). The primary results of this study indicate:

- a consistent staging area was observed in a section of Bathurst Inlet directly south of the proposed MLA within the marine LSA; and
- evidence of breeding was negligible in the areas surveyed in the marine RSA.

7.3.7.3 Regional Seabird and Seaduck Monitoring for the WEMP

The objective of the regional seabird and seaduck monitoring program is to evaluate potential effects of the Project on the local population of these species, measured as a Zone of Influence (ZOI) of altered numbers of staging breeding birds and/or breeding success surrounding the Project site. A seabird/seaduck monitoring program every three years is proposed for the WEMP when the MLA is active.

Seabird/seaduck monitoring will consist of two types of surveys: i) surveys to assess Project-related changes in the distribution of seabirds/seaducks in the RSA during staging periods, and ii) surveys to assess the effect of the Project on resident breeding seabirds/seaducks in the RSA. Methods and analyses are described in Section 7.3.5.3 (Regional Waterbird and Upland Bird Monitoring for the WEMP).

7.3.7.4 Local-Scale and Facilities Monitoring for Seabirds

Local-scale monitoring will be conducted during the construction process as pre-construction surveys. Pre-construction surveys are described in Section 7.2.3 (Pre-Clearing Surveys for Nests).

7.3.7.5 Monitoring for Seabirds During Shipping in the Northwest Passage

During the review of the DEIS, the GN DOE and Environment Canada requested that Sabina conduct monitoring for seabirds during shipping to the Project site.

Seabird monitoring will be conducted as incidental observations by the ships bridge crew. Sabina will produce a simplified SOP, following the basic methods provided in the protocol outlined in Eastern Canada Seabirds at Sea (ECSAS) standardized protocol for pelagic seabird surveys from moving and stationary platforms (Gjerdrum et al. 2012).

This seabird observer methodology will allow for the identification of seabird species present and provide an estimation of seabird densities along the shipping route. Detailed methods will be described in the WMMP Plan prior to construction of the Project. Data analysis will be conducted to quantify bird distribution and abundance. Data and the results of analyses will be reported in the annual WEMP report.

If incidental observations of groups of seabirds indicate that bird strikes are occurring, then adaptive management will be undertaken, as described in Section 6.11, Shipping Mitigation for wildlife. The results of monitoring activities will be reported in the WEMP report. In addition, Sabina commits to working with relevant parties on relevant research on the cumulative effects of shipping including marine birds by sharing all monitoring data collected during shipping activities.

7.3.8 Marine Mammals

7.3.8.1 Background

Ringed seals are year-round residents of the Arctic and are highly adapted for living in the winter fast-ice environment. Ice conditions influence ringed seal distribution and abundance (Smith and Stirling 1975, 1978; Moulton et al. 2002). Ringed seal seasonal distribution is related to prey availability, stable ice conditions, and physical ice characteristics (McLaren 1958; T. G. Smith and Stirling 1975). During winter and late spring (roughly November to mid-June), when virtually the entire Canadian Arctic Archipelago is icebound, ringed seals may occur in Bathurst Inlet in moderate abundance. As the ice forms in late autumn, ringed seals maintain breathing holes in new thin ice and cracks with the claws of their foreflippers (T. G. Smith and Stirling 1975; T. G. Smith and Hammill 1981). Ringed seal are dependent on marine ice, utilizing stable ice platforms for pupping and nursing (McLaren 1958, 1962; T. G. Smith and Stirling 1975; Finley et al. 1983; Kelly 1988). During March and April, ringed seals create lairs under pressure ridges and snow drifts on sea ice where breathing holes are often maintained to have their pups. Ringed seals also haul out on sea ice to moult and rest from approximately mid-May through mid-July depending on the region and annual conditions (Vibe 1950; McLaren 1958; T. G. Smith 1973; T. G. Smith and Hammill 1981; T. G. Smith 1987; Kunnasranta et al. 2002). Ice begins to break up in June (late spring), and the open water period usually lasts throughout

July, August, and September or October. During the open water period, ringed seals can be found in low densities often widely distributed.

7.3.8.2 Existing Baseline Surveys

Aerial surveys were conducted in the marine RSA for seals during baseline surveys conducted in 2004, 2007, 2012 and 2013 to determine their distribution and population size in Bathurst Inlet. In 2004, surveys were conducted in early September (September 8), while surveys conducted in 2007, 2012, and 2013 were conducted in late May or June to coincide with the peak period of seal haul-out during the spring moulting period. Additionally, ringed seals were recorded in summer (July and August) 2010 and 2011 during marine bird surveys in Bathurst Inlet and in July 2012 during other environmental baseline surveys.

Aerial surveys for ringed seals were conducted using strip transect methodology following previously established methods (Stirling, Kingsley, and Calvert 1982; Kingsley, Stirling, and Calvert 1985; Lunn, Stirling, and Nowicki 1997; Frost et al. 2002). Flights were conducted using fixed wing aircraft at an altitude of approximately 152 m (500 ft) above sea level and a ground speed of approximately 220 km/h (120 knots) during the open water survey, and an altitude of 91 m (300 ft) above sea level and at a ground speed of approximately 130 to 157 km/h (70 to 85 knots) for surveys conducted during the ice-covered season during ringed seal moulting periods. Surveys were usually flown during mid-day, when numbers of seals hauled out on the ice were expected to be highest.

Transect lines (approximately 2.8 km apart during all years and areas surveyed, except south of Kingaok in 2012 and 2013 where transects were 1.4 km apart) were flown in Bathurst Inlet. The transect strip width was approximately 500 m surveyed on either side of the aircraft. However, seals that were directly under the plane to approximately 100 m from the centerline on either side of the aircraft were not visible to the observers, thus the effective survey strip was approximately 400 m of either side of the aircraft.

A summary of results of baseline ringed seal surveys can be found in the existing environment section of the marine mammals (ringed seal) chapter in the FEIS (Volume 7, Section 7.1) and detailed results are found in the 2012 Wildlife Baseline Report (Rescan 2013c). The primary results of this study indicate:

- density (corrected density for detection bias) of ringed seals in Bathurst Inlet is approximately 2.0 seals/km^2 (uncorrected density was approximately 0.55 seals/km^2);
- density was considerably lower south of Kingaok relative to areas north of Kingaok;
- density was related to ice cover and ice condition. The greatest density occurred on cracked ice followed by solid ice, with lower densities in areas with high ice deformation and extensive melt water; and
- no lairs were observed south of Kingaok.

7.3.8.3 Regional Ringed Seal Monitoring for the WEMP

The baseline data for ringed seals was examined to determine if a monitoring program would be effective. A monitoring program will only be effective if there are sufficient animals observed to be able to compare pre- and post-construction. Prior to construction, baseline surveys observed few to no lairs and seal pups in the Project location (south of Kingaok). In 2012, no large sea ice cracks, no lairs and only 2 seal pups were reported south of Kingaok. It is acknowledged that surveys were conducted approximately a week late in 2012. In the rest of Bathurst Inlet, lairs were typically found associated

with large sea ice cracks. With no cracks in the sea ice south of Kingaok, it is likely that southern Bathurst Inlet is not high quality habitat for lairs.

With few observations of sea ice cracks, lairs and seal pups south of Kingaok, it was determined that a) there is likely little to no effect of the Project ice roads on ringed seals and b) that the ability to detect an effect on the seal population there would be highly unlikely. Hence, no regional surveys for ringed seals are planned as part of the monitoring program for the Project.

7.3.8.4 Local-Scale and Facilities Monitoring for Ringed Seals

Local-scale monitoring will be conducted during the construction process as pre-construction surveys. Pre-construction surveys are described in Section 7.2.8 (On-Ice Monitoring at the MLA)

7.3.8.5 Monitoring for Marine Mammals During Shipping in the Northwest Passage

During the review of the DEIS, the GN DOE and Environment Canada requested that Sabina conduct monitoring for marine mammals during shipping to the Project site.

Marine mammal surveys will be conducted as incidental observations by the ships bridge crew. Sabina will produce a simplified SOP, following the basic methods provided in the protocol outlined in *Recommended Seabird and Marine Mammal Observational Protocols for Atlantic Canada* (Moulton & Mactavish 2004).

Data analysis will be conducted to quantify marine mammal species occurrence, distributions and abundance. Survey effort will be clearly documented. Data and the results of analyses will be reported in the annual WEMP report. The results of monitoring activities will be reported in the WEMP report. In addition, Sabina commits to working with relevant parties on relevant research on the cumulative effects of shipping including marine mammals by sharing all monitoring data collected during shipping activities.

8. Mitigation and Adaptive Management

The WMMP Plan describes actions that are intended to reduce Project-related effects on wildlife. This plan is intended to ensure wildlife habitats and populations are maintained in the area that will be influenced by Project development, while taking into account operational requirements and the safety of Project employees.

Unless otherwise indicated, measures described in the Plan apply to all Project components for the life of the Project. This Plan is designed to be adaptive, effective, and achievable in both the short and long term, and includes measurable objectives that will be evaluated in the Wildlife Effects Monitoring Program (Section 7).

The facility-specific wildlife monitoring program (Section 7.2) is intended to monitor the effectiveness of mitigation actions (Section 6). The results of mitigation activities will be reported regularly (see Section 11, Environmental Reporting), and will include Key Performance Indicators (KPIs) that will be developed with the Standard Operating Procedures (SOPs) for each mitigation plan. The results of focal-species monitoring programs will also be included in the report.

This circle of mitigation activities, monitoring and evaluation, and new mitigation activities will adaptively manage wildlife issues identified and arising as a result of the Project.

9. Checking and Corrective Action

Checking and corrective action evaluates the predicted effects of the Project on wildlife VECs, and evaluates the compliance of the Project with issued licences and permits (e.g., Project Certificate). Evaluation of predicted effects will be conducted through a combination of facility-specific monitoring (Section 7.2) and focal-species monitoring (Section 7.3) depending on the scale of the predicted effect. If checks and monitoring identify issues with human safety due to wildlife interactions or non-compliance with issued licenses or permits, then corrective action will be taken.

10. Record Keeping

Record keeping will be conducted by Sabina and its subcontractors. Data will be entered into suitable electronic databases (e.g., MS Access), checked for quality control, and stored with subcontractor responsible for monitoring and with the Proponent. Data will be entered in a format and program that allows for comparison between years and storage in a single file format for each type of survey or monitoring activity. Data will be appended to each report and the compilation of all years of data will be transferred for storage with the GN DOE. Data may also be shared, upon request, with the CWS and the GNWT ENR for inclusion in regional monitoring programs.

11. Environmental Reporting

The WEMP will be reported during construction, operations, care and maintenance, and closure (excluding periods of temporary closure and post-closure). The periodicity of reporting for the closure and post-closure phases will be agreed upon prior to closure commencing. The WEMP report will include monitoring data from the facility-specific and focal species monitoring programs. Results from both monitoring programs will be analyzed with comparisons to findings from earlier years (i.e., baseline and annual monitoring) and recommendations for change to the wildlife monitoring and management practices or new adaptive management measures (if any) will also be included.

Reporting on mitigation and management activities, including performance as evaluated by mitigation plan KPIs will be included in an appendix to the WEMP.

The WEMP report will be delivered to regulatory agencies and stakeholders, including:

- the Government of Nunavut;
- the Kitikmeot Inuit Association or designate; and
- any monitoring partners involved in collaborative effects assessment.

12. Plan Effectiveness

As part of environmental reporting, Sabina will distribute copies of the WEMP report to stakeholders and collaborate with the Kitikmeot Inuit Association to report on mitigation, management, and monitoring activities. Sabina will also conduct an evaluation (as necessary) of the efficacy of mitigation and management activities and of monitoring activities using relevant methods, such as power analyses. Should new, more sensitive, monitoring methods be introduced, or existing methods be found to lack statistical power or a robust design, updated methods will be proposed to the stakeholders in a revised Wildlife Mitigation and Monitoring Program Plan. This Plan may be updated as frequently as every year, or not at all, if the mine plan, and methods for mitigation and monitoring are robust. The new Wildlife Mitigation and Monitoring Program Plan will be implemented following review by stakeholders and an opportunity for response by Sabina.

13. QA/QC

Quality assurance and quality control measures will be undertaken at three key stages in monitoring activities: 1) during field data gathering, 2) during data entry and analysis, and 3) through reporting and reassessment of methods as part of the evaluation of Plan Effectiveness.

The process of data gathering in the field will be quality controlled through the use of qualified wildlife biologists and a system of pre- and post-field checks to ensure that consistent, repeatable data is being gathered. Checks will be carried out by a second qualified biologist. QA/QC of data entry will be conducted via a process of standard data entry templates, and checking data through either double-entry data or feedback entry, where entered data is checked back to the field cards. QA/QC of data analysis will be conducted through a process of clear, written instructions for data analysis and pre-and post-analysis checks by a second qualified biologist. Finally, the efficacy of the methods as a whole will be evaluated through repeated scrutiny of the data using power analysis and through review by stakeholders.

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21. Conceptual Fish Offsetting Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Conceptual Fish Offsetting Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 21	All Sections	Replacement of DEIS Version	Complete document rewrite to reflect changes in facility design, water management, changes to losses/gains, TK, and to introduce the Bernard Harbour offset option.

BACK RIVER PROJECT
CONCEPTUAL FISH OFFSETTING PLAN

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Appendix A. Bernard Harbour Restoration Project Agreement Between: The Kugluktuk Hunters and Trappers Organization and Sabina Gold & Silver Corp.

Glossary and Abbreviations

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

CRA	Commercial, recreational, or Aboriginal
CPUE	Catch per unit effort
DFO	Fisheries and Oceans Canada
FEIS	Final Environmental Impact Statement
GIE	Goose Inflow East
Golder	Golder Associates Ltd.
ha	Hectare(s)
HTO	Hunters' and Trappers' Organization
KIA	Kitikmeot Inuit Association
km	Kilometre(s)
LSA	Local Study Area
MLA	Marine Laydown Area
NTKP	Naonaiyaotit Traditional Knowledge Project
PIT	Passive Integrated Transponder
Project, the	The Back River Project
RSE	Rascal Stream East
TF	Tailings Facility
TK	Traditional Knowledge
TSF	Tailings Storage Facility
VEC	Valued Ecosystem Component
WRSF	Waste Rock Storage Areas

1. Introduction

1.1 PURPOSE

The proposed Back River Project (the Project) lies in western Nunavut in the continuous permafrost zone of the continental Canadian Arctic. It is composed of two main areas: the Marine Laydown Area (MLA) and the Goose Property Area (MLA; Figure 1.1-1).

The MLA is located on the western shore of Southern Bathurst Inlet, approximately 130 kilometres (km) north of the Goose Property (Figure 1.1-2). Here, the Project will sealift materials and supplies through Bathurst Inlet to the MLA annually during the open-water season only. Ships could travel via either the eastern or western portion of the Northwest Passage and then south in to Bathurst Inlet. It is estimated that between three and five vessels will report to the MLA for annual resupply and fuel as part of the Project. Key Project infrastructure for the Back River MLA includes the following:

- a temporary Lightering Barge Terminal;
- water intake pipe and desalination discharge pipe; and
- the winter road where it crosses the Bathurst Inlet from the MLA to the Goose Property Area.

Mining will be completed using both open pit and underground methods. The Goose Property includes four open pits and four underground developments and the Project has an estimated mine life of ten years with a total production of 19.8 million tonnes (Mt) of ore (Figure 1.1-3). Key Project infrastructure at the Goose Property includes:

- four open pits, and four underground mines (Umwelt, Llama, Goose Main, and Echo);
- four waste rock storage areas;
- tailings storage facility (TSF);
- underground mining pads;
- a stockpile;
- camp;
- process plant; and
- airstrip and roads, including a culvert for the haul road crossing.

The current mine plan includes the development of the Llama deposit, which is located under Llama Lake, and the construction of the Saline Water Pond at Umwelt Lake. Llama Lake and Umwelt Lake will be fished-out prior to the development of those Project components. Thus, the dewatering of Llama and Umwelt lakes for mining operations, and the construction of related infrastructure to support these activities is expected to result in unavoidable serious harm to fish (as defined in the *Fisheries Act*; see Section 1.1.1). The purpose of the Conceptual Fish Offsetting Plan (Chapter 21), a part of the Final Environmental Impact Statement (FEIS), is to summarize anticipated Project effects on fish and fish habitat, describe the option considered for offsetting (i.e., 'Bernard Harbour'), and outline a proposed conceptual plan to offset the serious harm to fish according to Fisheries and Oceans Canada's (DFO's) Policy (DFO 2013a,b).

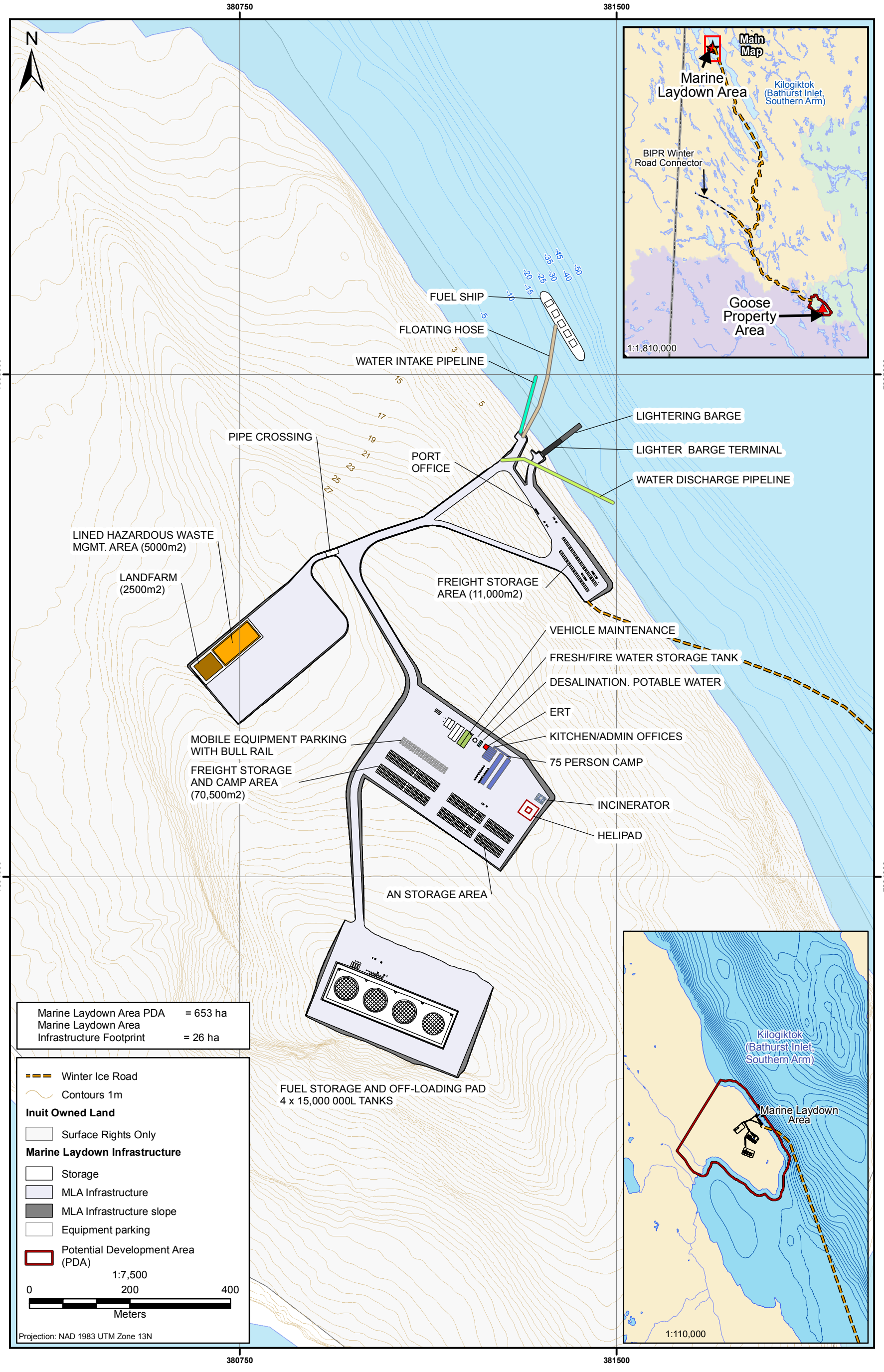
Figure 1.1-1

Sabina
GOLD & SILVER CORP.

Project Location

GIS # BR_FEIS_NA_tab_MLASiteLayout_v1

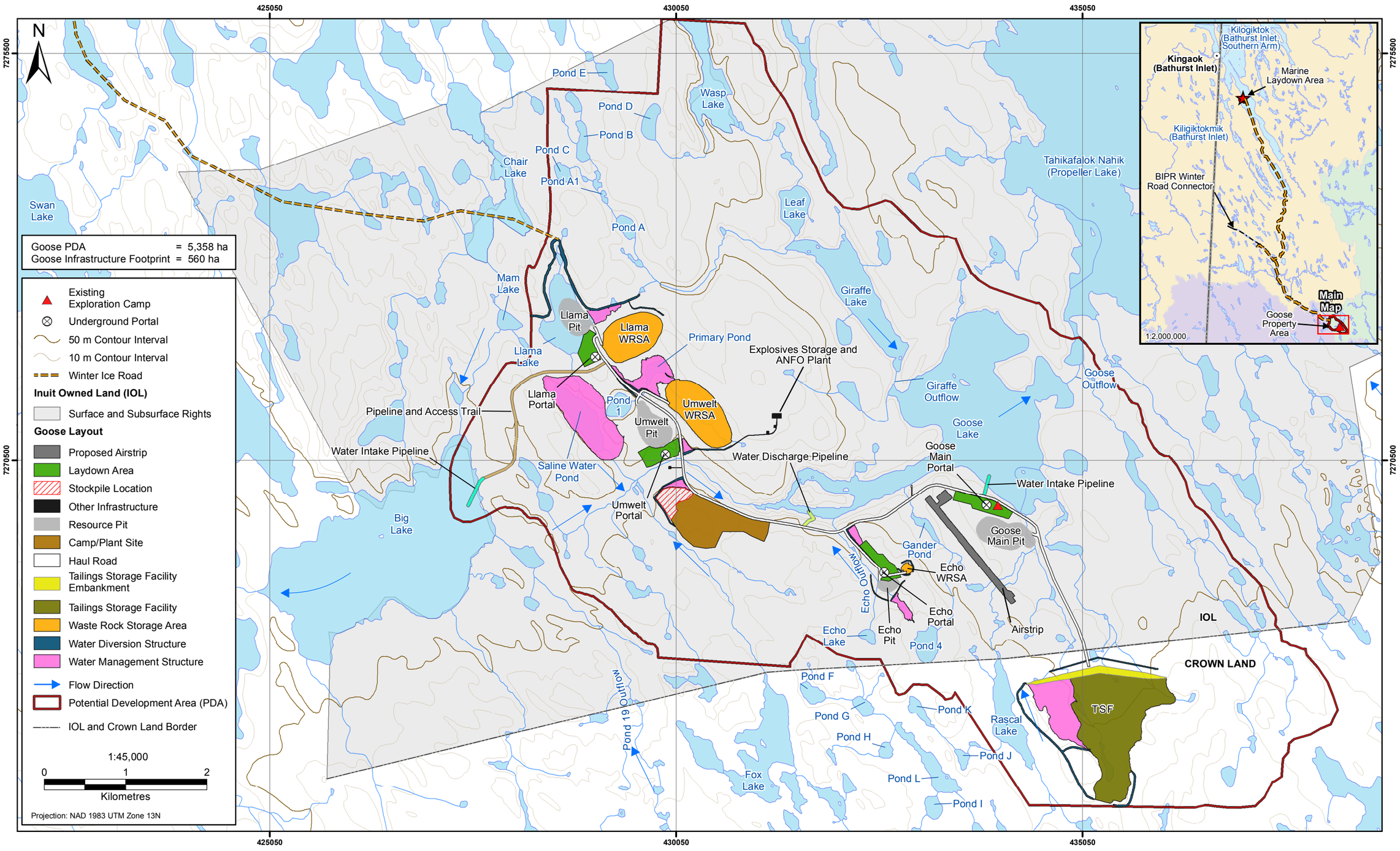
August 04 2015



Sabina GOLD & SILVER CORP.

Figure 1.1-2

Potential Development Area and Layout
Marine Laydown Area



Sabina GOLD & SILVER CORP.

Potential Development Area and Layout
Goose Property Area

Figure 1.1-3

The development of the conceptual plan and the identification of the Bernard Harbour offsetting option within the plan is the result of continued community and regulatory engagement associated with the Project. The conceptual plan should demonstrate that it is reasonable to assume at this time that a feasible offsetting option exists, and that a Final Fish Offsetting Plan can be implemented for the Project. The Final Fish Offsetting Plan will be developed during the permitting phase of the Project.

1.1.1 Requirements under the *Fisheries Act*

Subsection 35(1) of the *Fisheries Act* prohibits the carrying on of a work, undertaking, or activity that results in serious harm to fish[1] that are part of a commercial, recreational, or Aboriginal (CRA) fishery or to fish that support such a fishery. However, where it is not possible to completely avoid serious harm to fish such that some residual serious harm to fish remains, an authorization under paragraph 35(2)(b) of the *Fisheries Act* is required to carry on a work, undertaking, or activity. A *Fisheries Act* Authorization will be required for the Project.

The Application for Authorization must include the following information:

- description of proposed work, undertaking, or activity;
- project engineering specifications, scale drawings, and dimensional drawings (for physical works);
- timeline information;
- location information;
- description of fish and fish habitat (aquatic environment);
- description of potential effects on fish and fish habitat;
- description of measures and standards to avoid or mitigate serious harm to fish;
- description of the residual serious harm to fish;
- offsetting plan; and,
- letter of credit, as security for completion of the offsetting plan.

An offsetting plan is developed to undertake offsetting measures to counterbalance the unavoidable residual serious harm to fish from the Project, with the goal of maintaining or improving the productivity of the CRA fishery. DFO's approach to offsetting is described in the Fisheries Protection Policy Statement (DFO 2013a) and Fisheries Productivity Investment Policy (DFO 2013b). A Final Fisheries Offsetting Plan will be produced during the permitting phase of the Project with engagement of local communities and will need to be submitted as part of the Application for Authorization under the *Fisheries Act*. The plan would be approved by DFO as a condition of the Authorization.

As described in the Fisheries Productivity Investment Policy (DFO 2013b), an offsetting plan must include information about the objectives of the offsetting measures, the measures to offset residual serious harm to fish, an analysis of how the offsetting measure will meet their objectives (i.e., methodology used and estimate of the offset), schedule for implementation, and monitoring. Offsetting measures are focused on improving fisheries productivity. The preference of DFO is that offsets occur near a project or within the same watershed; however, offsetting measures can be

[1] "Serious harm to fish" is defined in Subsection 2(2) of the *Fisheries Act* and means "the death of fish or any permanent alteration to, or destruction of, fish habitat".

undertaken in waterbodies or for fish species other than those affected by the project, provided the measures are supported by clear fisheries management objectives or regional restoration priorities. Offsetting plans are negotiated with DFO on a case-by-case basis and would require engagement with Aboriginal groups. Offsetting measures should meet the following principles:

1) offsetting measures must support fisheries management objectives or local restoration priorities;
2) benefits from offsetting measures must balance project effects;
3) offsetting measures must provide additional benefits to the fishery; and
4) offsetting measures must generate self-sustaining benefits over the long term.

The three general categories of offsetting measures include: Habitat Restoration and Enhancement; Habitat Creation; and, Chemical or Biological Manipulations. Habitat restoration and enhancement includes physical manipulation of existing habitat to improve habitat function and productivity; examples include:

- placement of material to improve habitat structures (e.g., spawning beds or reefs);
- increasing shoreline complexity;
- river bank stabilization and re-vegetation of riparian areas;
- improving access to off-channel habitats;
- removal of anthropogenic barriers to fish migration; and
- enhancement of vegetated areas in lakes.

Habitat creation involves the development or expansion of aquatic habitat into a terrestrial area, such as creation or expansion of natural stream channels, lakes, side channel habitats, wetlands, or bays. Chemical or biological manipulations may include chemical manipulation of waterbodies or stocking of fish; however, these measures should be used only when the other groups of offsetting measures are not available, and only under specific circumstances, such as where the site-specific issues are well understood, the limitations to fisheries productivity are known, and fisheries management plans contain clear objectives for the fishery (DFO 2013b).

In remote, pristine areas where there is a lack of information about fisheries productivity and where offsetting opportunities are limited, such as near the Project, complementary measures may be considered in addition to other offsetting measures. Complementary measures may include data collection and/or scientific research related to maintaining or enhancing the productivity of commercial, recreational, or Aboriginal fisheries. According to DFO Policy, complementary measures may comprise up to 10 percent (%) of the required amount of offsetting, with the remaining 90% consisting of one or more projects that fall under the habitat enhancement, restoration, creation, or manipulation categories of offsetting measures.

2. Community and Regulatory Engagement

2.1 COMMUNITY ENGAGEMENT

Sabina has regularly engaged local communities and representatives of the Kitikmeot Inuit Association (KIA) on the Project. This has included engagement on topics, such as fish offsetting requirements for the Project and, more specifically, the Bernard Harbour restoration project.

2.1.1 Back River Project

Sabina has been conducting community engagement and consultation activities for the Project since June 2012. During this time, dozens of meetings have been held with the public, Sabina's two community advisory groups in Cambridge Bay and Kugluktuk, local Hamlets, Hunters' and Trappers' Organization (HTOs), youth, and other stakeholder groups. The focus of these activities has generally been on the communities of Cambridge Bay, Kugluktuk, Bathurst Inlet, Bay Chimo, Gjoa Haven, Taloyoak, Kugaaruk, and Yellowknife. For example, public meetings were held in various communities in June 2012, November 2012, April 2013, August 2013, November 2013, and June 2015. One-on-one meetings with community stakeholder groups have also been held at various times. The Nunavut Impact Review Board has additionally held public meetings on the Project in February 2013, March/April 2014, and November 2014.

In addition to providing information to local communities on development plans for the Project, Sabina has discussed topics, such as fish offsetting, tailings and contaminant management strategies, lake dewatering, potential fisheries and water-related effects, and other environmental management and monitoring-related topics. Copies of all public meeting presentations made by Sabina can be found on www.backriverproject.com under the 'Additional Resources' tab. A complete list of the various stakeholder meetings Sabina has hosted or participated in since June 2012 is included in Appendix V3-1A of the Project FEIS.

Numerous questions, issues, and suggestions have been raised by local residents over the course of Sabina's public consultation and engagement program. Generally, communities have expressed support for the opportunities the Project will provide, but have also strongly expressed the need for the Project to be developed in a manner that is safe for both people and the environment. Particular concern has been expressed about potential long-term effects on fish, other wildlife resources, water quality, and from mine tailings and contaminants. Comments received during Sabina's public consultation and engagement program have been incorporated into a comprehensive public consultation database. This database contains over 165 topic directories and includes comments made by the public and information on when, where, and the forum in which the comments were made.

Topic directories (and the number of times a related comment was made) with potential relevance to fish offsetting requirements for the Project are presented in Table 2.1-1. Appendix V3-1G of the FEIS provides a full summary of the topics contained in Sabina's public consultation database, while Appendix V3-1C of the FEIS contains copies of all June 2012 – June 2015 meeting minutes and public comment forms from which the summary was developed.

Sabina has gone through extensive effort to minimize or eliminate potential negative environmental and socio-economic effects in these areas. For example, a comprehensive environmental management and monitoring program has been developed, which addresses key areas of concern for local communities that were identified during public consultation. More details on Sabina's commitments to

addressing community-identified issues are provided in Volume 3 (Public Consultation, Government Engagement, and Traditional Knowledge) of the FEIS.

Table 2.1-1. Example Topics Discussed and Related Number of Comments per Topic Made During Sabina's Public Consultation and Engagement Program

Back River Discussion Topic	Number of References by Community Members
Acid rock drainage	4
Environmental monitoring	35
Blocking watercourses	2
Dewatering of lakes	21
Mine contaminants and waste	77
Tailings	78
Waste rock	6
Water quality, quantity, and management	62
Wildlife – Fish	57

All of the Project's existing camps and proposed infrastructure are located within the Kitikmeot Region. Accordingly, The KIA has been engaged on a regular basis by Sabina. Periodic site visits have been arranged for KIA board members and members of the KIA Lands, Environment and Resources Department, and the KIA has been kept informed of Sabina's various Project developments. The KIA is additionally responsible for issuing licences related to land and water use on Inuit Owned Land in the Kitikmeot Region, and Sabina is required to post reclamation security and negotiate wildlife compensation with them. Sabina is also required under the Nunavut Land Claims Agreement (NLCA) to negotiate an Inuit Impact and Benefit Agreement (IIBA) with the KIA. As such, regular communication pertaining to these matters has occurred between Sabina and the KIA throughout the Project's development. The KIA has likewise been an active reviewer and participant in the environmental assessment of Sabina's Back River Project.

2.1.2 Back River Offsetting Option

Sabina's commitment to the offsetting option proposed in the Conceptual Fish Offsetting Plan (i.e., Bernard Harbour) began in mid-2014. Since that time, Sabina has engaged local residents about the offsetting option in a number of ways (see Table 2.1-2). Foremost, Sabina has partnered with the Kugluktuk HTO in the planning and execution of the Bernard Harbour option. Stream remediation (or enhancement) activities in the Nulahugyuk Creek - Hingittok Lake system in the Kitikmeot Region of Nunavut (also known as Bernard Harbour) were initially proposed in the early 2000s by the Kugluktuk HTO. The Kugluktuk HTO has since worked closely with Golder Associates Ltd. (Golder) to advance early stages of the project (e.g. initial environmental baseline and habitat enhancement work) and, for some time, the two organizations were seeking an industry partner to help advance the project to completion.

Sabina was identified as an industry partner in early 2014 and has since advanced planning for the Bernard Harbour offsetting option in cooperation with the Kugluktuk HTO. Details on the relationship between the Kugluktuk HTO and Sabina in executing the Bernard Harbour offsetting option have been captured in the 'Bernard Harbour Restoration Project Agreement' between: The Kugluktuk Hunters and Trappers Organization and Sabina Gold & Silver Corp (see Appendix A), signed by both parties in June 2014. Importantly, the Bernard Harbour offsetting option is to remain a Kugluktuk HTO-led initiative

with Sabina providing support to the Kugluktuk HTO such that the objectives of the offsetting plan are achieved.

The Kugluktuk HTO has remained involved in the Bernard Harbour offsetting option through semi-regular planning meetings and updates. The Kugluktuk HTO has also been instrumental in the planning and execution of baseline studies and initial remediation studies (in cooperation with Golder), and in the planning of future remediation of Bernard Harbour. While the activities, meetings, and correspondences associated with this baseline and initial work are not included in Table 2.1-2, they are reflected in the associated baseline reports that have been prepared by Golder (ANL and Golder 2005; Golder and ANL 2007; Golder 2013). The Kugluktuk HTO has also played a key role in the Traditional Knowledge (TK) study that was conducted for the Bernard Harbour Offsetting Option (for more details, see Appendix V3-3D of the FEIS, or a summary of the TK study provided further below).

The Kugluktuk general public have been engaged about the Bernard Harbour restoration project in different ways. For example, a public meeting was held in Kugluktuk on June 17, 2015 where results of the Bernard Harbour TK study, results of baseline fieldwork, and plans for the Bernard Harbour offsetting option were presented by Sabina representatives. The offsetting option was also briefly reviewed with representatives of Sabina's Community Advisory Group in Kugluktuk and the Hamlet of Kugluktuk during June 2015 community meetings held for the Project. Various members of the Kugluktuk public have also assisted in the baseline fieldwork and initial stream enhancement work that has been conducted at Bernard Harbour (ANL and Golder 2005; Golder and ANL 2007; Golder 2013).

Local residents generally appear very supportive of the remediation work planned for Bernard Harbour and wish to see the Bernard Harbour Arctic Char fishery returned to its previous status. The Kugluktuk HTO and those residents who have previously lived at Bernard Harbour (e.g., many of the TK study participants) have expressed a particular desire to see the offsetting option completed. A number of individuals have stated they appreciate the low impact approach that is being used (e.g., no use of heavy equipment) and the involvement of community members (including youth) in the project. Sabina intends to continue engaging the residents of Kugluktuk as necessary as the Bernard Harbour restoration project advances.

The KIA has been kept informed of plans for the Bernard Harbour offsetting option through semi-regular meetings and correspondence. A KIA representative additionally participated in a Bernard Harbour site visit hosted by Sabina in July 2014, where Golder's initial remediation work was examined and future offsetting plans were discussed. The KIA has also been provided with copies of the TK study data, so that it may be incorporated into their Naonaiyaotit Traditional Knowledge Project (NTKP) database. It is understood the KIA may utilize this information for their own purposes in the future. The data and results of the TK study are also intended to be freely shared with other Nunavut organizations that may benefit from its use.

Other members of the Nunavut and Northwest Territories public have been made aware of the Bernard Harbour offsetting option. For example, the project was briefly reviewed in the communities of Cambridge Bay, Taloyoak, Kugaaruk, and Yellowknife during June 2015 community meetings held for the Back River Project (with a visit to Gjoa Haven scheduled to occur later in the year). Two presentations on Bernard Harbour were additionally made by Sabina representatives at the 2015 Nunavut Mining Symposium held in Iqaluit, where various community, government, and industry stakeholders participated. A full list of community engagement activities undertaken by Sabina in regards to the Bernard Harbour offsetting option can be found in Table 2.1-2. Sabina will continue to engage northern residents as necessary on the Bernard Harbour restoration project as it advances.

Table 2.1-2. Community Engagement Activities Conducted by Sabina Regarding the Bernard Harbour Restoration Project

Location / Date	Individual(s) / Organization	Description
Kugluktuk		
March 19, 2014	David Nivingalok (Chairperson) and Kevin Klengenberg (Secretary-Treasurer), Kugluktuk HTO	Teleconference to discuss proposed fish offsetting work to be conducted at Bernard Harbour.
March 25, 2014	Kugluktuk HTO	Meeting to discuss proposed fish offsetting work to be conducted at Bernard Harbour and the associated TK study.
April 29, 2014	Kugluktuk HTO	Meeting to discuss 'Kugluktuk HTO-Sabina Bernard Harbour Restoration Project Agreement'.
June 1-6, 2014	Selected elders and knowledge holders	A series of traditional knowledge interviews were held with selected elders and local knowledge holders as a component of proposed fish offsetting activities in the Bernard Harbour, Nunavut area. A project overview meeting/presentation was also held with local study participants prior to the interviews commencing.
July 13, 2014	Bernard Harbour TK study participants, HTO chairperson, and acting HTO manager	A TK study results verification meeting was held with participants in the Bernard Harbour TK study and with the Kugluktuk HTO chairperson and acting manager. Various clarifications were made by the participants, which were later incorporated into the final TK study report.
July 17, 2014	Kugluktuk HTO chairperson	The chairperson of the Kugluktuk HTO accompanied Sabina representatives and various other attendees during a day-long site visit to Bernard Harbour.
February 12, 2015	Kugluktuk HTO representatives	Sabina met with the Kugluktuk HTO chairperson, treasurer, and manager to provide an update on the Bernard Harbour restoration project and Bernard Harbour TK study.
February 17, 2015	Kugluktuk HTO	Letter and copy of the draft 'Traditional Knowledge Study Report on the Arctic Char Fishery in the Nulahugyuk Creek – Hingittok Lake Area (Bernard Harbour), Nunavut' provided to the HTO.
April 21, 2015	Kugluktuk HTO	Final copy of the 'Traditional Knowledge Study Report on the Arctic Char Fishery in the Nulahugyuk Creek – Hingittok Lake Area (Bernard Harbour), Nunavut' provided to the HTO.
May 8, 2015	Barbara Adjun, Kugluktuk HTO Manager	Phone update on the Bernard Harbour offsetting option.
May 21, 2015	David Nivingalok, Kugluktuk HTO Chairperson	Phone update on the Bernard Harbour offsetting option.
June 17, 2015	General public	Public meeting – Project update and FEIS submission overview. The results of the Bernard Harbour TK study and plans for Bernard Harbour were reviewed.
June 18, 2015	Kugluktuk Community Advisory Group	Project update and FEIS submission overview. Plans for the Bernard Harbour were briefly reviewed.
June 18, 2015	Kugluktuk HTO	Project update and FEIS submission overview. The results of the Bernard Harbour TK study and plans for the Bernard Harbour were reviewed.
June 19, 2015	Hamlet of Kugluktuk	Project update and FEIS submission overview. Plans for Bernard Harbour were briefly reviewed.
July 8, 2015	David Nivingalok, Kugluktuk HTO Chairperson	Letter providing information on the 2015 Bernard Harbour work proposal.

(continued)

Table 2.1-2. Community Engagement Activities Conducted by Sabina Regarding the Bernard Harbour Restoration Project (completed)

Location / Date	Individual(s) / Organization	Description
Cambridge Bay		
June 7-10, 2014	Selected elders and knowledge holders	A series of traditional knowledge interviews were held with selected elders and local knowledge holders as a component of proposed fish offsetting activities in the Bernard Harbour, Nunavut area.
June 15, 2015	Cambridge Bay Community Advisory Group	Project update and FEIS submission overview. Plans for the Bernard Harbour offsetting option were briefly reviewed.
June 16, 2015	Hamlet of Cambridge Bay Representatives	Project update and FEIS submission overview. Plans for the Bernard Harbour offsetting option were briefly reviewed.
June 16, 2015	General public	Public meeting – Project update and FEIS submission overview. Plans for the Bernard Harbour offsetting option were briefly reviewed.
Kingaok and Omingmaktok		
June 15, 2015	Residents of Kingaok and Omingmaktok	Dinner and meeting on the Back River Project (re: Project update and FEIS submission overview) in Cambridge Bay, specifically for residents of Kingaok and Omingmaktok. Plans for the Bernard Harbour were briefly reviewed.
Gjoa Haven		
October 6, 2015	General public	Project update and FEIS submission overview. Plans for Bernard Harbour were briefly reviewed.
Taloyoak		
June 17, 2015	General public	Public meeting – Project update and FEIS submission overview. Plans for the Bernard Harbour were briefly reviewed.
June 17, 2015	Hamlet of Taloyoak	Project update and FEIS submission overview. Plans for Bernard Harbour were briefly reviewed.
Kugaaruk		
June 16, 2015	General public	Public meeting – Project update and FEIS submission overview. Plans for Bernard Harbour were briefly reviewed.
Iqaluit		
April 14, 2015	Various community, government, and industry stakeholders participated	Sabina and Golder representatives participated in the Nunavut Mining Symposium in Iqaluit and made two presentations related to the Bernard Harbour offsetting option.
Yellowknife		
June 15, 2015	General public	Public meeting - Project update and FEIS submission overview. Plans for the Bernard Harbour offsetting option were briefly reviewed.

2.1.3 Incorporation of Traditional Knowledge (TK)

The Conceptual Fish Offsetting Plan relies on the information collected from Inuit-led TK information, public scoping, focus group meetings, government engagement, and scientific knowledge. To the extent possible, available TK is incorporated into the offsetting plan, including existing environment and baseline summaries, mitigation and adaptive management plans, and the selection of the offsetting option to counterbalance any losses in fisheries productivity.

2.1.3.1 Environmental Assessment

The following reports were reviewed for TK specific information related to fisheries at the Project and are summarized in other sections of the FEIS:

- *Inuit Traditional Knowledge of Sabina Gold & Silver Corp., Back River (Hannigayok) Project, Naonaiyaotit Traditional Knowledge Project (NTKP)* (KIA 2012) (Appendix V3-3A of FEIS);
- *Back River Project: Existing and Publically Available Traditional Knowledge from Selected Aboriginal Groups in the Northwest Territories* (Appendix V3-3B of FEIS); and
- *Naonaiyaotit Traditional Knowledge Project - Hannigayok (Sabina Gold & Silver Corp. Proposed Back River Project). Results from Data Gaps Workshops, Final Report (June 2014)* (KIA 2014) (Appendix V3-3C of FEIS).

2.1.3.2 Offsetting Option

The Kugluktuk HTO and the TK provided by the HTO has been instrumental in the planning and execution of baseline studies and initial remediation studies (in cooperation with Golder), and in the planning of future remediation of Bernard Harbour (e.g., ANL and Golder 2005; Golder and ANL 2007; Golder 2013). The Kugluktuk HTO has also played a key role in the TK study that was conducted for the Bernard Harbour Offsetting Option.

In an effort to develop a better understanding of the Arctic Char fishery in the Bernard Harbour area (and related historic and contemporary environmental conditions), a TK study was conducted in 2014 to 2015. The TK study was carried out by Sabina in partnership with the Kugluktuk HTO and was intended to complement the scientific baseline studies that have also been conducted at Bernard Harbour. The TK study involved one-on-one interviews with 11 Bernard Harbour land users from Kugluktuk and Cambridge Bay, who were selected for inclusion in the study by the Kugluktuk HTO. The TK study also made use of various secondary sources (e.g., historic records, land use reports, academic publications) and a Bernard Harbour site visit to provide additional information on the Arctic Char fishery. Results of the study provided a baseline summary of a historically-significant Arctic Char fishery for local Inuit, and ultimately, confirmation that Bernard Harbour was the preferred offsetting option for the Project.

Further information on the TK study can be found in Appendix V3-3D of the FEIS, see the Traditional Knowledge Study Report on the Arctic Char Fishery in the Nulahugyuk Creek – Hingittok Lake Area (Bernard Harbour), Nunavut (Appendix V3-3D of FEIS).

2.2 REGULATORY ENGAGEMENT

Sabina has regularly engaged DFO on the Project (Table 2.1-3). This has included engagement on topics such as fish offsetting requirements for the Project and, more specifically, the Bernard Harbour restoration project.

Table 2.1-3. Regulatory Engagement Activities Conducted by Sabina Regarding the Bernard Harbour Restoration Project

Date	Organization	Location	Purpose
2014			
February	Fisheries and Oceans Canada – Central and Arctic Region	Yellowknife	Introduction to the contents and structure of the Draft Environmental Impact Statement. Introduction of the Proposed Fisheries Offset Concept at Bernard Harbour.
April	Fisheries and Oceans Canada – Central and Arctic Region	Yellowknife	Introduction to the Back River Project.
June	Fisheries and Oceans Canada – Central and Arctic Region	Yellowknife	Update meeting and discuss attendance at the location of the proposed fisheries offset (Bernard Harbour site).
July	Fisheries and Oceans Canada – Regional Director, Ecosystems Management	Ottawa	Project status, Bernard Harbour and next steps.
	Fisheries and Oceans Canada – Central and Arctic Region	Kugluktuk	Attendance at the Bernard Harbour site: along with the Kugluktuk HTO and KIA.
August	Fisheries and Oceans Canada – Central and Arctic Region	Teleconference	Discussion of authorization requirements for Site Preparation Work.
October	Fisheries and Oceans Canada – Central and Arctic Region	Teleconference	Further discussion of authorization requirements for Site Preparation Work.
2015			
January	Fisheries and Oceans Canada – Central and Arctic Region	Teleconference	Exploring equivalency in Offsetting Policies.
March	Fisheries and Oceans Canada – Central and Arctic Region	Teleconference	Discussed PHC comment responses and direction on habitat banking process. Feedback on Site Preparation proposed methodology.
April	Fisheries and Oceans Canada – Central and Arctic Region	Teleconference	Discussed proposed approach to significance / residual effects assessment for FEIS.
May	Fisheries and Oceans Canada – Central and Arctic Region	Teleconference	Feedback on Rascal Lake Realignment and effects assessment approach. Update on Bernard Harbour status provided. Discussed baseline work prior to freshet.
September	Fisheries and Oceans Canada – Central and Arctic Region	Teleconference	Overall project update; discussion of potential Schedule 2 implications based on predicted habitat losses.
	Fisheries and Oceans Canada – Executive Fisheries Protection	Ottawa	Project status update; discussion on Bernard Harbour direction.

3. Regional Setting

3.1 MARINE LAYDOWN AREA

Bathurst Inlet is a fjord that is long (approximately 165 km), narrow (2 to 15 km), and deep (greater than 300 m). This waterbody is divided into two major basins separated by a shallow sill. The outer inlet is the deeper of the two basins and contains many islands and a complex bathymetry. The inner

inlet runs landward from the vicinity of Kingaok, has a relatively simple structure with few islands, and is shallower than the outer inlet, with depths between 100 and 150 m. The Western River discharges into the head of the inlet at the south, and the Mara River and Burnside River discharge into the western shoreline of the inlet. Numerous small streams discharge into the inlet along eastern and western shorelines. Bathurst Inlet cuts through the Bathurst Hills Ecoregion, which is characterized by strong relief built from massive granite rocks. The deeply indented, rocky shorelines lead to steep bathymetry with narrow nearshore areas.

Bathurst Inlet is typical of oligotrophic Arctic marine ecosystems, i.e., oxygenated throughout the water column, low in nutrients and metals, and low in phytoplankton biomass levels. Benthic invertebrates are both diverse and abundant in Bathurst Inlet, characteristics shared with other Arctic marine ecosystems. Mud and fine sediments dominate the benthic environment.

The marine fish community of Bathurst Inlet is characteristic of Arctic marine ecosystems and includes marine, anadromous, and freshwater/estuarine species. Thirteen species captured have been observed in freshwater, brackish or estuarine habitats during at least one part of their life history. Many fish species serve roles in the ecological and cultural health of the area.

Nineteen fish species are presumed to occur in waters in the immediate vicinity of the MLA in Bathurst Inlet (i.e., Local Study Area [LSA]) based on TK (KIA 2012; KIA 2014) and baseline sampling (Table 3.1-1) (also see Section 5.1.6 in Volume 7). None of the captured species are currently considered endangered, threatened, or are listed under Canada's *Species at Risk Act* (Government of Canada 2002). Fourhorn Sculpin were the most abundant species in 2001 and 2010, but were the third most abundant species in 2012. Capelin was the most abundant species in 2012, followed by Pacific Herring. Capelin were not captured on any previous sampling occasions, and their dominance in the community sampling is attributed to the date of sampling coinciding with the Capelin spawning period in 2012. During non-spawning periods, adult Capelin are generally associated with offshore habitat and are not expected to be present year-round in the nearshore areas of the LSA. Pacific Herring, Starry Flounder, Arctic Cisco, and Saffron Cod were captured in all years and on average comprised 10% or greater of the total catch.

Table 3.1-1. Fish Species Captured or Presumed to Occur in Bathurst Inlet

Common Name	Scientific Name	Primary Habitat	Depth Range
Arctic Char	*Salvelinus alpinus*	Freshwater/Anadromous	Benthopelagic
Arctic Cisco	*Coregonus autumnalis*	Freshwater/Brackish	Benthopelagic
Arctic Cod	*Boreogadus saida*	Marine	Bathypelagic
Arctic Flounder	*Pleuronectes glacialis*	Marine	Demersal
Bering Wolffish	*Anarhichas orientalis*	Marine	Demersal
Broad Whitefish	*Coregonus nasus*	Freshwater/Brackish	Benthopelagic
Capelin	*Mallotus villosus*	Marine	Pelagic
Fourhorn Sculpin	*Myoxocephalus quadricornis*	Marine/Brackish	Demersal
Lake Trout	*Salvelinus namaycush*	Freshwater/Anadromous	Benthopelagic
Least Cisco	*Coregonus sardinella*	Marine/Anadromous	Pelagic
Ninespine Stickleback	*Pungitius pungitius*	Freshwater/Estuarine	Benthopelagic
Pacific Cod	*Gadus marcocephalus*	Marine	Demersal
Pacific Herring	*Clupea pallasii*	Marine	Pelagic

(continued)

Table 3.1-1. Fish Species Captured or Presumed to Occur in Bathurst Inlet (completed)

Common Name	Scientific Name	Primary Habitat	Depth Range
Rainbow Smelt	*Osmerus mordax*	Anadromous	Pelagic
Round Whitefish	*Prosopium cylindraceum*	Freshwater/Brackish	Demersal
Saffron Cod	*Eleginus gracilis*	Marine/Brackish	Demersal
Slender Eelblenny	*Lumpenus fabricii*	Marine	Demersal
Sockeye Salmon	*Oncorhynchus nerka*	Anadromous	Pelagic
Starry Flounder	*Platichthys stellatus*	Marine/Brackish	Demersal

Note: Species highlighted in grey were not captured during Baseline sampling in 2010 and 2012, but they have an historic precedence of capture in Bathurst Inlet and are presumed to occur in Bathurst Inlet (reviewed in Volume 7, Chapter 5).

The community composition of fish species and the fish harvested (e.g., Arctic Char) by traditional user in the Regional Study Area reflects the influence of freshwater in the system (Figure 3.1-1). Traditional Knowledge of Arctic Char (locally known as Ekalukipik), a Valued Ecosystem Component in the environmental assessment and one of the main fish species for Ocean Inuit and Kiligiktolmiut (see Section 5.3, Volume 7, of the FEIS), was primarily discussed with reference to freshwater fishing (KIA 2012; KIA 2014). However, some coastal areas of char habitat (fishing grounds) were identified. Arctic Char occurrence was identified in the majority of rivers that flow to the ocean with the mouth of the Hiukkittak (River), the mouth of the Burnside River and the Mara River being important Arctic Char rivers for fishing.

Inuit uses of other marine fish species have also been described for tomcod (Arctic Cod or locally known as Hiughuktuk); both Arctic Char and Arctic Cod are the main fish species for Ocean Inuit and Kilikiktolmiut (KIA 2012; KIA 2014). TK information on the characteristics and uses of marine species also includes Saffron Cod, Capelin, smelt, flounder (i.e., turbot), herring, eels, wolfish, sculpin, crabs, oysters, and starfish. Arctic Cod and Saffron Cod are described as deep water, open ocean fish that are good for eating. Seasonal (summer) spawning migrations by Capelin in nearshore areas were observed and Capelin were used by drying them for eating or for dog food. Different eel species were identified in nearshore areas and considered potential food fish. Wolffish were described as strong tasting and as having thick skin. The occurrence of salmon and other unknown or new species (e.g., sharks) was also described.

The Project is located in western Nunavut in the continuous permafrost zone of the continental Canadian Arctic. All proposed infrastructure at the Goose Property lies within the Ellis River Watershed. The Ellis River Watershed flows to the northwest, and enters the ocean on the west side of Bathurst Inlet. The Back River Watershed lies south of the proposed infrastructure in the Goose Property Area and flows to the east eventually entering the Arctic Ocean south of Gjoa Haven.

The region containing the Project is characterized by extensive networks of lakes and streams within a hummocky landscape with low elevation relief and exposed bedrock uplands. Winter is characterized by extreme cold (mean monthly temperatures -33°C), and ice cover is present on lakes between October and July. Air temperatures are highest in July, reaching a mean monthly temperature of 14°C. Regional meteorological stations report total annual precipitation between 125 mm (2009) to 344 mm (2007) for the interval 2006 to 2012 (see Volume 4, Chapter 3 for additional information). Ice depths on waterbodies are typically 1.5 to 2 metres (m) thick, and shallow waterbodies (< 1.5 m) freeze to the bottom. Hydrology in the Project area is snowmelt dominated, with peak flows occurring from early May to mid-June in most watersheds. Occasional rainfall-driven high flow events may occur between June and September.

3.2 PROPERTY AREA

The Goose Property is in the headwater region of its respective watersheds and has a relatively small upstream catchment (Figure 3.2-1). A few deep lakes provide the majority of year-round fish habitat (such as Propeller and Goose lakes), while shallow and ephemeral lakes and ponds provide seasonal habitat. Year-round habitat quality in lakes is primarily limited by depth, since overwintering by fish is only possible in lakes that do not freeze to the bottom or retain sufficient dissolved oxygen levels during ice cover. Streams in the Project area are generally small and shallow and do not provide overwintering fish habitat. Over the course of the summer, these streams tend to have low flow and low water levels. Many streams are ephemeral, flowing only during freshet, while others feature seasonal barriers such as boulder fields and seepages.

Fish distribution in the Goose Property Area is typical of inland, headwater regions of the Canadian Arctic. Lake Trout (*Salvelinus namaycush*) is the dominant freshwater fish species in the Local Study Area, followed by Round Whitefish (*Prosopium cylindraceum*), Arctic Grayling (*Thymallus arcticus*), Slimy Sculpin (*Cottus cognatus*), and Ninespine Stickleback (*Pungitius pungitius*). Other species reported in the study area include Burbot (*Lota lota*) and Lake Whitefish (*Coregonus clupeaformis*). No Arctic Char (*Salvelinus alpinus*) have been captured at the Goose Property; however, they have been captured nearer Bathurst Inlet approximately 76 km north of the Goose Property.

In the TK report (KIA 2012), the Inuit note that fish are present throughout the landscape surrounding and including the Project Area. While Goose Lake may be occasionally fished by traditional land users, they are not known to be destinations or key locations for fishing (Volume 8, Chapter 4).The TK reports also notes that freshwater fishing primarily takes place in the Back River Watershed, along the Western River, and nearby Bathurst Inlet. Lake Trout are found in lakes throughout the region; however, they are also found in rivers where large, deep pools do not freeze in winter. Whitefish and Cisco (*Coregonus artedi*) are also found in such lakes. Arctic Grayling are fished in several lakes, rivers, and streams in the Back River Watershed and along the Western River. The Inuit observe that Arctic Grayling spawn over shallow boulder fields, and that the juvenile fish are commonly found in shallow, sandy streams (KIA 2012).

4. Project Activities Affecting Surface Waters

4.1 MINE PLAN OVERVIEW

The Project involves the construction, operation, and closure of open pit and underground mines at the Goose Property. A MLA will be established on the western shore of Bathurst Inlet to deliver supplies, via a 160 km winter ice road connecting the MLA to the Goose Property. (Figure 1.1-1)

The MLA infrastructure includes a temporary Lightering Barge Terminal, water intake and desalination discharge pipes, and the winter road where it crosses the Bathurst Inlet from the MLA to the Goose Property Area (Figure 1.1-2). Here, the Project will sealift materials and supplies through Bathurst Inlet to the MLA annually during the open-water season only. Ships could travel via either the eastern or western portion of the Northwest Passage and then south in to Bathurst Inlet. It is estimated that between three and five ships will report to the MLA for annual resupply and fuel as part of the Project.

GIS # BAC-06-095

August 12 2015

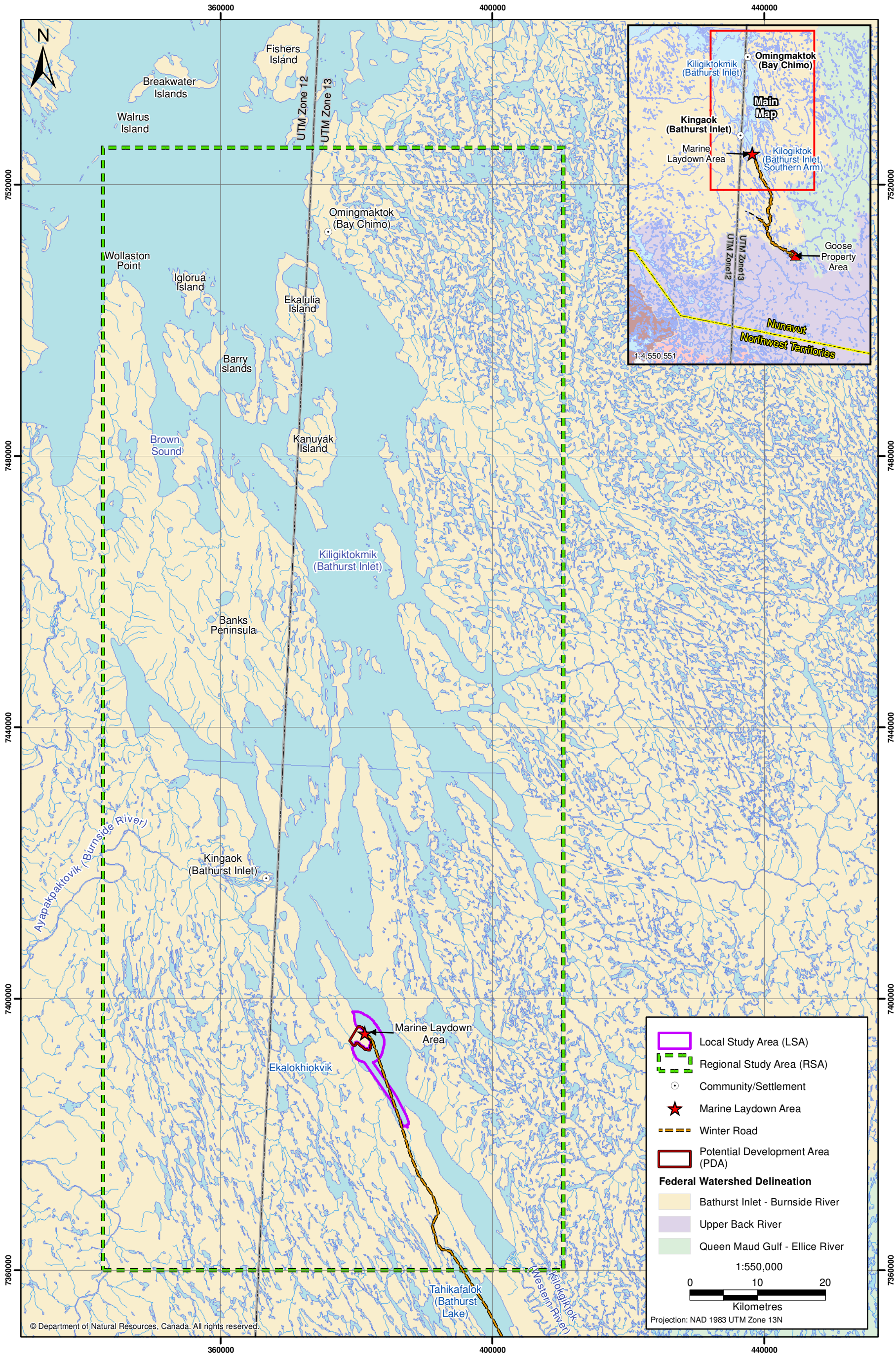


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Figure 3.1-1

Local Study Area and Regional Study Area for Arctic Char

Rescan an ERM company

GIS # BAC-06-264

September 30 2015

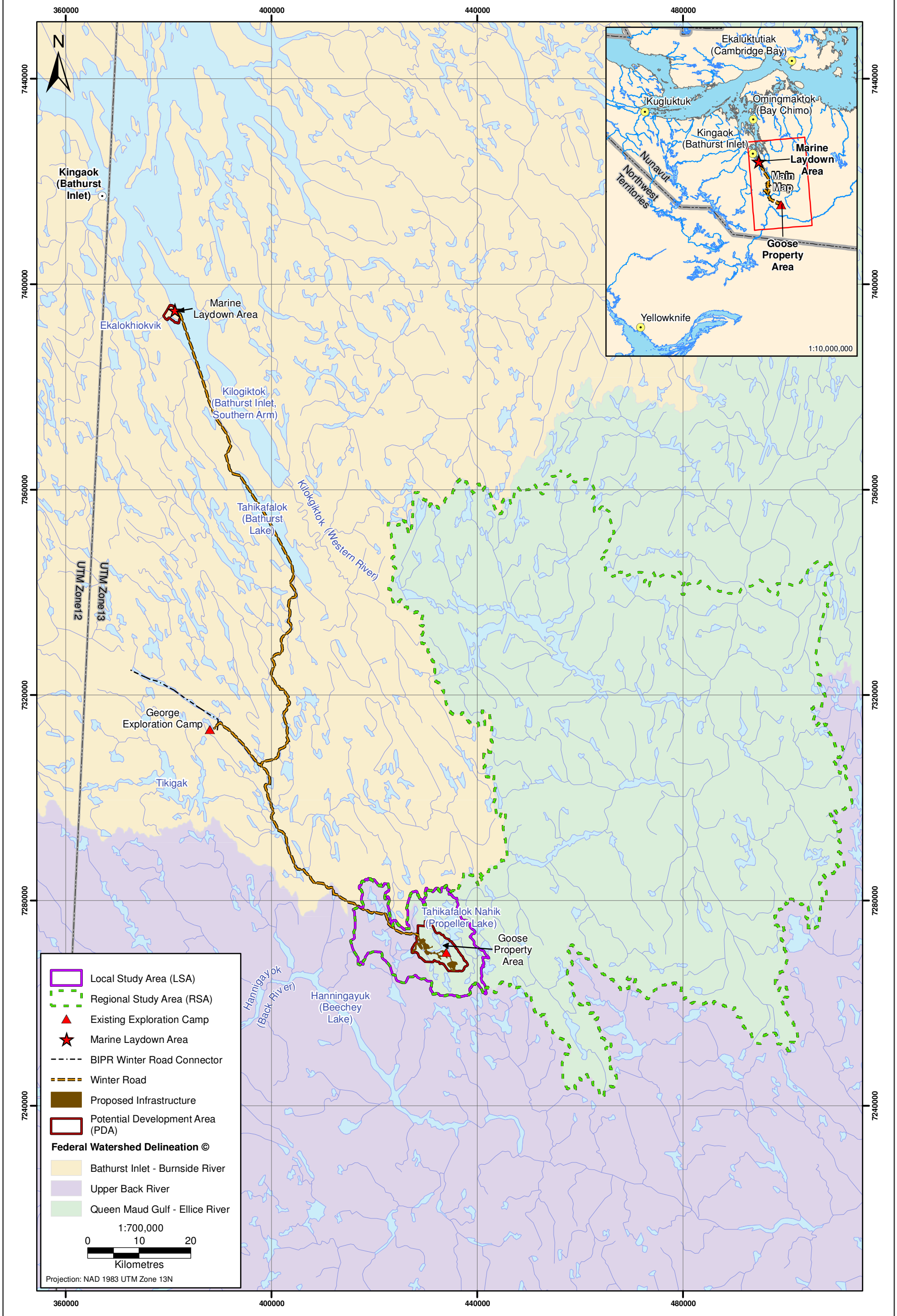

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Figure 3.2-1

Local Study Area and Regional Study Area for Freshwater Fish/Aquatic Habitat

Rescan an ERM company

The Goose Property is composed of four open pits and underground mines (Umwelt, Llama, Goose Main, and Echo), four waste rock storage areas (WRSA) established close to each pit, a Tailings Storage Facility (TSF), the Umwelt Tailings Facility (FT), the Goose Main tailings Facility (TF), underground mining pads, a stockpile, camp, process plant, airstrip, and roads (Figure 1.1-3). The life of mine ore production will be approximately ten years. The total mine life of the Project from construction to the end of closure is estimated to be approximately 21 years. The mine life was divided into four phases and three stages to describe key periods. Table 4.1-1 provides a summary of the four phases of the Project, with Phase 2 broken down into stages by the tailings deposition plan.

Table 4.1-1. Mine Phase and Stage

Phase	Stage	Description	Start	End	Comment
1	-	Construction	Year -3	Year -1	Building TSF and start Umwelt open pit mining and underground mining
2	1	TSF Operation	Year -1	Year 2	Begin milling and tailings deposition in TSF
	2	Umwelt TF Operation	Year 2	Year 6	Tailings deposition in Umwelt TF
	3	Goose Main TF Operation	Year 6	Year 10	Tailings deposition in Goose Main TF
3	-	Closure	Year 10	Year 18	Active site closure, continue water treatment and remove site infrastructure
4	-	Post-Closure	Year 18	Year 23	Site closed. Performance monitoring

The following sections provide a brief description of key pieces of infrastructure that directly or indirectly affect surface waters at the Goose Property (for more details see the Water and Load Balance Report, Appendix V2-7H in the FEIS).

4.1.1 Tailings Storage Facility (TSF)

Tailings deposition in the TSF, located approximately 300 m east of Rascal Lake, will last for two years of the Project life, resulting in 3.15 Mm^3 of deposited tailings. In addition to the tailings volume, the TSF was designed to contain site-wide contact water, mill process water, as well as saline groundwater from Llama open pit dewatering. The capacity of the TSF up to the full supply level (FSL) is 4.4 Mm^3. After tailings deposition in the TSF ceases, the available water storage up to the FSL level is 1.3 Mm^3. Once tailings deposition in the TSF is complete, the remaining supernatant water in the TSF will be reclaimed to the Goose Process Plant.

The closure plan for the TSF is to cover the exposed tailings and the containment dam with waste rock originating from the Goose Main open pit and convert the TSF into a waste rock storage area (TSF WRSA). This WRSA will in turn be covered with a 5 m cap of non-potentially acid generating (NPAG) waste rock. The Goose Main open pit is located 2 km north, and downstream of the TSF. Development of the Goose Main open pit is scheduled to overlap for three months with active tailings deposition in the TSF. It is assumed that waste rock will be deposited on the tailings beaches and the upstream and downstream face of the TSF dam.

Following the dewatering of supernatant water in the TSF, a portion of the TSF containment dam will be used to store contact water until the start of Closure. The available capacity of the pond at this point is 1.2 Mm^3. At Closure, runoff from the Goose WRSA will naturally flow downstream into Goose Main open pit; now named Goose tailings facility (TF).

4.1.2 Umwelt Open Pit and Tailings Facility (TF)

The Umwelt open pit is the first pit to be mined at the Goose Property and is scheduled to start one year before milling begins. Pit dewatering flows will be pumped to the former Llama Lake (then called Llama Reservoir), followed by the TSF once milling operations begin. After completion of Umwelt open pit mining, the open pit will be used for storage of mine water, tailings deposition, and the Goose Process Plant reclaim water as the Umwelt tailings facility (Umwelt TF). Based on available pit shell information, the estimated total storage capacity of the Umwelt open pit is 7.8 Mm^3, measured below a discharge elevation of 299.7 metres above sea level (masl).

Tailings will be deposited in the Umwelt TF until the solids are at an elevation 5 m below the discharge elevation. A total of 7.1 Mm^3 of tailings will be deposited in the Umwelt TF over a period of about four years. Once the Goose open pit mining is complete, excess water from the Umwelt TF during Operations will be pumped to the Goose Main TF.

At Closure, 5.0 m of water will cover the tailings deposited in the Umwelt TF (total water volume of 0.7 Mm^3). After Closure and once site specific water quality discharge criteria are met, excess water from the Umwelt TF will be directed to Goose Lake.

4.1.3 Llama Open Pit and Reservoir Facility

The Llama open pit is expected to be developed and mined in just under three years. The Llama open pit is the only pit on the Property that will be developed in an open talik and where groundwater inflows are expected to be encountered during mining. Pit dewatering flows will be routed to the TSF, followed by the Umwelt TF once it becomes active.

Following the completion of Llama open pit mining, the pit will be used to store excess site-wide contact water during Operations (as the Llama Reservoir) and hypersaline water (creating a meromictic lake). At Closure, once site specific water quality discharge criteria are met, excess water will be routed to Goose Lake. The available storage capacity of the Llama open pit below a discharge elevation of 294.4 masl is 5.6 Mm^3.

4.1.4 Goose Main Open Pit and Tailings Facility (Goose Main TF)

The Goose Main open pit will be mined and developed within four years, and will be used in Year 7 as a tailings facility. Pit dewatering flows will be pumped to the TSF, followed by the Umwelt TF once it becomes active.

The available storage capacity of the Goose Main open pit after development is 10.8 Mm^3 below a discharge elevation of 279.2 masl. Based on the mine schedule and milling rate, approximately 6.2 Mm^3 of tailings will be deposited to an elevation of 247.9 masl, providing 4.6 Mm^3 of storage for process water and site-wide contact water, and 31 m of water cover above the tailings surface. Process water inventory from the Goose Main TF will be treated during Operations and Closure and pumped back to the Goose Main TF until water quality discharge criteria are met.

4.1.5 Llama Lake

As described in the Site Water Monitoring and Management Plan (Volume 10, Chapter 7), the intent is to initially dewater Llama Lake to 450,000 m^3 to provide adequate storage for site-wide contact water from the Umwelt open pit dewatering and waste rock runoff during the construction of the TSF. Based on available bathymetry, Llama Lake has a total storage capacity of 1.1 Mm^3.

4.1.6 Umwelt Lake and Saline Water Pond

During the underground development of Umwelt, Llama, and Goose Main, it is expected that a significant volume of groundwater will need to be dewatered as underground development will occur in open taliks. As chloride concentrations in the groundwater are expected to be high, it was determined that the saline groundwater from the underground workings would need to be separated from the site-wide contact and process water managed on site.

The Umwelt Lake will be dewatered and the Saline Water Pond will be constructed in its footprint. Intercepted groundwater from underground development will be stored in the Saline Water Pond until water can be pumped to the Llama Reservoir and into the Llama, Umwelt, and Goose Main underground workings once mining is complete. Based on available bathymetry, the Umwelt Lake and Saline Water Pond have total capacities of 362,480 m^3 and 1.1 Mm^3, respectively.

At Closure, once the Saline Water Pond is dewatered to the Llama Reservoir, the first 2 m of sediments (773,817 m^3) may be excavated and transferred to the Goose Main TF.

5. Mitigation and Adaptive Management Measures

5.1 OVERVIEW

Mitigation measures will be in place to avoid or minimize the potential effects of the Project on fish and fish habitat (summarized in Table 5.1-1; also see Section 6.5.3 in Volume 6). Mitigation measures are supplemented by the use of additional management. The primary mitigation measure to avoid potential effects on freshwater fish/aquatic habitat is the Project design of siting infrastructure to avoid freshwater fish habitat wherever feasible. The camp/plant site, stockpile location, and waste rock storage areas have been located to avoid fish-bearing waters. Another key mitigation measure is the establishment of maximum water volume uses which have been based on protecting critical life stages of fish in Goose, Propeller, and Big lakes. The proposed mitigation and management measures are considered to be technically, environmentally, and economically feasible. Unavoidable losses of fish habitat (e.g. loss of Llama Lake due to Llama Open Pit and loss of Umwelt Lake due to Saline Storage Pond) will be counterbalanced through the implementation of a Fish Offsetting Plan. Procedures for the proposed fish-out are summarized in Section 11, whereas details on other mitigation and management measures are presented within the following plans in Volume 10 of the FEIS:

- Environmental Management Plan (Chapter 1);
- Environmental Protection Plan (Chapter 2);
- Fuel Management Plan (Chapter 4);
- Spill Contingency Plans (Chapter 5);
- Oil Pollution Emergency Plan (Chapter 6);
- Site Water Monitoring and Management Plan (Chapter 7);
- Mine Waste Management Plan (Chapter 9);
- Waste Management Plan (Chapter 10);
- Incineration Management Plan (Chapter 11);
- Road Management Plan (Chapter 14);

- Shipping Management Plan (Chapter 15);
- Borrow Pits and Quarry Management Plan (Chapter 16);
- Air Quality Monitoring and Management Plan (Chapter 17);
- Aquatic Effects Management Plan (Chapter 19);
- Tailings Management Plan (Chapter 22); and,
- Mine Closure and Reclamation Plan (Chapter 29).

Table 5.1-1. Summary of Select Mitigation and Management Measures for Fish and Aquatic Habitat

Mitigation Category	Mitigation Measures
1. Mitigation by Project Design	
	• The Project has been designed to employ winter road only access corridors, thereby limiting dust emissions and hence the potential influence on fish and aquatic habitat. There are no all-weather roads connecting the MLA to the Goose Property. • Infrastructure, waste rock storage areas, and the TSF have been confined to the local watersheds where the deposits are located, and have stayed out of the regional Upper Back River Watershed, thereby confining potential influence on fish habitat and community to the local drainage areas. • The area of landscape disturbance will be minimized, and restoration will occur as soon as possible in order to minimize erosion potential.
2. Best Management Practices	

	• Construction, including winter road construction, will follow all applicable DFO's 'Measures to Avoid Causing Harm to Fish and Fish Habitat'.
	• Efforts will be made during the final design stage to have the right-of-way cross each stream as close to perpendicular as possible to minimize the amount of riparian vegetation that may need to be disturbed during construction.
	• Where water will be withdrawn from fish-bearing lakes, reduction in water level and discharge will be below a threshold determined to have no significant residual effects on fish and fish habitat, as directed by DFO.
	• In-water work at the MLA will take not take place from mid-July through mid-August during the Capelin spawning migration; in-stream work at the Goose Property will not take place from May 1 to July 15 during spring spawning and incubation periods for Arctic Grayling.
	• Where possible, buffers along existing natural surface flow features will be used to maintain native vegetation and aquatic conditions.
	• Silt fences will be used in areas of cuts and excavations, downslope from exposed or erodible areas to prevent sedimentation of waterbodies.
	• All water intakes will be screened to avoid entrainment of fish in accordance with the DFO Fresh Water Intake End of Pipe Screening Guideline.
	• All Project activities requiring the use of explosives in or near waterbodies will consider the Guidelines for Use of Explosives In or Near Canadian Fisheries Waters (Wright and Hopkey 1998) and other applicable and available best management practices.
	• Speed limits will be followed for vessel operations to minimize propellor wash and wake effects.
	• The dewatering of waterbodies, will follow an approved dewatering plan, whereby water will not be discharged to the receiving environment if it does not meet approved criteria. Any poor quality water will be retained, discharged to the TSF or other appropriate holding facility.
	• Fishing will be banned within all Project areas and, thus, will not result in fish mortality.
	• Fish removal from waterbodies prior to dewatering will follow the DFO's General Fish-Out Protocol for Lakes and Impoundments in the Northwest Territories and Nunavut (Tyson et al. 2011).
	• Guidelines for vessel discharges and anti-fouling surface treatments will be adhered to at the MLA. These guidelines include the following requirements:
	  ○ organotin compounds are prohibited for vessels in Canadian waters;
	  ○ vessels must treat sewage prior to discharge, or discharge offshore; and
	  ○ vessels travelling in international water must exchange ballast water offshore.

(continued)

Table 5.1-1. Summary of Select Mitigation and Management Measures for Fish and Aquatic Habitat (completed)

Mitigation Category	Mitigation Measures
3. Adaptive Management	
• The need for any corrective actions to on-site emission management or installation of additional control measures will be determined on a case-by-case basis. Indications of the need for corrective actions and additional control measures may include: o if results from the Surveillance Network monitoring program (which will be outlined in the future Type A Water Licence) show non-compliance; o if results from the Aquatic Effects Monitoring Program, which will monitor the receiving environment around the mine infrastructure and activities, show adverse effects to the freshwater environment; or o if results from the Fish Offsetting Monitoring Program show that the offsetting program is not successful.	
4. Monitoring	
• The Aquatic Effects Monitoring Program will consist of the following components: o water quality and sediment quality monitoring; o monitoring primary producers and benthic invertebrates; and o monitoring fish and shellfish populations, as well as fish and shellfish tissues.	

5.2 SITE WATER MANAGEMENT

The Site Water Monitoring and Management Plan (Chapter 7, Volume 10 of the FEIS) was designed to mitigate potential negative effects from Project activities on the aquatic environment. In the Goose Property Area, site contact water (including runoff from WRSA and mine water) and treated sewage effluent will be directed to the tailings facilities and discharged to an approved site meeting applicable water licence criteria. At the MLA, greywater will be discharged on-land at an approved site and sewage will be collected by Pactos and incinerated.

Water management plans were prepared for each phase of the mine life: construction, operations, closure and post-closure. The operational period consists of open pit and underground mining, and will take place over a ten-year period. Three tailings facilities are operated in sequence, which are presented as three stages within the operations. The closure period will take place over an additional eight years, at which point the site enters post-closure and all remaining facilities are decommissioned.

Water on site is categorized into three types, including contact water, which is affected by mine workings (waste rock, ore stockpile, pits, tailings, etc.), non-contact water, which is runoff from undisturbed areas, and saline water, which is the groundwater inflows to mining areas. Each type of water is managed separately throughout each Project phase.

Contact water is contained in event ponds and tailings facilities, and is transferred via diversions and pumped pipelines (Figure 5.2-1). Non-contact water is diverted off-site through event ponds, pumped pipelines, berms and culverts. Saline water is pumped from the underground facilities and stored in the Saline Water Pond, which is subsequently pumped back underground or into the bottom of the Llama Reservoir.

A water treatment plant will be operational in the open water season at the Goose Property in the construction phase to initially dewater Llama and Umwelt Lakes in order to create storage for contact water and saline water, respectively. Treatment is inactive between Years 1 and 5, but begins again year-round from the Goose Main TF in Year 6 to reduce metal and suspended solids loading in the

facility. Once mining is complete in Year 10, water treatment continues during the open water season from the Goose Main TF, until Year 18, at which point the site is finally closed.

Five culvert crossings are required to maintain drainage patterns across the haul road and Goose airstrip at the Goose Property as illustrated on Figure 5.2-1. All crossings occur over small, ephemeral streams. One of these crossings will occur over a fish-bearing stream, the Gander Pond outflow stream located north of the airstrip, and therefore will be designed for passage of fish (i.e., Arctic Grayling). The remaining four crossings will occur over non-fish bearing streams. The culvert which requires fish passage will contain a 150 mm layer of cobble substrate material. Culvert sizing was done using the commercial code HY-8 (Federal Highway Administration 2015). Detailed design drawings of culverts will be provided to DFO during the regulatory phase of the Project.

5.3 SEDIMENT AND EROSION CONTROL

Sediment and erosion control measures will be applied throughout construction and maintained for the life of the Project. Efforts will be made to minimize the disturbance of the landscape and natural vegetation cover, and to schedule ground preparation to maintain adequate cover and avoid activities during periods of expected rainfall. The Project has been designed to use winter road only access corridors thereby limiting stream crossing and instream works and hence the potential effects on water and sediment quality. Efforts will be made during the final design stage to have the right-of-way cross each stream as close to perpendicular as possible to minimize the amount of riparian vegetation that may need to be disturbed during construction. Depending on the site-specific requirements, civil design structures may be used to prevent erosion and the deposition of sediment in the aquatic environment (a list of potential structures and approaches shown in Table 6.1-1, Chapter 19, Volume 10 of the FEIS).

Runoff in the Project area occurs during a short period of June through September/October, due to the Arctic climate and permafrost ground conditions. Streams and rivers begin to flow in May, after freezing solid during the winter, and peak during freshet in June and July. The freshet period is typically short, and instantaneous flows can be quite large (see the Hydrology baseline information, Volume 6, Chapter 1 of the FEIS). Water control and erosion control structures will be designed to freshet peak flows, and areas and structures vulnerable to freshet flows will be identified. Water control structures will be monitored for ice and snow blockages, which will be cleared as necessary.

5.4 BLASTING PLAN

All Project activities requiring the use of explosives in or near waterbodies will consider the Guidelines for Use of Explosives In or Near Canadian Fisheries Waters (Wright and Hopkey 1998) and other applicable and available best management practices, as directed by DFO. The blasting management plan will be discussed with DFO prior to any blasting activities, and will be subject to adaptive management.

5.5 ROUTINE INSPECTION AND MONITORING

In addition to specific monitoring programs, including those required under regulatory approvals, routine inspections will be done on Project activities and components that could interact with the aquatic environment (Table 6.1-2 in Chapter 19, Volume 10 of the FEIS). These routine inspections will ensure mitigation and management goals are met, help identify if additional mitigation measures are required, and provide important information on the performance of the Aquatic Effects Management Plan.

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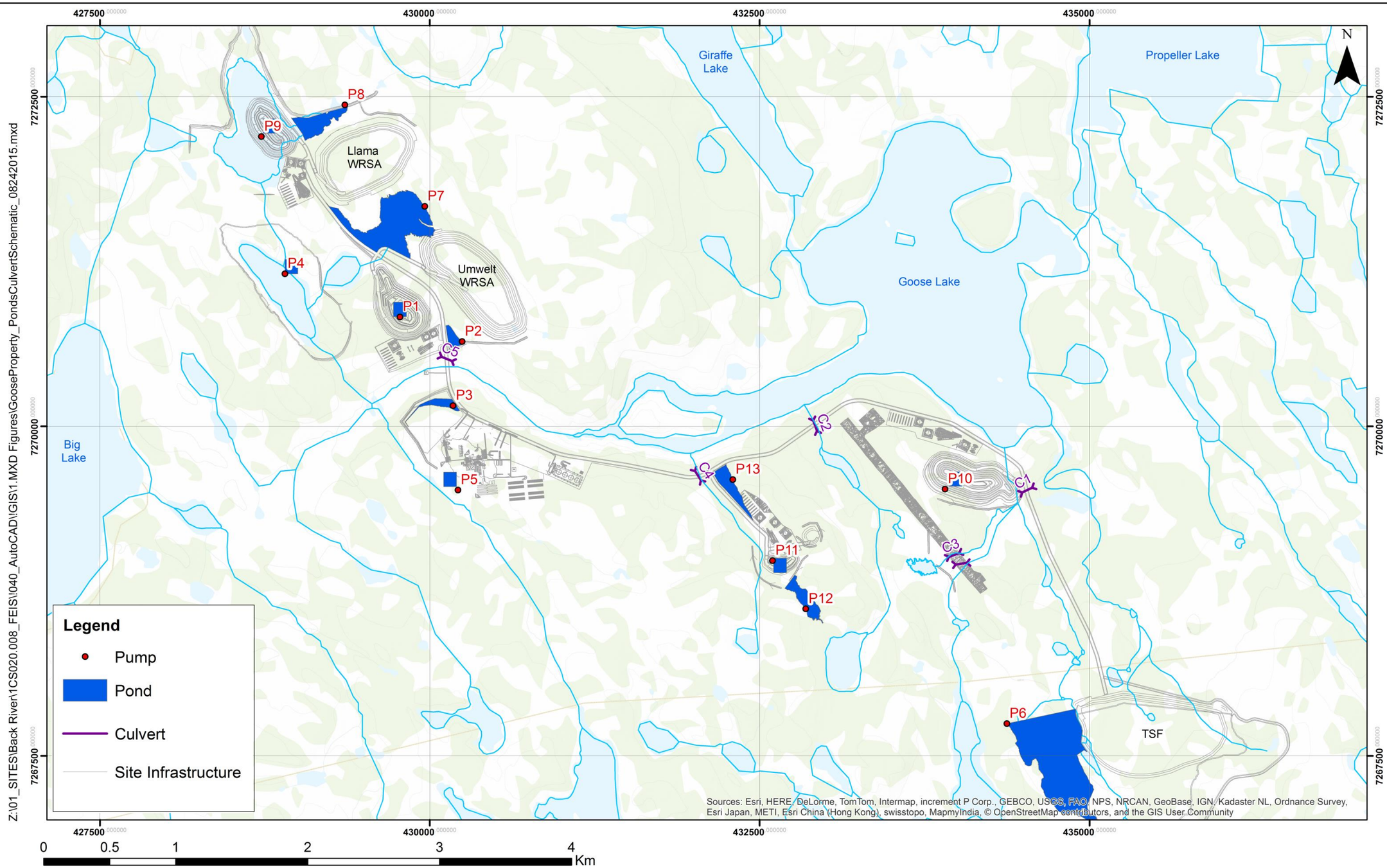


Coordinate System: NAD 1983 UTM Zone 13N

srk consulting	Sabina GOLD & SILVER CORP.	Site Wide Water Management Report
Job No: 1CS020.008 Filename: Fig3_Pumping_Culvert_Schematic.pptx	BACK RIVER PROJECT	**Goose Property Pumping & Culvert Schematic**
		Date: August 2015 / Approved: SAB / Figure: **5.2-1**

6. Project-Related Serious Harm to Fish

6.1 INTRODUCTION

Serious harm to fish (as defined in the *Fisheries Act*) refers to the ways that the aquatic environment is changed as a result of unavoidable adverse impacts with the Project. This would include the unavoidable death of fish or permanent alteration to, or destruction of, fish habitat. Serious harm can result in residual serious harm, impacting the productivity of a CRA fishery. Thus, there are two key steps required for the assessment in the offsetting plan:

1) A screening assessment to determine whether serious harm to fish is likely to occur; and,
2) An assessment of residual serious harm to the productivity of the fishery if it has been determined that effects are likely to occur.

The Pathway of Effects models (or diagrams) developed by the DFO can be used to identify any serious harm, which can ultimately lead to reductions in fisheries productivity (DFO 2014b). The Pathway of Effects models are similar to the general method of the environmental assessment for the Project. Project activities, the expected cause-effect relationship, and the mechanisms by which stressors ultimately lead to effects in the aquatic environment are described within Chapter 6 and 7 of the FEIS. For additional detail on the assessment approach for fish and fish habitat, see the General Methodology for Project Effects Assessment (Volume 9, Chapter 1).

Although mitigation measures will be in place to avoid or minimize the potential effects of the Project on fish and fish habitat (see Section 5), adverse effects may remain and lead to residual serious harm to fish. The offsetting plan summarizes predicted adverse effects to occur for the MLA and Goose Property area, as concluded in the environmental assessment of Project effects on fish habitat (Volume 6, Chapter 6, and Volume 7, Chapter 4) and on the fish community valued ecosystem components (VECs; Volume 6, Chapter 7, and Volume 7, Chapter 5). The offsetting plan focuses on Project infrastructure that may interact with the fish and fish habitat wherever the locations overlap with fish habitat (e.g., that may result in permanent alteration of habitat, or require a fish-out prior to the alteration of habitat). The potential introduction of deleterious substances to freshwater habitat at the Goose Property was determined to not measurably affect fish health (as stated in Volume 6, Chapter 7 of the FEIS), and water and sediment quality (as stated in two chapters in the FEIS: Volume 6, Chapters 4 and 5 for water and sediment quality, respectively).

6.2 MARINE LAYDOWN AREA

With consideration of the application of proposed mitigation and management measures, serious harm is predicted for Arctic Char and aquatic habitat VECs in the environmental assessment. Effects are summarized in Volume 7, Sections 4.5.4, and 5.5.4; all of which were classified as being Not Significant.

6.2.1 Aquatic Habitat Footprint

An adverse effect (i.e., serious harm) arising from the Project on the marine VEC fish/aquatic habitat is predicted due to habitat loss under the footprint of the Lightering Barge Terminal (Figure 1.1-2). At the MLA, the magnitude of effects on fish/aquatic habitat due to the footprint of the Lightering Barge Terminal is anticipated to be negligible. This conclusion is drawn from two lines of reasoning. First, the footprint affected by the Lightering Barge consists of the most common and abundant shoreline substrate and habitat along western Bathurst Inlet (sand and cobble). Second, the footprint area (equal to 0.038 ha

and 14.6 m and of shoreline) is negligible when compared to the area within the LSA (2,100 ha) and the amount of shoreline within the LSA (2,800 m). The geographical extent of the effect is confined to the Project footprint, entirely within the Potential Development Area and LSA (Figure 1.1-2, and Figure 3.1-2), and accounts for only 0.00001% of the LSA area and 0.005% of the LSA shoreline; therefore it is considered to be local within the Project footprint. The frequency of the effect will be sporadic (in place intermittently during the open-water season) during the construction and operation phases of the Project. The effect is anticipated to be immediately reversible following closure. The re-colonization of benthic invertebrates would likely be immediate following the permanent removal of the structure and the community will re-establish naturally with no intervention.

An adverse effect arising from the Project on the marine VEC fish/aquatic habitat is predicted due to habitat loss under the footprint of the in-water construction zone for the intake and discharge pipes (Figure 1.1-2). At the MLA, the magnitude of effects on fish/aquatic habitat due to the footprint of the pipe construction is anticipated to be negligible. This conclusion is drawn from two lines of reasoning. First, the footprint affected by pipe construction consists of the most common and abundant shoreline substrate and habitat along western Bathurst Inlet (sand and cobble). Second, the footprint area (equal to 0.55 ha) is negligible in magnitude when compared to the area within the LSA (2,100 ha). The geographical extent of the effect is confined to the Project footprint, entirely within the Potential Development Area and LSA, and accounts for only 0.0003% of the LSA area; therefore, it is considered to be local within Project footprint. The frequency of the effect will be once in the construction phase of the Project. The effect is anticipated to be immediately reversible following closure. The re-colonization of benthic invertebrates is likely to occur immediately following construction when the pipes and trench are covered with natural substrate or clean non-acid generating rock. The benthic invertebrate community will re-establish naturally with no intervention. Furthermore, the in-water work will take not take place from mid-July through mid-August during the spawning period of Capelin, an important forage fish for Arctic Char.

6.2.1.1 Residual Harm to Fish

Although any permanent alteration or destruction of habitat may affect the distribution of Arctic Char and other species that are part of a CRA fishery, the relationship between habitat area and fisheries productivity is typically curvilinear where declines in productivity manifest beyond a certain threshold (DFO 2014a). The expectation is that this threshold is considerable higher than the aquatic footprint because the predicted absolute losses in habitat are small and because the affected habitat types are abundant in the region. Furthermore, any serious harm to fish will be immediately reversible following closure. Therefore, with the implementation of proposed mitigation measures and best available and applicable management practices, it is unlikely that the MLA will result in residual serious harm to fish. The on-going productivity of fisheries will be maintained within the Bathurst Inlet marine ecosystem.

6.3 GOOSE PROPERTY AREA

Although the majority of Project infrastructure has been sited to avoid fish bearing water, some of the Project infrastructure has the potential to interact with the VEC freshwater fish (Lake Trout and Arctic Grayling) and aquatic habitat wherever the locations overlap with freshwater (Figures 1.1-3 and 6.3-1). Any such interactions may result in permanent alteration to, or destruction of fish habitat (i.e., serious harm to fish). Direct mortality with subsequent decreases in population abundance is also predicted occur as part of fish-outs prior to lake dewatering. Effects to fish and fish habitat are summarized in Volume 6, sections 6.5, and 7.5 of the environmental assessment; all of which were classified as being Not Significant.

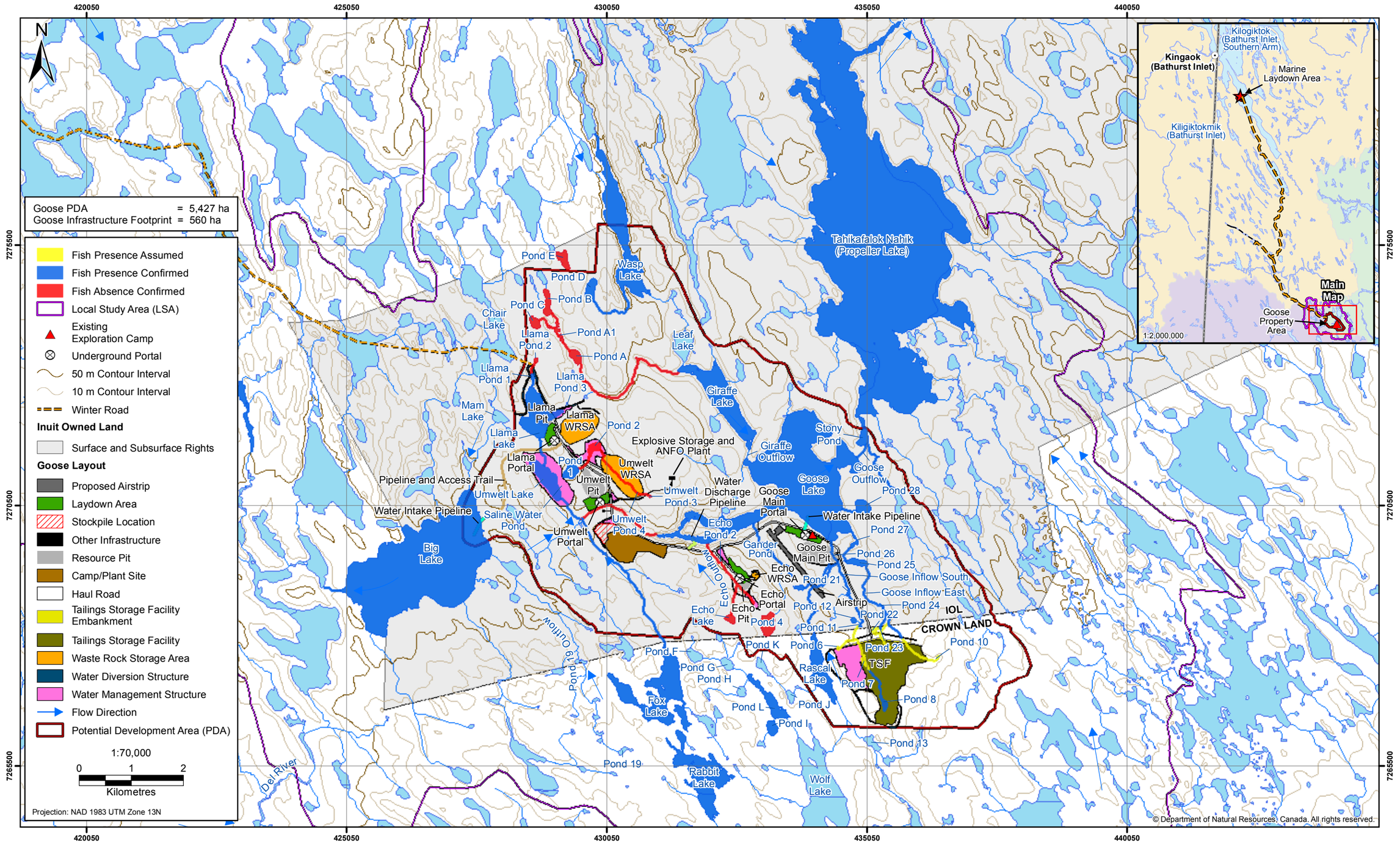


Figure 6.3-1

Fish Bearing Status within the LSA, Goose Property Area

Sabina GOLD & SILVER CORP.

Rescan an ERM company

6.3.1 Lakes

In fish bearing lakes, a direct loss of habitat will occur in Llama Lake as the result of construction of the Llama Pit and at Umwelt Lake as a result of Saline Water Pond construction (Figures 6.3-1). These habitat losses will result from draining each of the lakes during the Construction Phase and will persist in perpetuity. Prior to the draining of each of these lakes, a fish-out will be performed as directed by DFO (see Section 9).

At Llama Lake, the entire basin will be drained in preparation for the construction of the Llama Pit, which represents a complete loss of 36.6 ha of habitat used by Lake Trout, Arctic Grayling, Round Whitefish, and Slimy Sculpin (Figure 6.3-1; Table 6.3-1). The majority of the area of the lake is composed of shallow water (less than 4 m), with large, boulder-cobble substrate, followed by deep water areas (greater than 4 m) with fine substrates, and nearshore areas (less than 2.5 m deep) with fine substrates. Llama Lake was categorized as high quality habitat overall as it provides the majority of deepwater overwintering habitat in the northern section of the Llama Watershed and spawning habitat for Lake Trout and Round Whitefish. Llama Pit will be decommissioned during Operations, when it will be used as a contact water storage facility (Llama Reservoir). From this point onwards, all saline groundwater from the Saline Water Pond will be pumped to the bottom of the partially flooded Llama Reservoir to create a meromictic lake. Llama Reservoir is predicted to overtop during the Reclamation and Closure phase, with water from the reservoir discharging towards the south and into the reclaimed Saline Water Pond catchment (formerly Umwelt Lake).

Umwelt Lake will be drained to construct a Saline Water Storage Pond, which represents a complete loss of 19.4 ha of habitat used by Lake Trout, Arctic Grayling, and Round Whitefish and likely Slimy Sculpin (Figure 6.3-1; Table 6.3-1). The majority of the area of the lake is composed of shallow water (less than 2 m) with mixed cobble and boulder and fine substrates, followed by a small area of slightly deeper water habitat (maximum depth 3 m). Umwelt Lake was categorized as medium quality habitat overall as it provides mainly summer rearing habitat with limited deep water areas for overwintering Arctic Grayling. The Saline Water Pond will begin to be drained into Llama Reservoir during Operations. After draining is complete, the berms of the Saline Water Pond will be breached during the Reclamation and Closure Phase. After the Saline Water Pond closure and reclamation is complete, the diversion berms around the Llama Reservoir will be breached, and the reservoir will be allowed to fill with non-contact water. Details regarding the closure and reclamation of the area around the Saline Water Pond are presented in the Mine Closure and Reclamation Plan (Volume 10, Chapter 29).

The installation of water intake and discharge pipes during the Construction Phase in Goose Lake will affect 0.51 ha of fish bearing habitat (Figure 6.3-1; Table 6.3-1). In southeast Goose Lake, the dimensions of the in-water construction zone for the intake pipe are anticipated to be a maximum of 15 m wide by 129 m long for an approximate footprint of 3,563 m^2 (or 0.36 ha) In western Goose Lake, the dimensions of the in-water construction zone for the discharge pipe are anticipated to be a maximum of 15 m wide by 64 m long for an approximate footprint of 1,502 m^2 (or 0.15 ha). The natural substrate types found under both construction zones are common within Goose Lake and consist of predominantly cobble and boulder at the intake pipe location and predominantly boulder and bedrock at the discharge location. Construction of the intake and discharge pipelines will consist of placing the 4 inch pipe on the substrate surface, covering the pipe and construction zone with clean non-acid generating boulder/cobble rip rap, and daylighting the end of pipe at approximately 5 m water depth. The use of a rock apron is expected to mitigate any potential residual serious harm resulting from the intake and discharge pipes. The pipes will be decommissioned by cutting to the substrate level and capping; rip rap will be permanently left in place.

The installation of a water intake pipe at the eastern shore of Big Lake during the Construction Phase will result in a loss of approximately 0.52 ha of fish bearing habitat (Figure 6.3-1). The dimensions of

the in-water construction zone are anticipated to be a maximum of 20 m wide by 304 m long. The natural substrate type found under the intake pipe construction zone is common within Big Lake and consists of predominantly cobble and boulder. To construct the intake pipeline, a 4 inch pipe will be placed on the substrate surface then the pipe will be covered to the extent of the construction zone with clean non-acid generating boulder/cobble rip rap. The end of the pipe will be daylighted at approximately 5 m water depth. The use of a rock apron is expected to mitigate any potential serious harm resulting from the intake pipe. The pipes will be decommissioned by cutting at the substrate level and capping; rip rap will be permanently left in place.

6.3.2 Ponds

Several small, fish bearing ponds located in the Llama Watershed (associated with the Llama and Umwelt Pits) and the Goose and Wolf watersheds (both associated with the TSF) will be lost to infrastructure (Figure 6.3-1), representing a total wetted area loss of 22.6 ha (Figure 6.3-1; Table 6.3-1).

Within the Llama Watershed, Llama ponds 1 (0.71 ha north of Llama Lake) and 3 (0.57 ha east of Llama Lake) likely serve primarily as summer rearing habitat for juvenile fish from Llama Lake and will be indirectly lost through isolation by the placement of water management structures. Both ponds are ephemerally connected to Llama Lake by short streams which dry up in summer and are dominated by boulders nearshore and fine substrates in deeper regions. Llama Pond 1 may provide some overwintering habitat as it is estimated to be approximately 4 m deep, whereas Llama Pond 3 is less than 1 m deep and provides no overwintering capacity. These habitat losses will be initiated during the Construction Phase and persist in perpetuity.

Pond 1 (located east of Umwelt Lake; Figure 6.3-1) will also be indirectly lost from the Llama Watershed due to disconnection and isolation from Umwelt Lake for the construction of the Saline Water Pond. Pond 1 provides approximately 6.3 ha of low quality rearing habitat for forage fish (Slimy Sculpin and Ninespine Stickleback) which may overwinter within its 3 m depth. This habitat loss will be initiated during the Construction Phase and persist in perpetuity.

Fifteen ponds within the Goose and Wolf watersheds will be lost due to the placement of infrastructure: four within the boundary of the TSF (5.1 ha: ponds 6, 7, 8, and 9), ten due to the loss of catchment discharge downstream of the TSF (9.4 ha; ponds 11, 12, 20, 21, 22, 23, 24, 25, 26, 27) and one by isolation from connected waterbodies (0.56 ha; pond 10; Figure 6.3-1, Table 6.3-1). Within the planned TSF boundary, ponds 6, 7, and 9 are shallow (less than 1 m maximum depth) and consist predominantly of boulder and fine substrate. Given their shallow nature, fish use of these ponds is limited to the summer. Within the potential TSF location overwintering habitat only exists in Pond 8. Pond 10, potentially isolated on the eastern side of the TSF, is also sufficiently deep to provide potential overwintering habitat to forage fish along with summer rearing habitat. The remainder of the ponds downstream of the TSF are split into two groups based on seasonal connectivity; those ponds lower in the watershed that have good connectivity to Goose Lake throughout the summer, and those ponds higher in the watershed that have only ephemeral connectivity to Goose Lake during the spring freshet. Those ponds lower in the watershed (ponds 21, 25, 26, and 27) provide medium quality summer rearing habitat for Arctic Grayling and forage fish. Ponds located higher in the watershed (ponds 11, 12, 20, 22, 23, and 24) provide low quality summer rearing habitat for forage fish. In dry years, fish may become trapped and perish in ponds higher in the watershed if low in-stream flow conditions in the fall prevent fish from accessing viable overwintering habitat. Pond habitat losses will be initiated during the Construction Phase and the loss of ponds directly underneath the TSF (ponds 6, 7, 8, and 9) will persist in perpetuity. All remaining ponds may receive an increase in discharge and potentially a return to fish bearing condition once the TSF is breached and decommissioned in post-closure. However, for the establishment of a fisheries offsetting plan, all ponds are considered losses in perpetuity.

Table 6.3-1. Fish-Bearing Lakes and Ponds with Total or Partial Habitat Losses, Resulting in Serious Harm to Fish

Name	Watershed	Project Effect	Loss Type	Area (ha)	Maximum Depth	Species Captured*	Data Source
Llama Lake**	Llama	Infrastructure (Llama Pit)	Total	36.59	13.6	LKTR, RDWF, NSSB	1,2,3
Llama Pond 1**	Llama	Infrastructure (Water Diversion Structure)	Total	0.71	>3		6
Llama Pond 3**	Llama	Infrastructure (Llama Pit)	Total	0.57	0.8		6
Umwelt Lake**	Llama	Infrastructure (Saline Water Pond)	Total	19.36	3.0	LKTR, ARGR, RDWF	1,2,3,4
Pond 1	Llama	Infrastructure (Isolation)	Total	6.25	3.0	SLSC, NSSB	2
Pond 6	Wolf	Infrastructure (Tailings Storage Facility; TSF)	Total	0.50	1.0		5,6
Pond 7	Wolf	Infrastructure (TSF)	Total	1.66	<1		5,6
Pond 8**	Wolf	Infrastructure (TSF)	Total	2.70	2.0	NSSB	5,6
Pond 9**	Goose	Infrastructure (TSF)	Total	0.22	0.4		5,6
Pond 10	Goose	Infrastructure (Isolation from connected waterbodies)	Total	0.56	>3		5,6
Pond 11	Wolf	Infrastructure (Downstream of TSF loss of catchment)	Total	0.86	<1		5,6
Pond 12	Wolf	Infrastructure (Downstream of TSF loss of catchment)	Total	0.24	<1	NSSB	5,6
Pond 20	Wolf	Infrastructure (Downstream of TSF loss of catchment)	Total	0.19	NA		5,6
Pond 21**	Wolf	Infrastructure (Downstream of TSF loss of catchment)	Total	0.73	0.7	NSSB	5,6
Pond 22	Wolf	Infrastructure (Downstream of TSF loss of catchment)	Total	1.18	1.0		5,6
Pond 23	Goose	Infrastructure (Downstream of TSF loss of catchment)	Total	0.07	0.4	NSSB	5,6
Pond 24	Goose	Infrastructure (Downstream of TSF loss of catchment)	Total	0.22	0.7	NSSB	5,6
Pond 25**	Goose	Infrastructure (Downstream of TSF loss of catchment)	Total	4.20	0.4	NSSB	5,6
Pond 26**	Wolf	Infrastructure (Downstream of TSF loss of catchment)	Total	0.19	0.9		5,6
Pond 27*	Goose	Infrastructure (Downstream of TSF loss of catchment)	Total	1.56	>2	ARGR, SLSC, BURB, NSSB	5,6
Goose Lake	Goose	Infrastructure (Water Intake and Discharge Pipes)	Partial	0.51	16.5	LKTR, ARGR, RDWF, BURB, SLSC, NSSB	2,3
Big Lake	Big	Infrastructure (Water Intake Pipe)	Partial	0.52	5.6	LKTR, ARGR, RDWF, LKWF, BURB, SLSC	3

** LKTR - Lake Trout, ARGR - Arctic Grayling, RDWF - Round Whitefish, LKWF - Lake Whitefish, SLSC - Slimy Sculpin, BURB - Burbot, NSSB - Ninespine Stickleback, where no species has been captured, fish presence assumed due to direct connectivity (no barriers) with fish bearing habitat; ** losses potentially resulting in residual serious harm to fish.*

Data Sources: 1 – Rescan (2010); 2 – Rescan (2012a); 3 – Rescan (2012b); 4 – Rescan (2013); 5 – Rescan (2014); 6 – Rescan 2015 fisheries field data (in preparation

6.3.3 Streams

Several small, fish-bearing streams will be lost to infrastructure (Figures 6.3-1; Table 6.3-2) and are located in three watersheds, the Llama watershed (associated with the Llama and Umwelt Pits), the Goose watershed (associated with the TSF), and the Wolf watershed (associated with airstrip construction, the Goose Pit, and the TSF), representing a total wetted area loss of 3.2 ha (Table 6.3-2).

Within the Llama Watershed, four stream reaches will be lost totalling 0.6 ha of fish bearing habitat. Two streams are associated with the construction of the Llama Pit and the associated water management structures (Llama Inflow from Llama Pond 1 and Llama Outflow) and two streams are associated with the construction of the Saline Water Pond (Umwelt Inflow from Pond 1 and Umwelt Outflow). Llama Inflow from Llama Pond 1 contains overall medium quality habitat but offers good connectivity between Llama Lake and Llama Pond 1 for rearing Lake Trout and forage fish. Llama Outflow habitat is high quality overall, consisting of fair to good quality spawning habitat for Arctic Grayling, good spawning habitat for forage fish and good quality juvenile rearing habitat. Umwelt Inflow from Pond 1 is of fair quality overall with good connectivity between Umwelt Lake and Pond 1 and fair to good rearing and spawning habitat for forage fish only. Umwelt Outflow habitat is high quality overall, consisting of fair quality spawning habitat for Arctic Grayling, good spawning habitat for forage fish and good quality habitat for juvenile rearing fish. All streams will experience a complete, or very nearly complete reduction of discharge from upstream waterbodies and will provide little to no habitat for fish. In addition, there is a potential for small amounts of runoff along the Umwelt Outflow providing the opportunity for fish to become stranded in its lower reaches; however, the potential for reduced flow in these channels to allow fish to enter and become stranded, perish or to spawn and strand eggs will be mitigated. These habitat losses will be initiated during the Construction Phase when Llama and Umwelt lakes are drained. The loss of the upstream catchment will persist through operations and closure, after which the discharge will resume along the natural stream route. For the establishment of a fisheries offsetting plan, all ponds are considered losses in perpetuity.

Within the Goose and Wolf Watersheds, three streams will be lost, or partially lost totalling an approximate 2.6 ha of fish bearing habitat (Table 6.3-1). Two streams will be lost due to the construction of the TSF and the loss upstream catchment area (Goose Inflow East [GIE: 1.6 ha loss] and Goose Inflow South [GIS: 0.6 ha loss]), whereas Rascal Stream East (RSE: 0.5 ha loss) will be partially lost due to development of the airstrip and associated water management infrastructure (Figure 6.3-1).

The Goose Inflow East and South streams can be generally classified into two habitat types based on seasonal connectivity: sections lower in the watershed maintain good connectivity to Goose Lake throughout the summer and provide habitat for Arctic Grayling and forage fish (sections downstream of Pond 24 in GIE, and of Pond 21 In GIS; Figure 6.3-1), whereas sections higher in the watershed have only ephemeral connectivity to Goose Lake during the spring freshet and provide habitat only for forage fish. In sections of GIS and GIE lower in the watershed, the habitat is rated as high quality, providing good spawning and rearing habitat for Arctic Grayling and forage fish from Goose Lake and direct connection to overwintering habitat in Goose Lake. The lower section of GIS also provides part of the corridor that Arctic Grayling use to migrate between Goose and Rascal lakes (Figure 6.3-1). In sections of GIS and GIE higher in the watershed, the habitat is generally rated as low, with fair spawning and rearing habitat for forage fish, but often a discontinuous connection between ponds, of which only two provide overwintering capability (Pond 8 and 10).

Table 6.3-2. Fish-Bearing Streams with Total or Partial Habitat Losses, Resulting in Serious Harm to Fish

Name	Watershed	Project Effect	Loss Type	Area (ha)	Length (m)	Width (m)	Species Captured*	Data Source
Goose Inflow East**	Goose	Infrastructure (Tailings Storage Facility [TSF] and downstream loss of catchment)	Total	1.55	3,887	4	ARGR, SLSC, BURB, NSSB	2,3
Goose Inflow South**	Wolf	Infrastructure (TSF and downstream loss of catchment)	Total	0.63	3,527	1.8	ARGR, SLSC, BURB, NSSB	1,2,3
Rascal Stream East**	Wolf	Infrastructure (airstrip and reaches downstream to Goose Inflow South)	Partial	0.45	1,228	3.7	ARGR, SLSC, BURB, NSSB	1
Llama Inflow from Llama Pond 1**	Llama	Infrastructure (water diversion structure)	Total	0.02	99	1.8		3
Umwelt Inflow from Pond 1	Llama	Infrastructure (isolation from connected waterbodies)	Total	0.01	129	1.0		3
Llama Outflow**	Llama	Infrastructure (Llama Pit dewatering; loss of catchment)	Total	0.08	436	1.8	ARGR, RDWF, SLSC, NSSB	3
Umwelt Outflow**	Llama	Infrastructure (Saline Water Pond dewatering; loss of catchment)	Total	0.44	551	8.0	ARGR, NSSB	3
Gander Outflow	Wolf	Infrastructure (culvert for Haul Road)	Partial	<0.01	30	0.7	ARGR, NSSB	1

** LKTR - Lake Trout, ARGR - Arctic Grayling, RDWF - Round Whitefish, LKWF - Lake Whitefish, SLSC - Slimy Sculpin, BURB - Burbot, NSSB - Ninespine Stickleback, where no species has been captured, fish presence assumed due to direct connectivity (no barriers) with fish bearing habitat; ** losses potentially resulting in residual serious harm to fish.*

Data Sources: 1 – Rescan (2013); 2 – Rescan (2014); 3 – Rescan fisheries field data (in preparation)

Stream habitat losses in GIE and GIS will be initiated during the Construction Phase and the loss of higher watershed sections directly underneath the TSF will persist in perpetuity. All remaining downstream sections of GIE and GIS will receive reduced flows because of lost upstream catchment area resulting in channel discontinuity, increased periods of dry channel and fewer flow days. The potential for reduced flow in these channels to allow fish to enter and become stranded, perish or to spawn and strand eggs will be mitigated. GIE and GIS may return to baseline discharge and potentially a return to fish bearing condition once the TSF is breached and decommissioned in post-closure. However, for the establishment of a fisheries offsetting plan, the entire length of GIE and GIS are considered losses in perpetuity.

The Rascal Stream East (RSE) was surveyed in 2012 and 2013, and is characterized by a heavily braided channel that is dominated by glide and riffle habitat. Boulders dominate the substrate, punctuated by patches of gravel and cobble substrate. The stream is heavily utilized by Arctic Grayling, and contains good quality spawning, rearing, and foraging habitat. The 1.1 km section of RSE upstream of the airstrip culverts, nearest Rascal Lake, will remain undisturbed and provide approximately 0.7 ha of habitat available for spawning, rearing and foraging Arctic Grayling and forage fish from Rascal Lake. Stream habitat losses in RSE will be initiated during the Construction Phase when the culverts for the airstrip are installed and a culvert diverting flow to GIE is established to realign discharge in RSE around the Goose Pit and under a haul road. The habitat losses will continue through post-closure, when the entire volume of RSE is diverted into the Goose TF to reduce filling time for the Goose Pit Lake. Once the Goose TF is full, the pit lake will be breached to allow flow to Goose Lake along the natural RSE alignment. Thus, the RSE will have habitat losses under two culverted areas and reduced flows during the filling of the Goose Pit. Reduced flow in the RSE may be sufficient to allow fish to enter and become stranded, perish or to spawn and strand eggs. RSE may return to baseline discharge and potentially a return to fish bearing condition once the culverts are removed and the Goose Pit Lake is breached in post-closure. However, for the establishment of a fisheries offsetting plan, the length of RSE downstream of the airstrip culverts are considered habitat losses in perpetuity.

Fish habitat loss related to Project infrastructure will also be incurred in Gander Outflow, which will be culverted during site road construction and result in the loss of 21 m^2 (or less than 0.01 ha) of fish bearing habitat underneath the culvert footprint. This section of Gander Outflow includes fair spawning and good rearing habitat for Arctic Grayling and was rated as important overall. Habitat loss will be mitigated with crossing structures that are properly sized and installed using best available and applicable management practices. At stream crossing sites, these impacts could reduce or eliminate spawning, rearing and feeding habitat for Arctic Grayling. However, the Gander Outflow crossing will be culverted with a closed bottom corrugated metal pipe designed to maintain Arctic Grayling passage by keeping water velocities under 1.5 m/s (Site Water Monitoring and Management Plan (Volume 10, Chapter 7). Furthermore, the culvert will be embedded to a depth of 0.4 m and filled with streambed material to promote fish passage and habitat suitability. Any habitat alteration will be initiated during the Construction Phase and persist until decommissioned in post-closure.

6.3.3.1 Residual Harm to Fish

It is expected that serious harm to fish will occur for 22 lakes and ponds, and 8 streams at the Goose Property. Total area of affected habitat is approximately 79.6 ha of lakes and ponds, and 3.2 ha of streams. Residual serious harm to fish is not expected at the Gander Outflow crossing where best management practices will be deployed to maintain fish passage to upstream locations. For example, the culvert will be embedded to a depth of 0.4 m and filled with streambed material to promote fish passage and habitat suitability. Residual serious harm to fish is also not expected to result from the construction of the water intake and discharge pipe. The natural substrate types found under the pipe construction zones are common within the affected lakes and consists of predominantly cobble and

boulder. Furthermore, pipes will be covered to the extent of the construction zone with clean non-acid generating boulder/cobble rip rap. This use of a rock apron is expected to mitigate any potential residual serious harm resulting from the intake pipe. However, some of the Project infrastructure is expected to result in residual serious harm to fish, specifically where infrastructure overlaps with habitat supporting CRA species, such as Arctic Grayling and Lake Trout, and with potential spawning/rearing and foraging habitat with discernible connections to habitat supporting CRA species. It is expected that residual serious harm to fish will occur within 10 lakes and ponds, and 7 streams, totalling 66.8 ha of lakes and ponds and 3.2 ha of streams. Most of the expected Residual Harm to fish will occur in Llama Lake (36.6 ha) and Umwelt Lake (19.4 ha).

6.4 LOSSES IN FISHERIES PRODUCTIVITY

Fisheries production (e.g., biomass), as a surrogate of fisheries productivity (Randall et al. 2013), was estimated for lakes and streams where residual serious harm to fish is expected. Where possible, conservative inputs were considered such that losses were overestimated, reducing the uncertainty in the assessment. For losses incurred within the Llama-Umwelt lake system, two approaches were considered. The first approach considered population sizes estimated for fish from hydroacoustic data (surveys completed in 2010) combined with catch data collected during baseline surveys, including body size measurements, for Llama and Umwelt lakes (see Appendices V6-6A to V6-6C). The second approach considered a biomass equation derived for northern lakes (Samarasin et al. 2015) combined with catch data, including body size measurements, for Llama and Umwelt lakes. The equation applied for estimating losses for lakes was as follows:

$$\log_{10}(biomass) = 1.08 + 1.04\ (\log_{10}(lake\ area)) + 0.05\ (no.of\ species) + 0.03\ (mean\ annual\ air\ temp.);$$

where biomass is measured in kg, and lake area in ha.

The above biomass equation was also applied to derive the calculation of losses associated with the Goose Lake tributary streams and ponds in the Goose and Wolf watershed, including Goose Inflow South, and Rascal Stream East streams. Losses within the tributaries to Goose Lake were based on the predicted total biomass of fish in Goose Lake derived from the biomass equation, combined with catch data for Goose Lake to determine species composition (Appendices V6-6A to V6-6C of FEIS; also see Golder 2007), and the estimated proportion of biomass of fish in Goose Lake that use the affected tributary streams and ponds as part of a species life history. The assumed life history functions of the affected tributary streams include foraging, rearing and spawning habitat; however, as a conservative assumption, the calculated proportion of fish in Goose Lake that use the affected tributary streams and ponds was assumed to be all individuals of the following species: Arctic Grayling, Ninespine Stickleback, and Slimy Sculpin, all of which have been recorded as frequent users of both Goose Lake and the affected streams. This assumption is conservative because it is expected that other tributary systems of Goose Lake (e.g., Giraffe Outflow, Goose Inflow East, Gander Outflow) will continue to provide suitable habitat for species with the development of the Project and some proportion of the population of Goose Lake will be sustained.

6.4.1 Llama Lake-Umwelt Lake System

6.4.1.1 Species Composition

Hydroacoustic gear was used to estimate abundance of fish (age 1 or older) in Llama and Umwelt lakes in 2010. The total number of fish in each lake was estimated at 226 (95% CI 4 to 1,794) and 155 (95% CI 5 to 864), respectively. Based on concurrent sampling conducted with gillnets, roughly 78% of the fish in Llama Lake were estimated to be Lake Trout, while 22% were Round Whitefish. Based on the same kind of concurrent sampling, approximately 77% of the fish in Umwelt Lake were estimated to be Arctic

Grayling, while the remainder of the fish in that waterbody were Round Whitefish. However, variation in species relative abundance was observed when taking into account all sampling years (2010, 2011, and 2012). For example, based on all gill netting years, Lake Trout is the dominant species in Llama Lake, accounting for approximately 65% of the total number of fish, whereas Round Whitefish make up most of the remaining 35% of individuals. For Umwelt Lake, the dominant species is Arctic Grayling if considering data across all gill netting years (70%), followed by Round Whitefish (27%), and Lake Trout (3%). Thus, for the two lakes combined, the population size was predicted to be 381 fish, based on hydroacoustic surveys and to include a catch composition of 39% Lake Trout, 31% Round Whitefish, and 30% Arctic Grayling based on sampling efforts (Figure 6.4-1). Thus, species-specific population estimates include 147 Lake Trout, 120 Round Whitefish, and 114 Arctic Grayling (Figure 6.4-1).

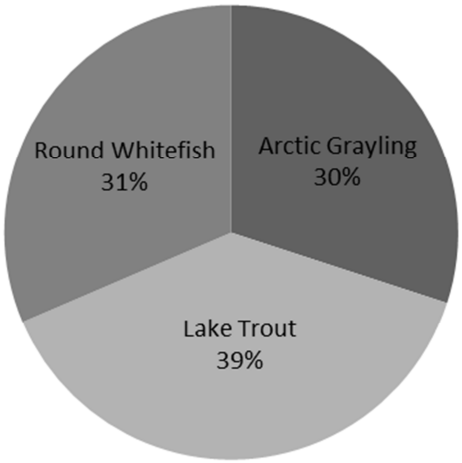


Figure 6.4-1. Species Composition of the Llama-Umwelt Lake System, Goose Property Area

6.4.1.2 Fish Biomass

The first approach for calculating biomass considered population sizes estimated from hydroacoustic data combined with catch data for Lake Trout, Round Whitefish, and Arctic Grayling, including body size measurements (e.g., weight), for Llama and Umwelt lakes. Given reported populations sizes in Section 6.4.1.1, and recorded mean weight of fish captured in Llama and Umwelt lakes, which were 0.236 kg for Arctic Grayling, 0.802 kg for Lake Trout, and 0.367 kg for Round Whitefish, the estimated biomass per species is 27 kg of Arctic Grayling in Umwelt Lake, 118 kg of Lake Trout in Llama Lake, and 44 kg of Round Whitefish in the two lakes combined. Total estimated biomass for the two lakes combined is approximately 189 kg.

The second approach for calculating biomass was based on an equation derived for northern lakes (Samarasin et al. 2015) combined with baseline catch data, including body size measurements, for Llama and Umwelt lakes. This second approach also considers contributions of small-bodied species, such as Ninespine Stickleback and Slimy Sculpin. Equation inputs included 36.6 ha for area of Llama Lake, 19.4 ha for Umwelt Lake, 0.71 ha for Llama Pond 1, 0.57 ha for Llama Pond 3, five species (Arctic Grayling, Lake Trout, Ninespine Stickleback, Round Whitefish, and Slimy Sculpin), and a mean annual air temperature of -11.1^{o}C. Thus, the total calculated biomass is 661.2 kg for the Llama-Umwelt lake system.

6.4.2 Goose Lake and Tributaries

6.4.2.1 Species Composition

In general, Arctic Grayling and Slimy Sculpin were the most abundant species captured in streams, followed by Ninespine Stickleback, Burbot, Round Whitefish, and Lake Trout. The highest abundance of fish (CPUE) caught by electrofishing streams was recorded in the Rascal Stream East (connecting Rascal Lake to Goose Lake) where numerous young-of-year Arctic Grayling and Slimy Sculpin were captured. Arctic Grayling fry (over 1,000 individuals) were also observed in each of the Goose Inflow South and Rascal Stream East during fry surveys.

Goose Lake contains six fish species: Lake Trout, Round Whitefish, Arctic Grayling, Slimy Sculpin, Burbot, and Ninespine Stickleback. Based on four sampling years (2006, 2011, 2012, and 2013) and multiple gear types (gill nets, electrofisher, and beach seines), the total catch included 202 fish, most of which were Round Whitefish (34% of total catch) and Lake Trout (26%), followed by Slimy Sculpin (22%), Ninespine Stickleback (14%), Arctic Grayling (2%), and Burbot (2%).

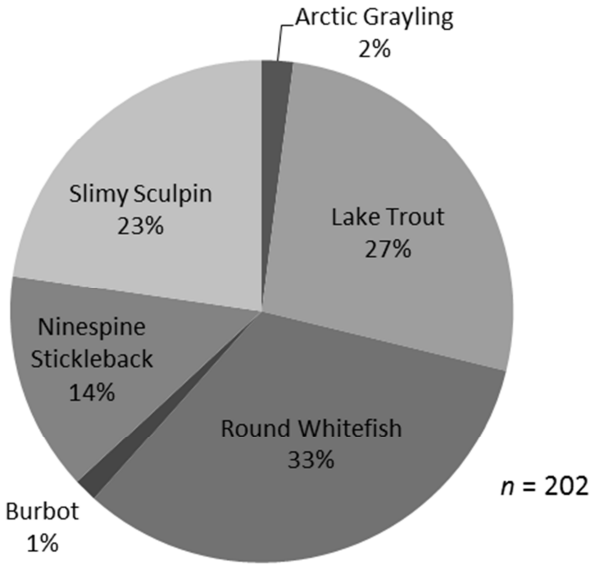


Figure 6.4-2. Species Composition of Goose Lake, Goose Property Area

6.4.2.2 Fish Biomass

To calculate biomass of fish that rely on affected tributary habitats (see Table 6.3-1 and 6.3-2), available biomass in Goose Lake was first estimated using the biomass equation derived for northern lakes (Samarasin et al. 2015). Equation inputs included 320.2 ha for area of Goose Lake, 2.7 ha for Pond 8, 0.22 ha for Pond 9, 0.73 ha for Pond 21, 4.2 ha for Pond 25, 0.19 ha for Pond 26, 1.56 ha for Pond 27, six species (Arctic Grayling, Burbot, Lake Trout, Ninespine Stickleback, Round Whitefish, and Slimy Sculpin), and a mean annual air temperature of -11.1°C. With the application of these inputs to the biomass equation, 4,634 kg of fish biomass was calculated for Goose Lake, and of this value, it was assumed that all biomass of Arctic Grayling, Ninespine Stickleback, and Slimy Sculpin was linked to the affected tributary streams and ponds. The reported relative abundances of fish species in Section 6.4.2.1, combined with mean weights of fish captured in Goose Lake (0.183 kg for Arctic Grayling, 0.002 kg for Slimy Sculpin, and 0.001 kg for Ninespine Stickleback) were then applied to calculate biomass loss. The calculation of losses produced 74 kg of Arctic Grayling, 9.0 kg of Slimy Sculpin, and 2.8 kg of Ninespine Stickleback in Goose Lake, for a total of 85.8 kg of fish biomass.

7. Offsetting Option - Bernard Harbour

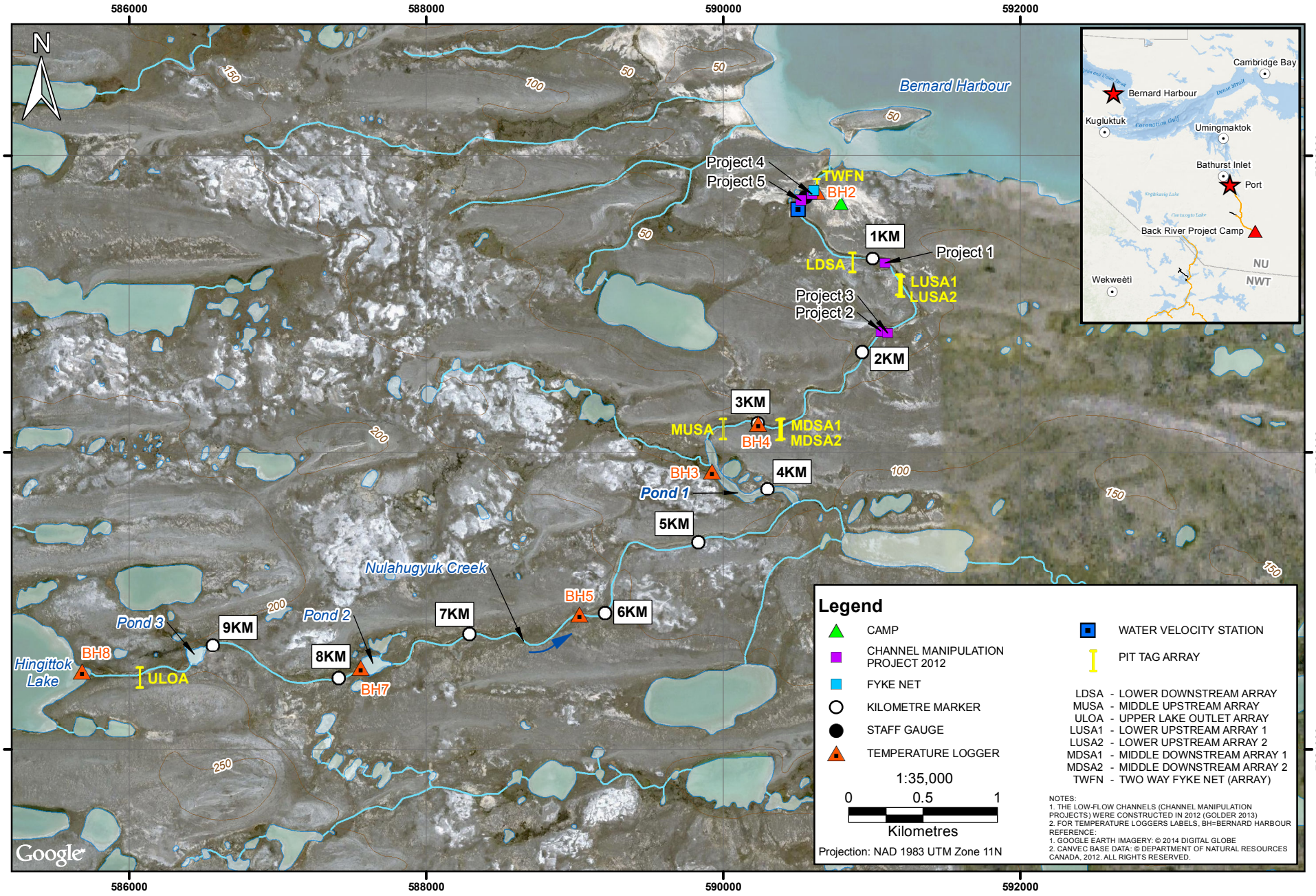
7.1 INTRODUCTION

The Hingittok Lake-Nulahugyuk Creek (HLNC) system at Nulahugyuk (Bernard Harbour), Nunavut (Figure 1.1-1) was once the site of a traditional domestic fishery for Arctic Char (Salvelinus alpinus; char). Records from the Canadian Arctic Expedition indicate that the creek at Bernard Harbour supported a large migration of anadromous char in the early 1900s (Jenness and Jenness 1991). By the early 1990s, however, harvesters were reporting that the run was in decline and that the numbers of migrating char were much lower than those observed 30 or 40 years ago based on local knowledge (ANL and Golder 2005; Golder and ANL 2007). In response to these concerns, members of the Kugluktuk HTO, and Golder biologists, performed a preliminary assessment of the size and timing of the Arctic Char run, and habitat conditions for fish passage during 2004 and 2005 (ANL and Golder 2005; Golder and ANL 2007), and again in 2012 (Golder 2013).

Although the previous work reflected only a short window (i.e., less than 2 weeks) within an assumed longer migratory window per study year, the results suggested a decline in the size of the char run. In addition, the timing of the upstream char migration appeared to have shifted to earlier in the summer. It was hypothesized that the char run was affected by lower flows and poor channel conditions in mid to late summer when char generally undertake a return migration from the sea.

During earlier investigations (ANL and Golder 2005; Golder and ANL 2007; Golder 2013) site-specific blockages (e.g., channel crossover locations) at several sites, which appeared problematic for migrating adult Arctic Char, were identified. Upstream movements by char were particularly restricted during low flow periods (Plate 7.1-1) and primarily within the lower (approximately 3.5 km) section of the creek. As a possible corrective measure, it was proposed that ‘low-flow channels’ be constructed to facilitate fish passage during low discharge periods to extend the migration window; where a low-flow channel is characterized by an unobstructed flow path with sufficient depths within the larger channel. The low-flow channels would be particularly beneficial during drier than normal years.

Plate 7.1-1. Arctic Char struggling to migrate upstream through a shallow section of Nulahugyuk Creek, July 5, 2014.



Sabina Gold & Silver Corp.

Figure 7.1-1

NULAHUGYUK CREEK BASELINE MONITORING, BERNARD HARBOUR, 2014

In 2012, a stream enhancement and community stewardship project aimed at understanding and enhancing the use of the Bernard Harbour system by Arctic Char was successfully undertaken (Golder 2013). Five low-flow channels, combined with directional weirs to aid fish navigation, were constructed with the guidance from local Traditional Knowledge to assess the feasibility of applying this approach on a wider scale to increase fish production in the HLNC system (Figure 7.1-1). The project was designed and executed by Golder in collaboration with local partners, including students and residents of Kugluktuk, Nunavut, the Kugluktuk HTO, and the Nunavut Department of Environment.

In 2014, Sabina initiated a comprehensive study of the migratory Arctic Char population at Bernard Harbour. The main goal was to provide rigorous baseline data in support of an offsetting plan for the Project. The baseline information would provide a reference for future quantification of the potential benefits of using "low-flow channel" methods. Specifically, the baseline study was designed to address four general objectives:

1) Monitor the timing and size of the annual migratory char run in Nulahugyuk Creek using two-way fyke net traps installed for the duration of the migration period; data was collected for the three migratory phases in 2014, including:
    a. the downstream (seaward) outmigration of adults (assumed to be spawners from the previous fall), which were predicted to be the first migratory fish captured in the trap during the spring freshet;
    b. the adult upstream (lakebound) migration (consisting of char that would spawn in the year following the sampling year); and,
    c. the downstream (seaward) outmigration of juveniles, which were assumed to be 4 or 5 years old and migrating later in the summer as occurred in 2012 (Golder 2013).

2) Monitor rates of movement and successful upstream passage to Hingittok Lake during the 2014 open water season using Passive Integrated Transponder (PIT) tag methods (e.g., Hering et al. 2010; Puffer et al. 2014); the movement data complement data on the size and timing of the run by providing a direct measurement of the effects of migrations conditions on Arctic Char in the creek for the study year under examination.
3) Assess fish habitat and the relative abundance of fish species in Hingittok Lake using standard inventory methods to gain some understanding of the carrying capacity of the lake for Arctic Char as it relates to enhancement efforts being made to improve fish access in the creek.
4) Collect habitat data to prepare a remediation plan for using low-flow channels to improve upstream passage for fish in Nulahugyuk Creek; this objective was performed in 2014 and 2015 and is a direct follow-up of work initiated by Golder in 2012 and includes:
    a. Assessments of the structural integrity and performance of low-flow channels previously constructed; and
    b. Scoping-level assessments of the number of problem locations and total length of the creek where low-flow channels could be constructed to effectively increase fish production.

In addition to the objectives outlined above, the 2014 and 2015 work was intended to complement and integrate objectives of the Kukgluktuk HTO. This was to be achieved by incorporating students, organizations, and community members and by designing a study that fosters education, stewardship and community involvement in conservation initiatives. Past studies (e.g., Stern et al. 2008) have demonstrated a lasting positive change in environmental attitude, action, and knowledge following environmental education programs, such as the one implemented at Bernard Harbour.

7.1.1 Study Area

The HLNC drainage at Bernard Harbour is located approximately 100 km directly north of the hamlet of Kugluktuk, Nunavut, along the south coast of Dolphin and Union Strait (Figure 7.1-1). The project site is about 4.5 hours (h) travel time by boat from the community. Nulahugyuk Creek, the outflow from Hingittok Lake (882 hectares [ha] in size), flows north for approximately 10 km before entering the sea at 68°44'52"N, 114°45'27"W. The contributing basin area at the mouth of creek is approximately 125 square kilometres (km^2) in area, and may be characterized by limited groundwater derived flows punctuated by precipitation-driven peak flows. It is expected that most of the precipitation falls as rain during the open water season. Based on 1981 to 2010 Canadian climate normal station data for Kugluktuk, mean total precipitation is approximately 247 millimetres (mm), of which 144 mm falls during June, July, August, and September (see http://climate.weather.gc.ca). Daily maximum temperatures, on average, are above zero for June through September, peaking in July at 15.6 °C, and below zero for the remaining months of the year.

7.2 METHODS

The field study in 2014 began on June 13 and was strategically planned to allow the field team to capture the first Arctic Char moving through Nulahugyuk Creek once the ice had melted enough to allow passage for fish. The commencement date was selected based on data collected during 2012 (Golder 2013), anecdotal information from the Canadian Arctic Expedition in 1916 (Jenness and Jenness 1991), as well as information from Kugluktuk residents. Field personnel remained on site until July 17, 2014 to capture the downstream outmigration of juvenile char. A short field program was also performed from July 21 to 25 in 2015 to collect supplemental information on habitat (fish were not monitored in 2015).

7.2.1 Fish Capture and Sampling

Fish were captured in Nulahugyuk Creek using a two-way fyke net trap installed on June 16, 2014, operating continuously until July 17, 2014 (Figure 7.2-1). The fyke net was installed 0.3 km upstream from the mouth of the creek (Figure 7.1-1) in a shallow run area with a mean width of about 18 m. The wings of the fyke net were installed across the creek such that all fish moving upstream or downstream would be directed into the opening. Once they had entered the trap they were directed through a series of funnels. Captured Arctic Char were directed for a total distance of about 6.4 m prior entering a holding basket at the base of the net. The trap was checked several times daily and fish were removed and processed accordingly. The frequency of checks increased with water temperature and capture success to reduce crowding and potential stress to fish.

In Hingittok Lake, multiple gill net sets (short-duration sets) and angling events were used to provide information on fish species composition and abundance. Gill net mesh size and configuration were based on Broad Scale Monitoring (BSM) techniques for North American (NA1) and Ontario small mesh (ON2) gill nets (Sandstrom et. al. 2013). A series of bottom-set gill nets were deployed over four days in July 2014 (July 8, 11, 13, and 14). Each set consisted of either two large (NA1) or two small (ON2) gangs joined for a double-gang configuration. The nets were checked frequently (maximum soak time was approximately four hours) to minimize mortalities. Angling at Hingittok Lake was also performed on July 11 and 13, 2014 using a variety of unbaited, spoon-type lures.

Captured fish were enumerated, and identified to species, most of which were weighed (grams [g]) and measured (fork length [FL] [mm]), and a small number of representative individuals were photographed. To minimize stress during periods of warm water temperatures (>17°C), a small number of fish were enumerated but not processed at the fyke net trap (i.e., were immediately released on the side of the trap corresponding to their direction of travel). When possible, otoliths (the calcified

structure from the inner ear) were removed from observed mortalities (e.g., from stranding at upstream locations), folded in parafilm, and stored in a labelled coin envelope for age analysis at a later date. For catch summaries, char smaller than 300 mm were classified as 'juveniles', fish between 300 and 550 mm were classified as 'immature' (or sub-adults), and fish larger than 550 mm were classified as adults (Golder 2013).

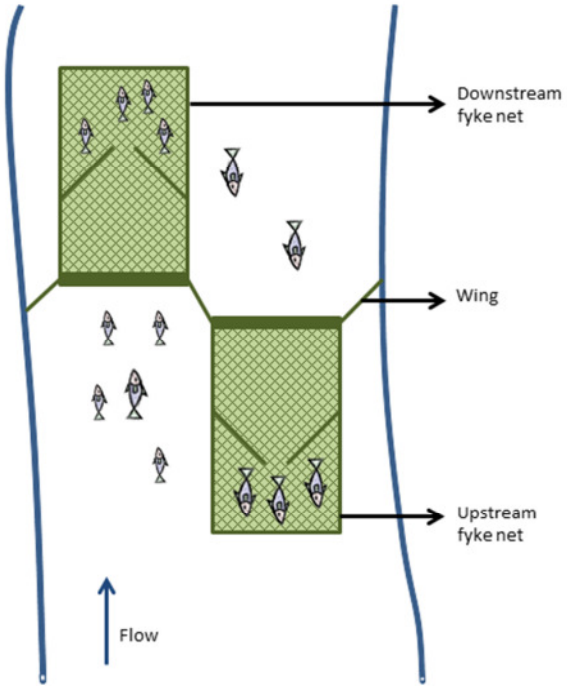


Figure 7.2-1. Conceptual Schematic Showing Two-Way Fyke Net Trap Configuration in Nulahugyuk Creek

7.2.1.1 Mortality Surveys

Mortality data was collected opportunistically as incidental observations, for example, during habitat assessments. When there was an opportunity, field crew members visually surveyed the creek for dead char and when located, carcass information was documented using a hand-held GPS, photographs, and field notes. Carcasses were scanned with a hand-held tag reader (see further below for a description of tags and readers).

7.2.2 Movement Monitoring

Upstream movements for a subset of captured Arctic Char were monitored using implanted PIT tags and Radio Frequency Identification (RFID) antenna-reader arrays installed at strategic locations on the creek (Figure 7.1-1) (similar to methods discussed in Hering et al. 2010; Puffer et al. 2014). PIT tag methods are ideal for monitoring movements of fish in shallow streams such as Nulahugyuk Creek (i.e., constricted environments) because of the low cost of the tags and a high number of individuals can be tracked to reliably describe movements. PIT tags are also ideal for long-term studies since they contain no battery and will be operational for the lifespan of the tagged fish.

Seven PIT tag antennae-reader arrays were installed strategically in relation to the location of the 2012 low-flow channel project areas and reference sections. An array was also installed near the outlet of Hingittok Lake (Figure 7.1-1). The arrays were configured using either a single antennae (Lower

Downstream Array [LDSA], Middle Upstream Array [MUSA], Upper Lake Outlet Array [ULOA]) or paired antennas (i.e., Lower Upstream Array 1 [LUSA1], Lower Upstream Array 2 [LUSA2] and Middle Downstream Array 1 [MDSA1], Middle Downstream Array 2 [MDSA2]), each of which was constructed from bound T90 cable.

Boulder spurs or weirs were constructed to prevent fish from moving around the arrays and to direct fish through the arrays. Antennas were oriented vertically to increase PIT tag reception range. The bottom of the antenna loop was embedded in the creek substrate and the top of the loop was suspended approximately 5 centimetres (cm) above the water surface. This configuration ensured that Arctic Char passed through the loop perpendicular to the antenna field. Antennas were connected to individual tuner boxes located creek-side, with twinax cable extending from the tuner boxes to a multi antenna HDX-PIT tag reader box. The arrays were powered by deep-cycle 130-ampere marine batteries which were kept continually charged using solar panels.

7.2.2.1 Statistical Analyses

Detection probabilities (*p*) were generated for individual antennae by assigning binary detection values for individual char based on whether they were detected (1) or not (0) at a given array. Detection probabilities were calculated for each array based on the mean detection value. Zero values above the furthest upstream detection were excluded from the detectability calculations because these fish were assumed to have been removed from the system. Therefore, detection values for each array were based only on data where detection occurred, or was known to occur further upstream. Detectability for the ULOA array was based on the mean detectability of the downstream arrays, with the exception of MUSA where a technical malfunction reduced detectability at that site.

Binary logistic regressions were used to explore relationships between upstream migration success (fish detected [1], or not detected [0] at the lake outlet) and environmental and biological parameters including migration date, stream discharge (daily and 4-day mean), water temperature (daily and 4-day mean), length, weight and condition factor. Various models were compared based on their Akaike Information Criterion (AIC) score, with lower values identifying models better representing the data analyzed, and Receiver Operating Characteristic (ROC), with higher values indicating greater sensitivity and specificity of the model (Hosmer and Lemeshow 2000).

Arctic Char movement speed (metres per hour [m/h]) was compared between arrays using analysis of variance (ANOVA). Movement speed was square root transformed to meet assumptions of normality. The significance level, alpha (α), was defined a priori as $\alpha = 0.05$. Normality was assessed graphically by examining the distribution of residuals using normal probability plots (Zar 1999). All analyses were conducted using Systat 13 (Systat Software, San Jose, CA).

7.2.3 Habitat Surveys

7.2.3.1 Water Temperature and Discharge Measurements

A stream discharge station with staff gauge was established approximately 0.5 km upstream from the mouth of Nulahugyuk Creek. Water velocities and water depths were measured at 0.75 m intervals along a transect set perpendicular to flow of water at the station. Each point velocity was measured at 0.6 times the depth from the creek bed, which is representative of the mean velocity at that vertical profile. Velocity was measured using a direct read-out Swoffer™ Model 2100 velocity meter and top-setting wading rod. Discharge was calculated across the wetted width of the channel based on the point measurements of velocity, depth, and interval width represented by each point measurement. Stream discharge measurements were collected 22 times between June 13 and July 15, 2015; the staff gauge

was read an additional 28 times between June 13 and July 16. Daily flows were also measured during the 2015 program (July 22 to 24).

Water temperatures were measured at 0.25 h intervals at six locations along Nulahugyuk Creek using Onset® HOBO Water Temperature Pro V2 Data Loggers in 2015 (Figure 7.1-1). The loggers collected data every 15 minutes and ran continuously for the duration of the field study.

7.2.3.2 Nulahugyuk Creek Habitat

Habitat was assessed along the entire length of Nulahugyuk Creek (approximately 10 km) between July 10 and July 14, 2014. Major habitat types within the sections were described in accordance with the classification system outlined in O'Neil and Hildebrand (1986). Supplemental information on problem locations (i.e., barriers) were then collected on July 16, 2014, and again on July 23 and 24, 2015, but with a focus on the lower 3.5 km of Nuluhugyuk Creek where most of the barriers are located on the creek (Golder and ANL 2007). The surveys for barriers were timed to coincide with both low flows and the upstream migration period of char. To prepare for future remedial works, global positioning system (GPS) coordinates were obtained for each problem location, and each problem location was rated according to level of adult char upstream impassibility. Field technicians assigned ratings (1 to 3) to all problem locations based on their knowledge of observations of mortalities and fish passage made in 2012 (Golder 2013) and 2014 (Table 7.2-1), where higher rankings represent higher risks for fish strandings and barriers.

Table 7.2-1. Characterization of Barriers and Problem Locations for Fish Passage

	Ranking of Expected Risk of Mortality and Failed Migration (Higher Rank = Higher Risk)	
Types of Barriers	**Average Flows**	**Below Average Flows**
Small-scale partial barrier	Rank 1	Rank 2
Large-scale partial barrier	Rank 2	Rank 3
Small-scale full barrier	Rank 3	Rank 3
Large-scale partial blockage with complete barriers present	Rank 3	Rank 3

The integrity of previously completed low-flow channels was also visually assessed and photographed during low discharge conditions (July 18, 2014, and again on July 22, 2015). Supporting information on channel width, velocity and depth within the assumed thalweg (deepest area of channel) was collected every 2 m for the length of each project. Mean values and standard deviations of channel characteristics are reported.

The highest risk locations (rank 3) were those where fish stranding and partial barriers to movement may be common during average-to below average conditions through most of the upstream migration period. These locations were characterized by dispersed flows and boulder fields at the reach-level, impeding upstream movements and may directly expose fish to terrestrial predators, such as gulls. Higher-risk locations were also characterized by significant barriers to movement during average to below-average flow conditions during the later stages of migration. Rank 2 locations were those that may be difficult for fish to pass during peak periods of migration under below average flow conditions and may also present a high potential for stranding and partial blockage of movements during the later stages of migration when water levels decline (even during average years). Rank 1 locations were those that are likely passable through most of the upstream migration period during average flow conditions, but present the potential for stranding and stressful conditions during below-average flow conditions and towards the later stages of migration when water levels decline in summer.

7.2.3.3 Hingittok Lake Bathymetry

Bathymetry at Hingittok Lake was determined while gill nets were in place as part of the lake fish inventory. Bathymetry transects were completed from July 8 to July 11, 2014 using a Garmin GPSMAP 298 sounder (Garmin, Olathe, KS) coupled with a GPS. Transect layout consisted of longitudinal transects in a north/south orientation along the lake, bisected by lateral transects across the width of the lake. Longitudinal and lateral transects were approximately equally spaced to provide as much coverage of the lake as possible. Data were stored in the boat-mounted sonar with a GPS enabled and downloaded onto a computer as 'gpx' file. Bathymetry data (i.e., depth and GPS position) were then transcribed onto a 1-m bathymetric contour map using the ArcGIS 'topo to raster' tool (ArcMapTM v9.3.1, 2009). Erroneous points were screened out by eliminating any unrealistic depths with the visual aid of georeferenced aerial imagery provided by Google Earth.

7.3 RESULTS

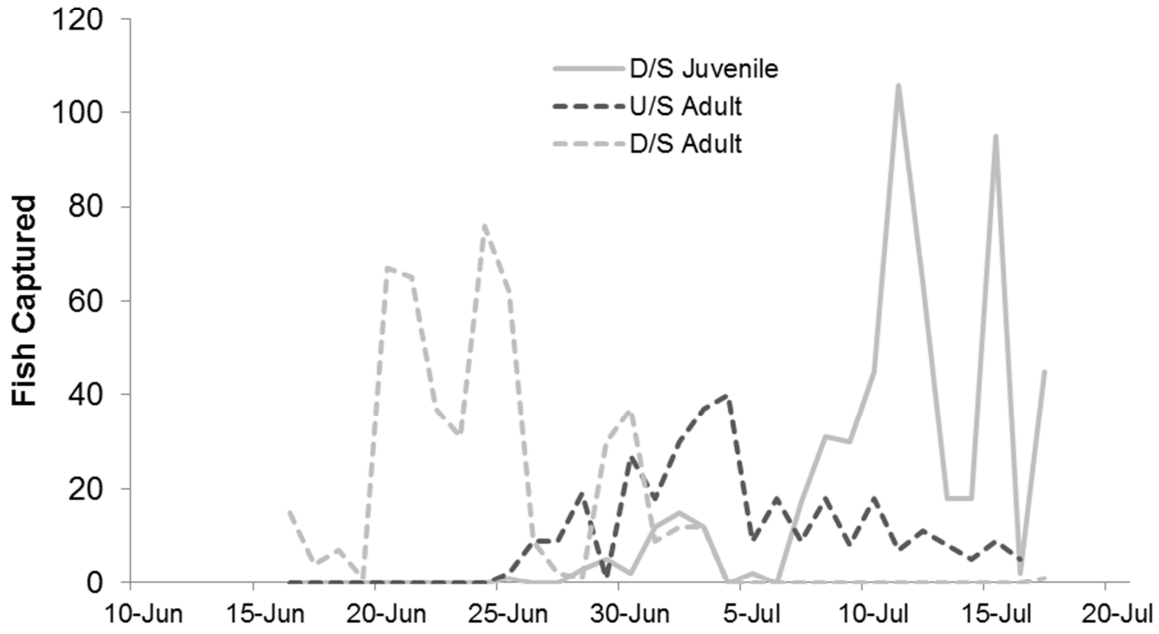
7.3.1 Fish Capture and Sampling

7.3.1.1 Nulahugyuk Creek

The fyke net was in place for a total of 35 days, 16 hours and 17 minutes beginning the evening of June 12, 2014 (18:15) and ending July 17, 2014 (10:32). In total, 1,332 Arctic Char were captured from Nulahugyuk Creek with the first char captured moving downstream on June 16 (Figure 7.3-1). Three distinct groups of migratory char were described including adults moving downstream after overwintering in Hingittok Lake (n = 478), adults moving upstream (n = 332) to overwinter and potentially spawning first, and juveniles moving downstream from Hingittok Lake (n = 522). Downstream movement by adults was documented from the first day of the program and was largely completed by July 4 (Figure 7.3-1). Upstream movement attempts by adults began on June 25 and continued through to the completion of the field study. Downstream movement by juveniles began on June 25 and also continued to the completion of the field study. Migration successes were quantified for adult Arctic Char migrating upstream from the ocean to Hingittok Lake (see below – Upstream Passage).

Arctic Char catch-per-unit-effort (CPUE) for the upstream fyke net was 0.39 fish/hour, while CPUE for the downstream fyke net was 1.17 fish/hour. The combined CPUE for upstream and downstream fyke nets was 1.56 fish per hour. Three Ninespine Stickleback were also captured but not included in CPUE calculations. Maximum daily upstream CPUE for adults was 1.17 fish/hour on July 4, 2014; whereas maximum downstream CPUE for adults was 3.17 fish/hour on June 24, 2014; and maximum daily juvenile CPUE (migrating downstream) was 4.42 fish/hour on July 11, 2014.

Arctic Char length and weight measurements and condition factor for the three migratory groups and one immature individual are summarized and described in Table 7.3-1 and Figure 7.3-2 (not every individual was measured). The largest captured Arctic Char was 887 mm in length with a weight of 6,645 g. Adult char moving upstream had the highest average condition factor (± standard deviation [SD]) of the three migratory groups (K_{us} = 1.09 [± 0.1]); whereas, downstream-moving juveniles had lowest average condition factor (K_{juv} = 0.81 [± 0.1]). Adult char moving downstream had an average condition factor of 0.84 (± 0.1). Adult char moving downstream from Hingittok Lake were approximately 27% lighter in weight than char moving upstream from the ocean. It was noted by the field crew that although none appeared obviously ripe for spawning, many char moving upstream were developing spawning colours had better condition (visual judgment of weight to length ratio) than adults moving downstream.



Note: D/S = downstream travelling fish and U/S = upstream travelling fish

Figure 7.3-1. Daily Captures of Migratory Arctic Char in Nulahugyuk Creek, 2014

Table 7.3-1. Summary of Arctic Char by Size Class Captured in Fyke Nets in Nulahugyuk Creek, June 12 to July 17, 2014

Migratory Group	Number of Char	Length Range (mm)	Mean Length (mm) ± SD	Weight Range (g)	Mean Weight (g) ± SD	Mean Condition Factor ± SD
Adults moving upstream	329	602 to 887	728.8 ± 53.9 (n = 328)	2,250 to 7,545	4,271.2 ± 991.3 (n = 329)	1.09 ± 0.1
Adults moving downstream	476	509 to 859	717.0 ± 54.3 (n = 475)	1,545 to 5,080	3,134.6 ± 747.6 (n = 473)	0.84 ± 0.1
Immature fish moving downstream	1	305	-	243	-	0.86
Juveniles moving downstream	521	145 to 261	192.5 ± 19.1 (n = 347)	25 to 140	60.3 ± 18.2 (n = 313)	0.81 ± 0.1

Note: mm = millimetres; ± = plus or minus; SD = standard deviation; g = grams; n = number of fish; - = no data

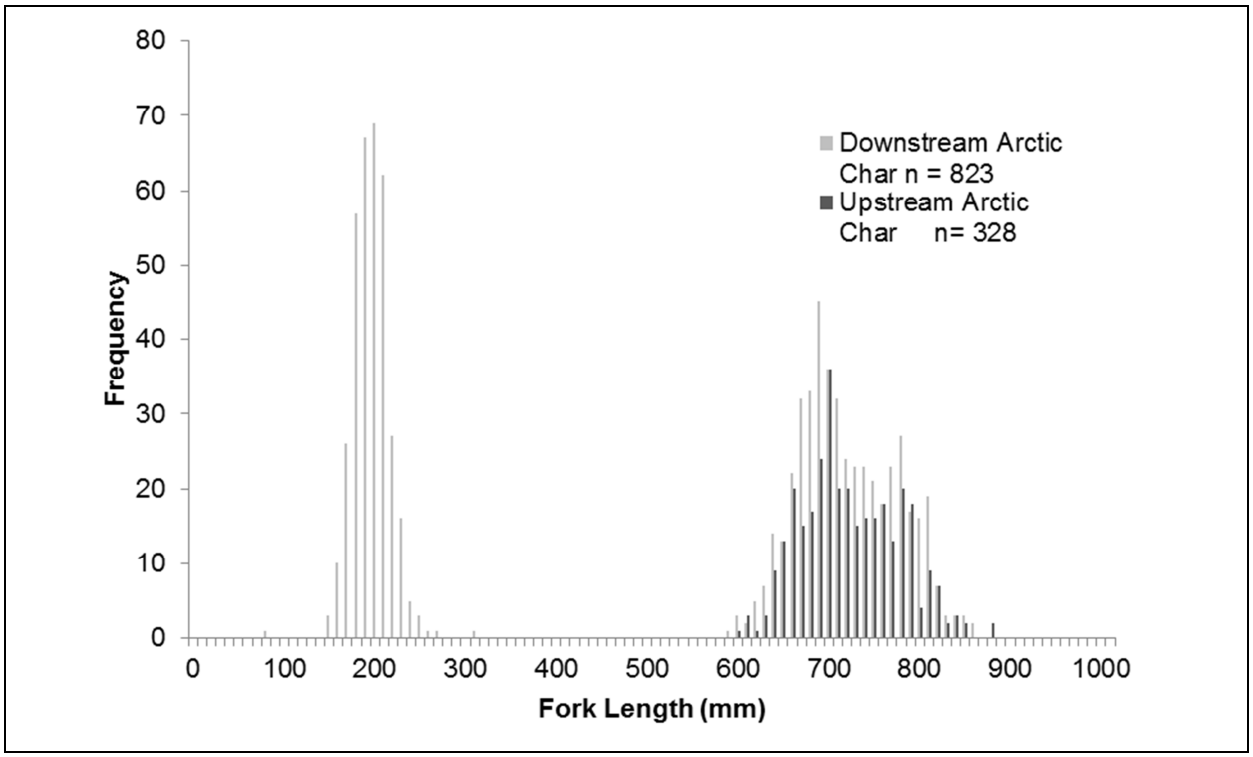


Figure 7.3-2. Length-Frequency Distribution of Arctic Char Captured in the Fyke Net Trap

7.3.1.2 Hingittok Lake

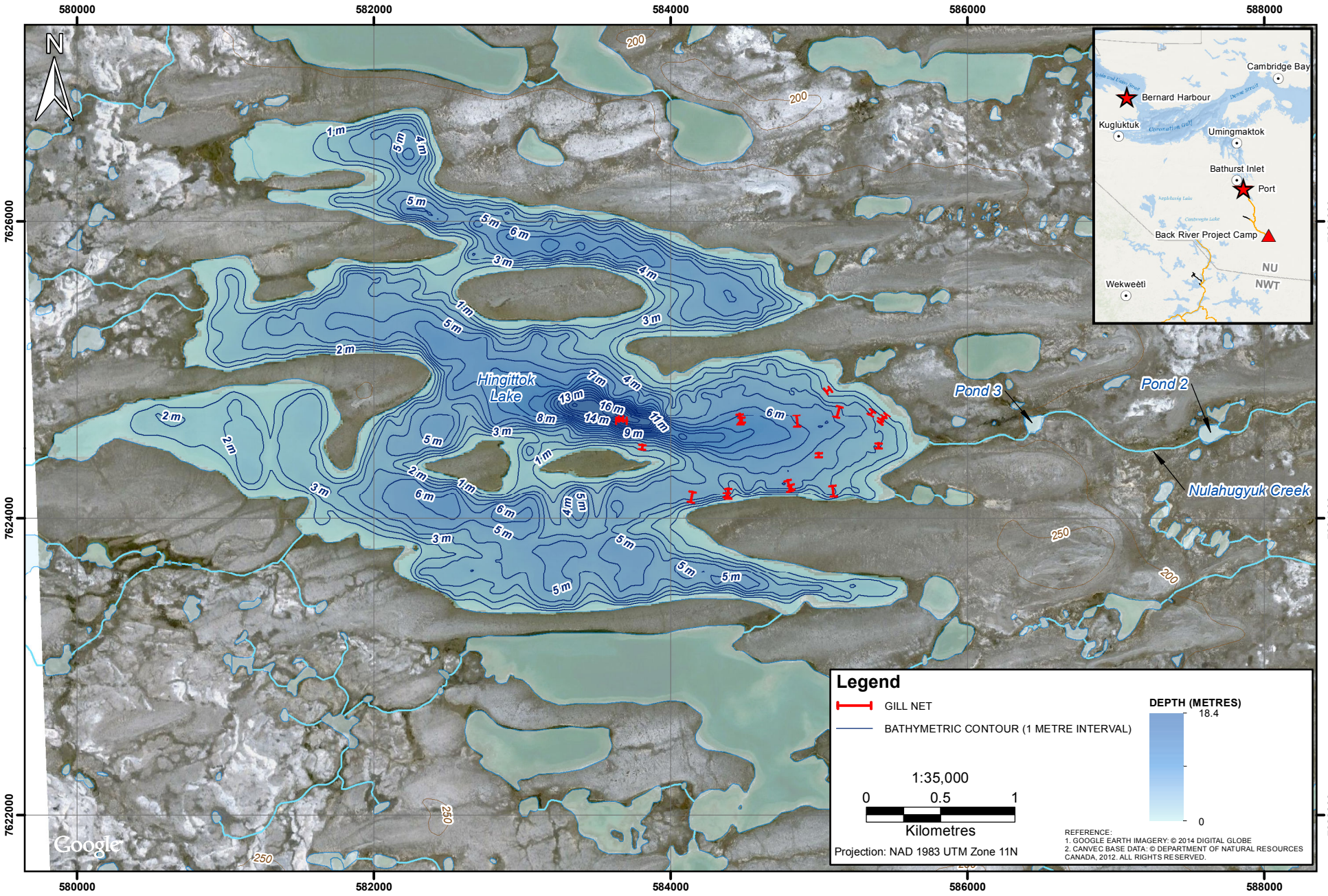
Twenty-nine short-duration gill net sets were deployed for a total of approximately 65 hours in Hingittok Lake in 2014 (Figure 7.3-3). Gill netting efforts in Hingittok Lake captured a total of 54 fish including 36 Lake Trout (*Salvelinus namaycush*), 10 Arctic Char, 7 Cisco (*Coregonus artedi*), and 1 Ninespine Stickleback (*Pungitius pungitius*). Of the 10 char captured, 7 were adults and 3 were juveniles. Mean CPUE for large mesh nets was 2.16 fish/h/100 m; approximately twice that of small mesh nets which was 1.07 fish/h/100 m. It is noteworthy that two of the captured char were PIT tagged earlier in the season in 2014.

A total of 2.5 hours, mid to late afternoon, was spent angling by two crew members in the lake, resulting in the capture of eight Lake Trout (CPUE of 1.5 fish/angler hour). Overall, Lake Trout was the dominant species captured from Hingittok Lake (based on gill netting and angling combined), contributing 71% to the total catch (Figure 7.3-4).

7.3.2 Upstream Passage

In total, 315 upstream migrating adult char were implanted with PIT tags with unique identification numbers. Selected Arctic Char for PIT tag monitoring were a representative sample of the population moving upstream, and characterized by an average length (± SD) of 726.8 (± 52.4) mm, weight of 4229.8 (± 949.8) g and condition factor or 1.09 (± 0.1).

A high degree of detectability was obtained at most antennae-reader arrays (Table 7.3-2). The only exception was MUSA which suffered from a series of technical issues including a malfunctioning battery from July 8 to July 9, and suboptimal tuning prior to July 11, resulting in reduced detectability.



Sabina Gold & Silver Corp.

Figure 7.3-3

HINGITTOK LAKE FISH BASELINE MONITORING, BERNARD HARBOUR, 2014

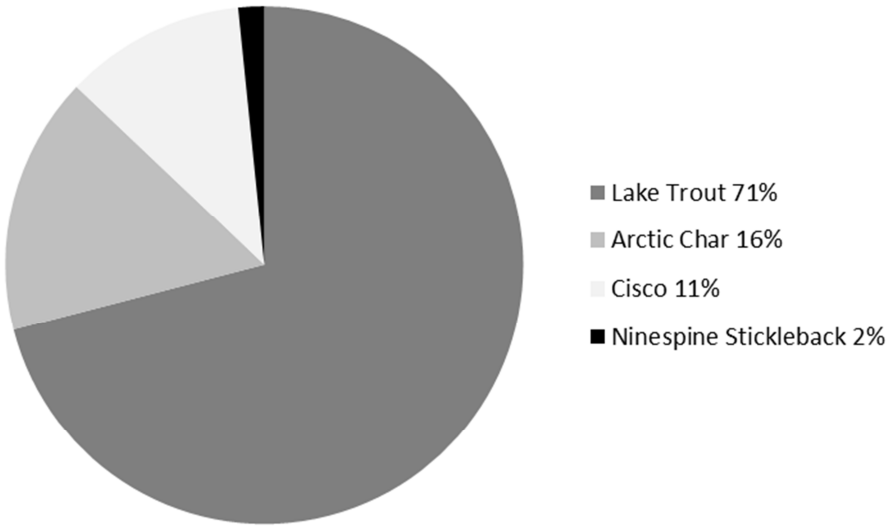


Figure 7.3-4. Fish Species Composition in Hingittok Lake, 2014

Of the 315 tagged Arctic Char, 103 were detected at the ULOA indicating the completion of a successful upstream movement from the sea. Adjusted for array detectability, this equated to 110 tagged fish, or a success rate of 34.9% between June 25 and July 17, 2014 (Table 7.3-2). Although migratory success was relatively high early on in the study (93%), it declined rapidly over time with none of the fish tagged after July 6 detected at the ULOA (Figure 7.3-5). This indicates that a threshold was reached and stream conditions became impassable for char after this date. Any remaining fish either perished, likely from exhaustion, predation, or stranding, or remained in the ponds located in the middle and upper reaches of the creek. Twelve tagged char were incidentally confirmed as mortalities while field crews were working along the creek in July 2014; half of the mortalities were observed after July 6.

Table 7.3-2. Location of Radio Frequency Identification (RFID) Arrays and Detection Information

Array	Approximate Distance Upstream from Bernard Harbour (km)	Detection Probability	Detected Total	Corrected Total
Two-way fyke net (TWFN)	0.30	1.00	315	315
Lower Downstream Array (LDSA)	0.75	0.90	263	293
Lower Upstream Array 1 (LUSA1)	1.14	0.93	261	280
Lower Upstream Array 2 (LUSA2)	1.16	0.91	255	279
Middle Downstream Array 1 (MDSA1)	2.73	0.97	205	212
Middle Downstream Array 2 (MDSA2)	2.75	0.96	202	211
Middle Upstream Array (MUSA)	3.15	0.59	94	158
Upper Lake Outlet Array (ULOA)	9.43	0.93	103	110

For those fish recorded as being successful migrants to Hingittok Lake, migration time between the farthest downstream array and the farthest upstream array (distance of 8.68 km) varied among individuals and throughout the study period with a mean migration time (± standard error) of 108.3 h (± 4.7). The fastest fish completed the migration in 34.2 h, and the slowest in 239.0 h. The migration time was generally faster from June 25 to June 30 (79.3 h [± 5.4]) than from June 30 to July 6 (123 h [± 5.8]).

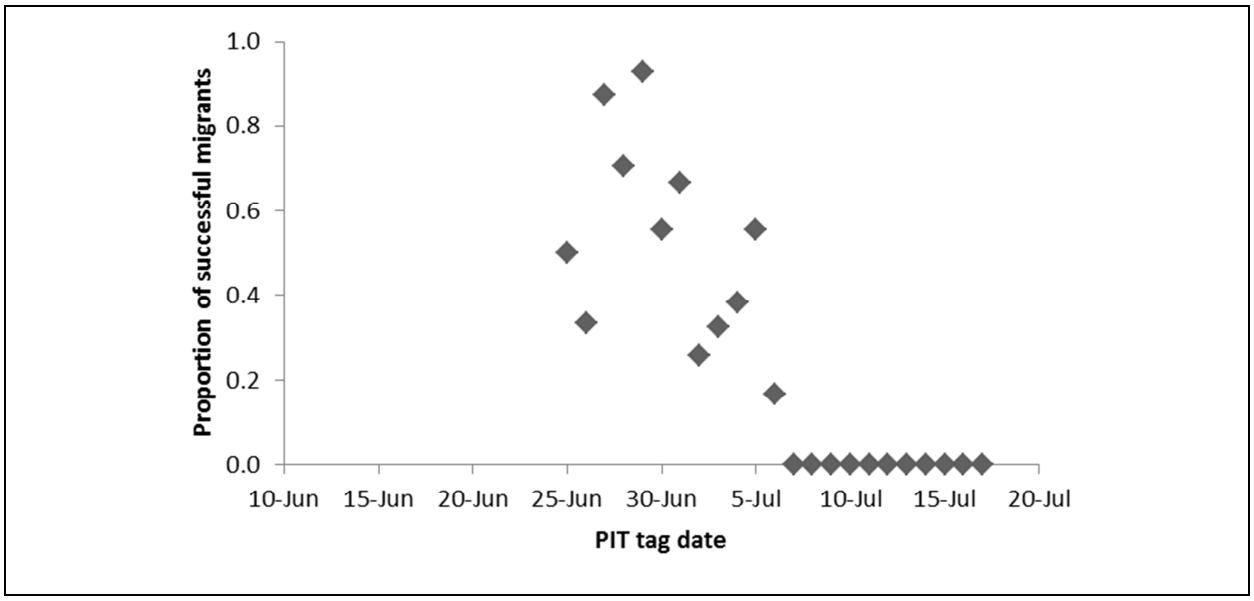


Figure 7.3-5. Proportion of Successful Migrants Detected at ULOA Plotted Against Passive Integrated Transponder (PIT) Tag Implantation Date

7.3.2.1 Migration Success Model

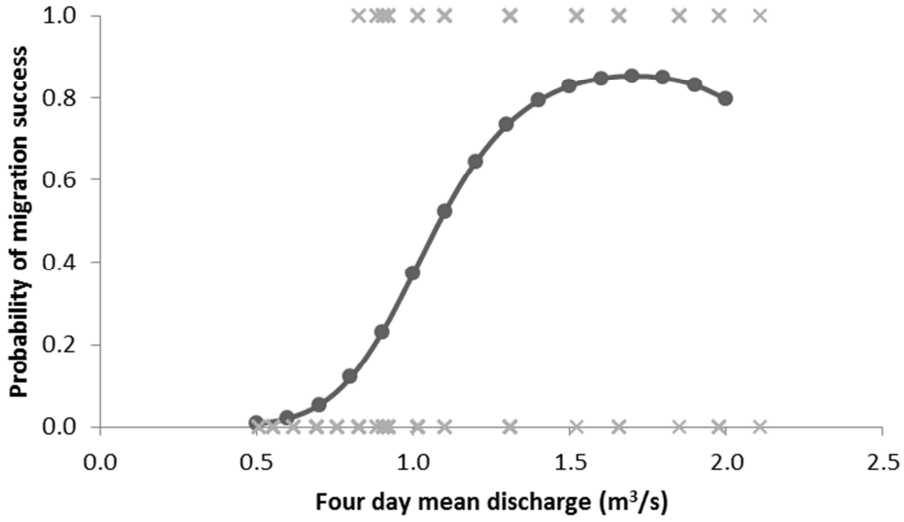
The number of Arctic Char observed among the RFID arrays declined sequentially as the fish moved upstream. Prior to July 6, a considerable reduction in detected char occurred over a 0.35 km reach between MDSA2 (2.75 km) and MUSA (3.15 km) with a 24% reduction in individuals occurring in this area. After July 6, a 50% reduction in the number of char detected occurred over a 1.57 km reach between LUDS2 (1.16 km) and MDSA1 (2.73 km), with no fish detected after MUSA (>3.15 km).

Using a binary logistic regression, the primary factors influencing migratory success were determined to be four day mean discharge and char weight (Table 7.3-3). Model fit was significant ($p < 0.001$) with an ROC value of 0.84. The output of the formula (when fish weight is held constant at 4.2 kg) is presented graphically in Figure 7.3-6. With respect to the four-day mean discharge, the probability of migration success ranged from a high of 85% at greater than 1.5 m^3/s, declining to a low of 0% at 0.5 m^3/s and lower discharge values. Regarding fish weight, the probability of migratory success ranged from a high of 95% for fish that weigh 2.5 kg to a low of 31% in fish that weigh 7.5 kg when discharge was held constant at 1.76 m^3/s.

Table 7.3-3. Parameter Estimates for Binary Logistic Model Predicting Migration Success

Parameter	Estimate	Standard Error	Z	p-Value	95% Confidence Interval Lower	95% Confidence Interval Upper
Constant	-8.398	2.417	-3.48	0.001	-13.134	-3.661
Four day mean discharge	15.714	4.134	3.8	<0.001	7.612	23.815
Four day mean discharge (squared)	-4.612	1.643	-2.81	0.005	-7.831	-1.392
Weight	-0.77	0.192	-4.02	<0.001	-1.146	-0.395

Note: Z = statistical score; p-Value = probability value; % = percent; < = less than; kg = kilograms.



Note: X symbols represent whether individual fish succeeded in migrating to ULOA (1) or not (0).

Figure 7.3-6. Results of Binary Logistic Regression Plotting the Probability of Migration Success Against Stream Discharge, Holding Arctic Char Body Weight Constant at 4.2 kg

7.3.3 Fish Habitat

7.3.3.1 Nulahugyuk Creek

From the confluence with the sea, Nulahugyuk Creek transitions from faster moving riffles to run and pool habitats near Hingittok Lake. Approximately 82% of the lower section of the creek to the first pond was quantified as riffle habitat in July 2014 (Plate 7.3-1). The creek then transitions from riffle (44%) to run (53%) habitats in the middle section of the creek between the first and second ponds. It is largely shallow run habitat (90% or more) from the second pond to the outlet of Hingittok Lake.

Substrate was predominantly cobble (60% or more) and boulder (approximately 5 to 19%) and gravel (approximately 5 to 13%) with small amounts of sand and silt typically occurring in pool habitats. The maximum depth in the creek (excluding the three ponds on the creek) was less than 0.75 m.

In general the habitat characteristics of flowing sections of the creek indicate little cover for large fish with only small patches of intermittent (or discontinuous) cover provided by large boulders and undercut banks, and associated small pools. Where this habitat was provided (e.g., Plate 7.3-1), Arctic Char were often incidentally observed holding.

Potential barriers to fish passage were identified at 13 sites in total (Table 7.3-4). These locations were characterized as difficult for adult Arctic Char to migrate upstream because of boulder barriers, 'broken' thalwegs and lack of water depth, resulting in possible strandings and mortalities (for example, see Plates 7.3-2a, 7.3-2b, 7.3-3a, and 7.3-3b). The problem sites are where low-flow-channel (enhancement) projects may benefit production of Arctic Char (Table 7.3-4). Three sites were identified as the highest the priority for site remediation, as a rank 3, followed by five rank 2 locations, and five rank 1 locations where remediation efforts are needed. Five of the problem sites were identified within a sharp bend in the lower section of the creek, starting 1.3 km from the mouth of Nulahugyuk Creek and for an upstream distance of approximately 800 m. Many strandings and mortalities were incidentally observed along this section during 2012 and 2014. Furthermore, most of

the problem sites where remediation work is proposed (approximately 77%) are within the lower 3 km of the creek, which is consistent with previous habitat assessments of the creek (Golder and ANL 2007).

Plate 7.3-1. Riffle habitat with small pool provided near bank (left), looking upstream, approximately 1.3 from mouth of Nulahugyuk Creek, July 16, 2014.

Table 7.3-4. Summary of Potential Locations for Fish Passage Enhancement Projects

Site Identification	Approximate Distance Upstream of Bernard Harbour (km)	Ranking Based on Expected Risk of Mortality and Blockage (Higher Ranking = Higher Risk)	Minimum Required Low-Flow Channel Length to Improve Passage (m)
Site 1*	1.3	Rank 3	41
Site 2	1.5	Rank 2	42**
Site 3	1.6	Rank 2	34***
Site 4	2.0	Rank 2	30
Site 5	2.1	Rank 3	22
Site 6	2.4	Rank 3	45
Site 7	2.9	Rank 2	14
Site 8	4.8	Rank 1	20
Site 9	5.7	Rank 1	40
Site 10	7.8	Rank 1	15
Site 11****	2.6	Rank 1	38
Site 12****	2.8	Rank 1	19
Site 13****	3.0	Rank 1	15

Note: km = kilometres; m = metre; extended rock weirs are recommended for most sites, for example, to direct migrating fish upstream through the low-flow channel.
** The site was initially described as two separate problem locations in 2014 but was later characterized in 2015 as one problem site requiring an extended low-flow channel (versus two separate consecutive channels); ** two parallel low-flow channels recommended (length represents combined length of parallel channels);*** requires further evaluation; a directional weir may be a viable alternative for this location; and **** problem sites identified in 2015.*

Plate 7.3-2a. Looking upstream towards barriers at Site 5, July 16, 2014.

Plate 7.3-2b. Looking downstream towards barriers at Site 5, July 16, 2014.

Plate 7.3-3a. Looking upstream towards barriers at Site 6, July 16, 2014.

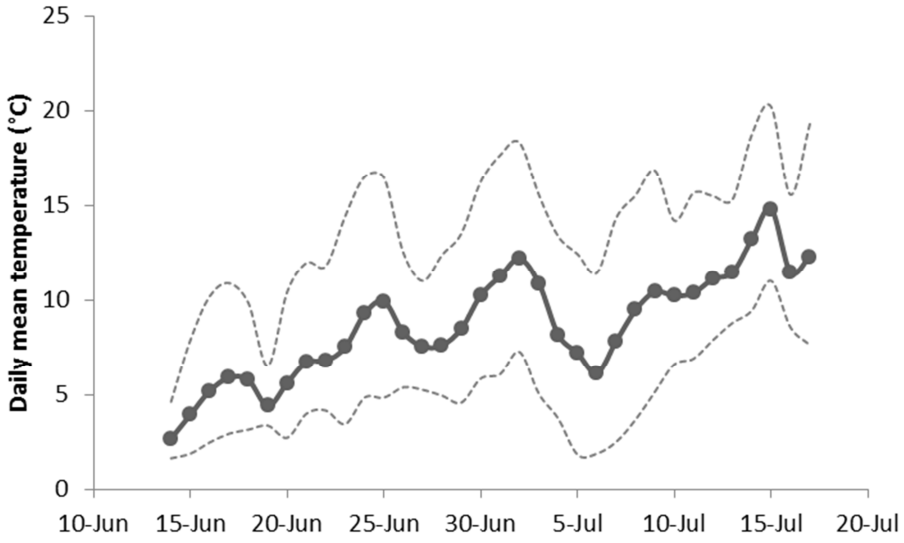
Plate 7.3-3b. Looking downstream towards barriers at Site 6, July 16, 2014.

Water Temperature and Flows

The water temperatures in 2014 in Nulahugyuk Creek increased steadily as the season progressed with mean daily temperatures rising from 2.7°C on June 14 to 12.3°C on July 17 (Figure 7.3-7). The warmest temperatures occurred during the latter half of the study period exceeding 17°C at the downstream site (BH2) for 24.3 hours. Diurnal variation in water temperature was evident with a mean difference of 8.8°C between daily minimum and maximum values. A temperature gradient was also observed between the upstream and downstream sites (BH2 and BH7; Figure 7.1-1) with a consistent mean difference of 2.4°C across the sampling period, indicating a rate of change of 0.3°C/km in downstream direction.

In 2014, creek discharge declined over the study period ranging from a high of 6.0 cubic metres per second (m^3/s) on June 15 to a low of 0.5 m^3/s on July 15 (Figure 7.3-8). Discharge was also low on July 22, 2015 (0.4 m^3/s). A 5.5 m^3/s decline in discharge corresponded to a 29 cm decrease in water depth over the 2014 study period, based on the following relationship between the gauge water level and creek discharge:

$$water\ level\ (cm) = 56.012 + \left(5.2795 \times creek\ dischage\ (m^3/s)\right), \qquad R^2 = 0.97.$$



Note: Maximum and Minimum Daily Values Indicated by Upper and Lower Dotted Lines Respectively.

Figure 7.3-7. Daily Mean Temperature (°C) Recorded at Nulahugyuk Creek from June 10, 2014 to July 17, 2014

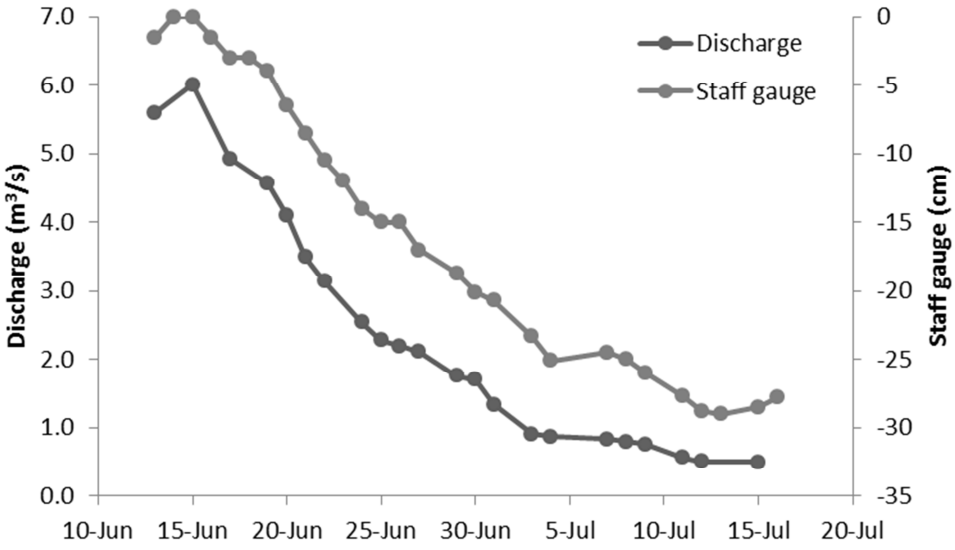


Figure 7.3-8. Stream Discharge (m^3/s) and Staff Gauge Depth (cm) Recorded at Nulahugyuk Creek Between June 13, 2014 and July 15, 2014

7.3.3.2 Hingittok Lake

Based on 1:50,000 CanVec data, Hingittok Lake is 982.3 ha in area and features numerous peninsulas and bays around three large islands in the centre of the lake (Figure 7.3-3). Shoreline length (38,085 m including island shorelines) was extensive relative to the size of the lake and the shoreline development factor (the ratio of a lake's perimeter to surface area that provides a measure of irregularity of shoreline) was approximately 12.3. The higher the ratio, the more irregular the shoreline

is, and thus, more shoreline habitat is potentially available (a perfect circle would have a shoreline development factor of 1). The bathymetry data derived a lake volume of approximately 30,553,000 m^3 (Table 7.3-5). The maximum depth was approximately 18 m and mean depth was 3.7 m.

Table 7.3-5. Approximate Lake Area and Volume for Various Depth Intervals in Hingittok Lake, July 10 to 14, 2014

Depth (m)	Volume (m^3)	Area (ha)	Depth (m)	Volume (m^3)	Area (ha)
>0	30,553,274	982.3	>10	553,638	14.7
>2	15,767,454	607.7	>12	308,168	10.2
>4	6,214,620	352.4	>14	138,401	6.9
>6	2,002,020	95.6	>16	32,068	3.7
>8	964,592	28.9	>18	335	0.2

Note: m = metres; m^3 = cubic metres, ha = hectares; > = greater than.

7.4 REMEDIATION PLAN

7.4.1 Low-Flow Channels

Existing habitat and fish passage conditions in Nuluhugyuk Creek are poor, a combination of boulder fields and dispersed flows are preventing many char from accessing spawning locations in Hingittok Lake, as confirmed by local knowledge (Golder and ANL 2007; Appendix V3-3D of the FEIS) and by the previously collected fisheries data at Bernard Harbour (Golder 2013; including 2014 baseline data reported in this plan). Thus, the goal of remediation is to improve passage for fish migration in Nulahugyuk Creek by removing boulder barriers in the creek and by increasing water levels within specified paths or movement corridors within the channel. 'Soft' engineering methods (without the use of heavy machinery) will be deployed. Upon remediation of fish passage conditions, benefits to the local fishery are predicted through increased adult survival and increased fecundity (See Section 7.5).

The methods will follow those successfully developed by the Kugluktuk HTO and Golder in 2012 (Golder 2013; see Plate 7.4-1), which are based on local knowledge of traditional fishing activities at Bernard Harbour (Golder and ANL 2007; Golder 2013; Appendix V3-3D of the FEIS). Specifically, the methods will include the construction of low-flow channels and the use of directional rock weirs at problem locations in Nulahugyuk Creek; where a low-flow channel is characterized by a manipulation of flows and substrates such that there is an unobstructed flow path with sufficient depths (greater than approximately 20 cm) within the larger channel for fish passage. All small boulders will be relocated to form the low-flow channel within the area of the assumed thalweg of the problem sections of the creek. Where needed, weirs above the low-flow channel will be constructed to direct and augment flows through the channel and weirs below the low-flow channel may also be created to direct Arctic Char migrating upstream, such that fish avoid adjacent shallow boulder gardens where stranding may occur (Plate 7.4-2). It is expected that each problem location will be remediated by a field crew of approximately five people and one supervisor (Golder 2013). This cost-effective method can increase water levels by up to 102% (or up to 10 cm) during the latter part of the upstream migration period when water levels are in decline (Golder 2013).

Field personnel are expected to be provided by the Kugluktuk HTO, who will be a partner in completing the remediation work, as well as future monitoring and maintenance of the low-flow channels. The accessibility of Bernard Harbour, which can be reached by a four hour boat ride from Kugluktuk during open water conditions, provides a logistical advantage over less accessible options in the Canadian Arctic. Furthermore, local enthusiasm for the Project is well documented, and the many residents in

Kugluktuk who still maintain a camp at Bernard for hunting and fish will be engaged while there are opportunities through the life of the offsetting option. The integration of local and traditional knowledge will continue during subsequent field programs, workshops, and meetings.

Plate 7.4-1. A Low-Flow Channel Previously Created in 2012 ('Project 2'), Looking Upstream, July 18, 2014.

Plate 7.4-2. Directional Weir (Kugluktuk HTO Students in Background) for Migrating Arctic Char in Nulahugyuk Creek, June 24, 2015.

7.4.2 Benefits to Fisheries Productivity

To estimate the potential increases in fisheries production (as a surrogate of fisheries productivity) following the remediation of Nulahugyuk Creek, the effects of the low-flow channels on migration success was estimated and then related to changes in the number and biomass of adult Arctic Char in in Nulahugyuk Creek and Hingittok Lake. The effects of remediation on migration success was estimated using hydrologic data collected in 2012 and 2014, combined with the migration success results from 2014. Using the same dataset, a water level target in the low-flow channels that maximizes the migration success was also identified.

7.4.2.1 Predicted Changes in Migration Success

An understanding of flow conditions that determine water levels at the low-flow channel locations is needed as part of predicting changes in migration success. Using the pre-manipulation depths of the pilot projects in 2012, which was, on average, 12.5 cm when discharge was approximately 0.4 m^3/s (Golder 2013), and the relationship between stream discharge and stream depth at the staff gauge presented in Section 6.3.3.1, a 12.5 cm depth equates to a level of 58.1 cm at the staff gauge. Furthermore, creating an increase in depth from 12.5 cm to 22.5 cm with the construction of a low-flow channel would be equivalent to an increase in water levels from 58.1 to 68.1 cm at the staff gauge, assuming the wetted width of the creek at the staff gauge location was equal to or less than the wetted width at the location of the low-flow channel projects. This increase in depth to 68.1 cm at the staff gauge would be equivalent to a stream discharge of 2.3 m^3/s, based on the relationship between gauge water level and creek discharge presented above (Section 7.3.3.1).

With an understanding of how changes in water levels at the low-flow channel locations (prior to remediation) relate to flows in the creek, changes in the probability of migration success were estimated using the logistic equation provided in Section 7.3.2.1. For example, when discharge is 0.4 m^3/s, the probability of migration success prior to remediation is predicted to be very low (0.002), whereas when discharges is 2.3 m^3/s, the probability of migration success is maximized (0.85), assuming fish weight is held constant at 4.2 kg. As a consequence, a 10 cm increase in depth at the selected problem locations would equate to an increase in the probability of migration success from 0.002 to 0.850 during low-flow periods of the upstream migration, once remediation activities are completed.

Based on the logistic equation, Arctic Char reached the greatest probability of migration success when discharge reached 1.6 m^3/s or greater (See Figure 7.3-6). This equates to a staff gauge level of 64.5 cm, 6.4 cm greater than the depth initially observed at the enhancement location. This would suggest an 'optimal' channel depth of greater than 19 cm to maximize the migration success for an Arctic Char of average size, and confirms that the methods deployed in 2012 can improve fish passage. Indeed, a behavioral response of Arctic Char to increased flows was noted in Golder (2013). Field crews observed successful upstream movements of adult char shortly after the completion of the low-flow channels in 2012 (within 1 h of completion), suggesting lack of depth was a limiting factor to upstream movements.

7.4.2.2 Predicted Changes in Fish Biomass

Changes in fish abundance and biomass for the Arctic Char run in Nulahugyuk Creek and Arctic Char arriving in Hingittok Lake were predicted using baseline data on the 2014 upstream migration applied to a simplified 'population' model. Assuming that 2014 represents an 'average' or 'below-average' year for the Arctic Char run, the increase in the number of fish in Hingittok Lake following site remediation was based on the difference between the product of the probability of migration success offsetting year 0 (0.349) multiplied by the size of the 2014 run (332), which equals 116 fish, and the product of the probability of migration success post-remediation (0.85) multiplied by the expected size of the run (332), which equals 282 fish. Thus, the predicted increases are approximately 166 char or

697 kg of char (using a mean weight of 4.2 kg) arriving at Hingittok Lake to spawn for year 1 post-remediation (Figure 7.4-1).

By year 3 post-remediation it is expected that the size of the run at Bernard Harbour would be larger than years 1 and 2 post-remediation, potentially comprising an additional 72 Arctic Char that would have otherwise perished during offsetting year 1 without remediation (so 415 char in total). This prediction assumes that sexually mature Arctic Char spawn every second year (e.g., Babaluk et al. 1998), and that the average return rate is 50% (Klemetsen et al. 2003).

By year 8 post-remediation, the run size may more than double in size when offspring of the adults arriving to Hingittok Lake during year 1 post-remediation return to Bernard Harbour; where the predicted increase assumes consistent fecundity and juvenile survival rates over time (e.g., by year 9 two offspring return from each 'added' adult) and that mature char in Nulahugyuk Creek are age 8 or older (Golder, unpublished data). Thus, by approximately offsetting year 9, there may be over 747 Arctic Char (or 3,137 kg) in the run at Nulahugyuk Creek, and 635 Arctic Char (or 2,667 kg) successfully arriving in Hingittok Lake each year (Figure 7.4-1).

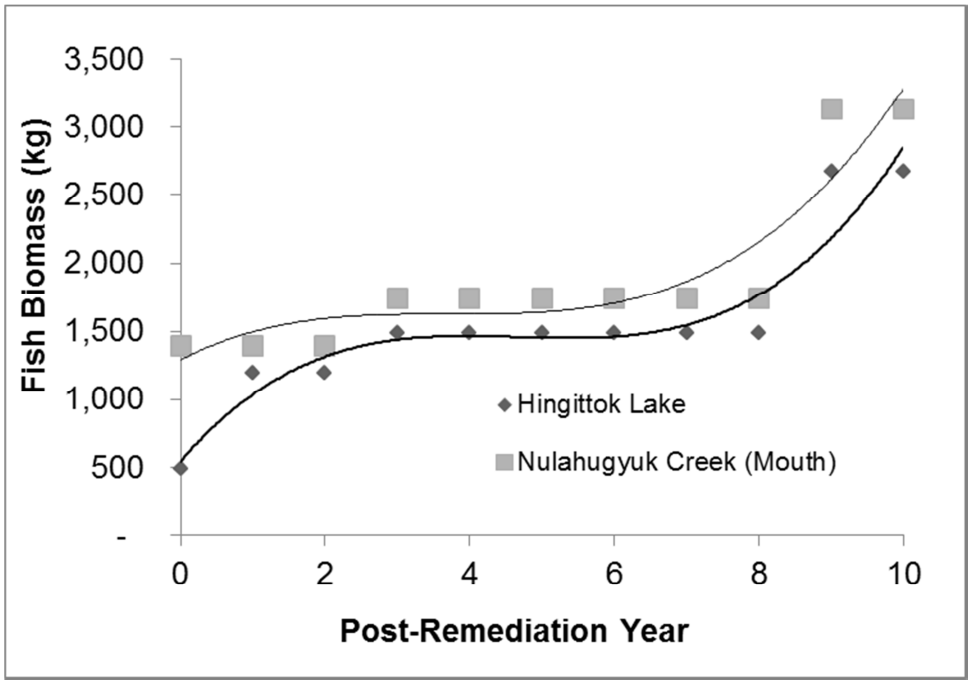


Figure 7.4-1. Post-Remediation Predictions for Fish Biomass in Nulahugyuk Creek and Hingittok Lake (Bernard Harbour)

It is important to note that the actual increases in fish abundance and biomass post-remediation will be greater if the 2014 baseline values for the average size of the Arctic Char run are greater than the selected model inputs. For the purposes of the offsetting plan, the modelled changes conservatively used the upstream migration abundance data, versus the downstream migration abundance data, as an approach to reduce uncertainty in predictions. The abundance data for the downstream migration of adult Arctic Char, which would reflect the upstream migration in 2013, was approximately 1.4-times higher than the upstream migration in 2014 (478 adults captured downstream versus 332 adults capturing upstream in 2014).

7.4.2.3 Offsetting Accounting

The potential losses and gains in fisheries productivity were projected across time using fish production as a surrogate measure of fisheries productivity (Randall et al. 2013). Fish production provided a transferable unit for the calculation of both losses at the Goose Property Area and gains at Bernard Harbour.

Serious harm to fish (i.e., losses) will be incurred with the temporary drawdown of Llama and Umwelt Lakes, and the construction of related infrastructure, affecting Goose Lake tributary streams and ponds in the Goose and Wolf watersheds. The fish-out and subsequent drawdown of Llama and Umwelt lakes will result in a biomass loss of 661.2 kg in total for the Llama-Umwelt lake system (Section 6.4.1). With construction of the airstrip extension and Tailings Storage Facility, and subsequent reduction in downstream flows, the calculated biomass loss for Rascal Stream East, Goose Inflow South and other waterbodies in the Goose and Wolf watersheds will be 85.8 kg of fish biomass (Section 6.4.2). Thus, the total loss of biomass at the Goose Property Area during construction is predicted to be 747 kg. Annual losses associated with a hypothetical optimal harvest strategy were also considered (e.g., Hillborn and Stokes 2010), estimated to be 10% of total biomass for affected habitat. This was projected as additional losses across time as a conservative approach to the offsetting accounting as means to address any uncertainty in the predictions. In other words, it was assumed that when all residual serious harm to fish are realized during construction within the Goose Property Area, there is a loss of an additional 74.7 kg of biomass that would have otherwise been harvested without the Project development. For example, over a ten-year period, total cumulative losses include the initial 747 kg of biomass due to construction of infrastructure plus the hypothetical annual loss of 74.7 kg of surplus biomass that could be harvested in the nine years that follow, which all together is equivalent to 1,419 kg of biomass (Figure 7.4-2).

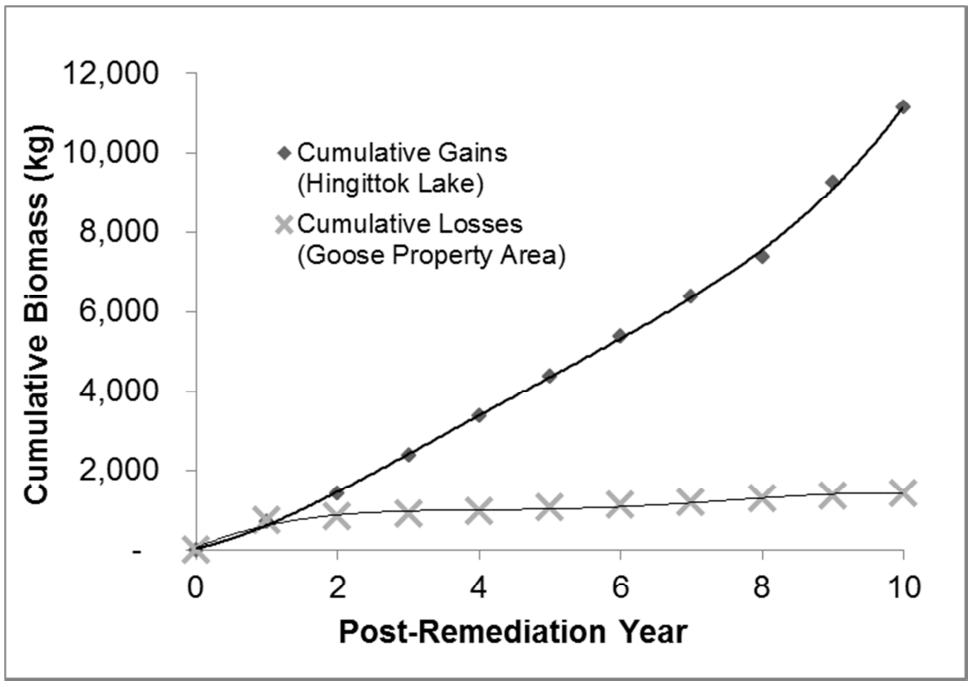


Figure 7.4-2. A Comparison of Predicted Cumulative Gains in Fish Production Versus Cumulative Losses Over Time

Substantial gains in fish productions are predicted at Bernard Harbour, which will counterbalance losses incurred at the Goose Property Area (Figure 7.4-2). Gains in biomass of Arctic Char are predicted to

range from almost 700 kg during year 1 and 2 post-remediation to over 1,880 kg by year 9 post-remediation. Over a ten-year period, the offsetting option may generate a total cumulative gain of 11,134 kg of Arctic Char, almost 8-times the predicted losses over the same period. Furthermore, predicted gains are expected to magnify over time until char abundance (e.g., juvenile densities) approach the carrying capacity of Hingittok Lake.

7.4.3 Schedule

The temporal scope of the proposed offsetting program at Bernard Harbour is 2014 to 2025 (Table 7.4-1). The proposed monitoring program is planned for a period of no more than 10 years post-enhancement and will include up to four sampling years of the Arctic Char run. This length of time and level of effort are expected to be adequate to demonstrate that the offsetting objectives have been achieved, where the goal of monitoring will be to demonstrate that fish production follows a projected trajectory of cumulative gains that will eventually exceed cumulative losses (Section 7.4.2.3).

Table 7.4-1. Overview of Activities in Support of the Conceptual Fish Offsetting Plan for the Back River Project (2014 to 2025)

Phase	Offsetting Year	Annual Activities / Deliverables
Baseline	2014	Monitor adult and juvenile migrations, and passage conditions DFO/community engagement
	2015	DFO/community engagement Follow-up field investigation of habitat conditions Conceptual Fish Offsetting Plan
Remedial Works	Summer 2016 (Year 0)	DFO/community engagement Construct habitat offsetting enhancements (pending authorization and practical arrangements)
	Fall 2016	Remediation report Final Fish Offsetting Plan
Evaluation	2017 (Year 1 or 2)*	Monitor adult and juvenile migrations, and passage conditions Annual Report
	2018 – 2019 (Year 2 – 3)	Sabina/Kugluktuk HTO inspection years; inspect each year and repair channels (as needed) Annual field summary memo
	2020 (Year 4)	Monitor adult and juvenile migrations, and assess passage conditions Annual Report
	2021 – 2024 (Year 5 – 8)	Sabina/Kugluktuk HTO inspection years; inspect each year and repair channels (as needed) Annual field summary memo
	2024 (Year 9)	Monitor adult and juvenile migrations, and assess passage conditions Annual Report Offsetting Project Synthesis Report DFO/community engagement
	2025 (Year 10)	Final monitoring program (as needed) Technical memo update to synthesis report

Npote: DFO = Fisheries and Oceans Canada; HTO = Hunters and Trappers Organization
** Schedule may shift if, for example, remediation efforts require additional efforts and extend beyond one open water season.*

Sabina would conduct annual field monitoring and maintenance, working with community members. Biological monitoring and reporting to DFO would occur in offsetting year 1, 4, 9, and 10 (as needed) of the monitoring period. However, it is important to note that this schedule assumes that complete remediation of the creek occurs within one open-water season, and that the schedule may shift if additional remedial works are required the following season.

7.5 EVALUATION MONITORING

Monitoring will include at least one year of baseline monitoring and up to four years of evaluation monitoring (years 1, 4, 9 and 10) over a period of 10 years. This length of time of the monitoring program and level of monitoring effort are expected to be adequate to demonstrate that the offsetting objectives have been achieved, where the goal of monitoring will be to demonstrate that fish production follows a projected trajectory of cumulative gains that will eventually exceed cumulative losses. Monitoring will also inform any required improvements to remediated habitats, or supplementary habitat enhancements.

Objectives of the fish and fish habitat monitoring will be similar to those outlined for the 2014 baseline monitoring study. Sampling methods will be consistent across years and phases of the offsetting plan to allow for a reliable assessment of gains. Monitoring will include biological and environmental components to provide a suite of measurement indicators under two primary objectives:

1) quantify the size and timing of the Arctic Char migrations (for the three migratory phases); and
2) assess improvements in environmental conditions for fish passage.

The primary objectives of fish habitat monitoring will be to evaluate the physical integrity and function of the remediated sections of the creek for fish passage under spring and summer conditions. Detailed habitat measurements will be collected concurrently with fish monitoring. Measurements will include depths, channels widths, composition of streambed substrate, and channel stability. Measurements will be collected at both remediated and non-remediated (reference) sections of the creek. Monitoring reports will be submitted to DFO by December 31 of any given year that monitoring is carried out.

Any signs of measurable accumulations of substrates within the low-flow channels will be measured in detail, and recommendations for actions taken to remediate areas affecting fish passage will be provided. It is not expected that Nulahugyuk Creek will be maintenance-free after the remediation, but annual inspections and light maintenance are expected to provide acceptable performance. For example, only minor shifts of two to three small boulders are expected in 20 to 40% of the low-flow channels each year based on the 2014 and 2015 habitat assessments at Bernard Harbour.

Sabina will conduct observational monitoring (e.g., inspections of signs of erosion, sedimentation) and address any minor maintenance problems, if needed, working with community members during Years 2, 3, 5, 6, 7, and 8. Activities will include qualitative visual assessments and photographs of the remediated sections of the creek. Inspection reports will be submitted to DFO by December 31 of any given year that observation monitoring is carried out.

7.6 CONTINGENCIES

Sabina will evaluate the success of the offsetting project after each year of monitoring to determine if the proposed offsetting project is performing to expectations within the specific timeframe of the project. At any point within the monitoring period, should it be determined that the performance of the project is not meeting expectations, either through channel design modifications not providing passage, insufficient flow conditions or lack of fish utilization, alternate channel design options or

additional habitat enhancements will be investigated and applied, if appropriate, in order to improve the performance of the offsetting option to meet the expectations under DFO's Policy (DFO 2013a,b). If it is determined by Sabina, in consultation with DFO, that the proposed offsetting project will not meet the offsetting objectives for the Back River Project, an alternate project will be identified and implemented, with an associated monitoring plan, to achieve the offsetting commitments for fisheries losses at the Project.

8. Complementary Measures

In remote areas where there are low levels of human developments, such as the Canadian Arctic, there are not only limited opportunities for offsetting fisheries productivity losses, but there is also a general lack of knowledge on fisheries populations beyond that generated from baseline monitoring programs. Thus, an investment in data collection and scientific research may also be considered as a Complementary Measure for an offsetting plan when it takes into account the guiding principles outlined in the Fisheries Productivity Investment Policy. Research must relate to improving the state of knowledge around maintaining or enhancing the productivity of commercial, recreational, or Aboriginal fisheries to be considered as a Complementary Measure. A suite of Complementary Measures for the Back River Project will be considered. As Complementary Measures, the research investments may contribute up to 10% of gains to offset losses and reduce uncertainty associated with predicted gains from the offset option (e.g., described in Figure 7.4-1).

8.1 FISH-OUT LIFE HISTORY DATABASE

As described for the Conceptual Fish-Out Plan (Section 9), the fish out of Llama and Umwelt lakes will follow the sampling framework and protocols described in DFO's General Fish-Out Protocol (Tyson et al. 2011). Under DFO's protocol, life history information (i.e., lengths and weights) on all fish and species in Llama and Umwelt lakes will be collected. Laboratory analyses will be performed on a subset of captured fish. Aging structures will be collected and analyzed from a subset of captured species (e.g., Lake Trout) to characterize the age structure and growth characteristics of populations. Tissue samples (e.g., muscle) from a subset of captured species will also be collected and prepared for analyses of metal concentrations at an accredited laboratory. The combined dataset on life history, population, and environmental variables will then be provided to DFO, contributing to a regional fisheries database on lakes in Nunavut.

The proposed level and type of data collection follows DFO's General Fish-Out Protocol and is in support of the development of a regional database for managing fisheries in Arctic lakes. This level of effort is in excess of what would otherwise be required in support of a fish-out program; therefore, this work qualifies for consideration as a Complementary Measure for the Back River offsetting plan. This Complementary Measure will represent an important contribution to fisheries science and the management of stocks of fish species in the region. The details on data collection and reporting will be confirmed in the Final Fish-Out Plan.

8.2 BERNARD HARBOUR TK STUDY

As noted previously, a TK study was conducted in 2014-2015 in an effort to develop a better understanding of the Arctic Char fishery in the Bernard Harbour area (and related historic and contemporary environmental conditions). The TK study was carried out by Sabina in partnership with the Kugluktuk HTO and was intended to complement the scientific baseline studies that have also been conducted for the Bernard Harbour remediation project. The TK study involved one-on-one interviews

with 11 Bernard Harbour land users from Kugluktuk and Cambridge Bay, who were selected by the Kugluktuk HTO for inclusion in the study. The TK study also made use of various secondary sources (e.g., historic records, land use reports, academic publications) and a Bernard Harbour site visit to provide additional information on the Arctic Char fishery. The TK study was led by a qualified social scientist using proven qualitative TK research methods. Further information on the TK study can be found in Section 2.1.3., while a copy of the TK study report can be found in Appendix V3-3D of Sabina's FEIS.

Considering the remote, pristine area that Bernard Harbour is located in and the lack of existing scientific information and documented TK on the local Arctic Char fishery, Sabina considers the Bernard Harbour TK study a Complementary Measure. For one, the TK study provides a significant amount of new environmental baseline information related to the Arctic Char fishery at Bernard Harbour. This includes information on Arctic Char harvesting, migration, spawning, health, response to changing environmental conditions, and other topics. This information will be useful for assessing the relative success of any future remediation activities that are undertaken at Bernard Harbour, while helping to address existing knowledge gaps related to the management and conservation of the Arctic Char fishery in the Coronation Gulf. Second, the TK study describes recent environmental changes observed by Inuit in the area and the negative implications these changes have had on the Arctic Char fishery in the region. This highlights the potential benefit stream remediation activities may have on the Arctic Char population at Bernard Harbour, while also contributing to the growing literature on environmental change in the Canadian Arctic.

The TK study also presents detailed information on an area of historic and contemporary importance to Inuit, and on a species readily harvested by Inuit (i.e., Arctic Char). The contributions the TK study makes to the local historic and cultural record are thus notable. Finally, the TK study demonstrates how the proposed approach to stream remediation (i.e., using low-impact stream channel manipulation methods) is grounded in historic Aboriginal fisheries management strategies that have been used at Bernard Harbour (i.e., seasonal stream channel manipulation and rock weir construction). This 'made in the north' approach represents a unique opportunity for fisheries offsetting and community benefits to be realized simultaneously, while also serving as a potential model for future project proponents.

While the results of the TK study are to remain the property of the Kugluktuk HTO, the data and results of the study are intended to be freely shared with other Nunavut organizations that may benefit from its use (as per the terms of the Bernard Harbour Restoration Project Agreement Between: The Kugluktuk Hunters and Trappers Organization and Sabina Gold & Silver Corp. signed by both parties in June 2014). For example, the KIA has been provided with copies of the data obtained from the TK study, so that it may be incorporated into their NTKP database. As noted by the KIA (2012), the NTKP is the foundation for recorded and geo-referenced Inuit TK in the western Kitikmeot Region. The NTKP covers Inuit land use, and fish and wildlife ecological data within a 750,000 km^2 study area, the Slave Geological Province. As well as being a repository of Kitikmeot Inuit TK, the NTKP was designed as a land use planning tool, designed to inform and improve the quality of environmental assessments for proposed developments in the Kitikmeot Region.

8.3 ARCTIC CHAR MOVEMENT STUDY

Research on the migratory movements of Arctic Char was conducted in 2014 in an effort to develop a better understanding of the ecology of Arctic Char at Bernard Harbour (i.e., the Nulahugyuk Creek-Hingittok Lake system). The research was carried out by Sabina in partnership with the Kugluktuk HTO and was intended to supplement previously completed scientific baseline studies at Bernard Harbour. It is expected that the Arctic Char movement studies will continue as part of a complementary measure when monitoring the Bernard Harbour Offsetting Option into the future.

The research will address questions on how Arctic Char move within Nulahugyuk Creek, and also on where Arctic Char from Bernard Harbour move within the broader region of the Coronation Gulf. The first question is being addressed by quantifying upstream movements for the duration of the migration period for a subset of capture Arctic Char using implanted PIT tags and Radio Frequency Identification (RFID) antenna-reader arrays installed at strategic locations on the creek. In 2014, a total of 315 upstream migrating adult char were implanted with PIT tags, each of which has a unique identification number that can be tracked by a handheld reader or remotely deployed antennae-reader array. Seven PIT-tag antennae-reader arrays were installed strategically in relation to the location of the 2012 low-flow channel project areas and reference sections to monitor the speeds and rates of successful passage across a range of conditions in the creek. An antennae-reader array was also installed near the outlet of Hingittok Lake to quantify the rate of successful upstream passage from the mouth of Nulahugyuk Creek to the spawning lake. Further information on the results of the PIT-tagging study completed in 2014 can be found in Section 7.3.2.

A Floy-tag program was also initiated in 2014 and included the use of external (Floy) tags for a subset of adult char moving downstream from Hingittok Lake such that char captured by local community members (e.g., later in the season in the Coppermine River) could be identified as individuals originating from Bernard Harbour. The external tags were implanted through the dorsal surface of the char lateral to the dorsal fin. The tags were orange, and each tag had a visible identification number for tracking the fish. A total of 475 adult char captured moving downstream were implanted with Floy tags. Resulting data from recaptures by domestic and recreational anglers, as well as future research teams, will be collected over time through tag return programs initiated by Sabina and the Kugluktuk HTO. This program will contribute valuable information on 'large-scale' movements of Arctic Char in the Coronation Gulf, and possibly the location of overwintering sites. Data collection is ongoing and the analysis of the return information will supplement the information collected on 'small-scale movements' of Arctic Char in Nulahugyuk Creek.

Considering the remote, pristine area that Bernard Harbour is located in and the lack of existing scientific information on the local Arctic Char fishery, Sabina considers information generated from the Arctic Char movement study a Complementary Measure. The study will provide a significant amount of new environmental baseline information related to the migratory ecology of Arctic Char, an area of fisheries science where there is currently a paucity of data to support any new management or conservation initiatives. This includes information on Arctic Char migration speeds, migration survival, environmental factors that influence the migration of Arctic Char, and the distribution or home ranges of Arctic Char from Bernard Harbour. This information will be useful for assessing the relative success of any future remediation activities that are undertaken at Bernard Harbour, while helping to address existing knowledge gaps related to the management and conservation of the Arctic Char fishery in the Coronation Gulf.

9. Conceptual Fish-Out Plan

9.1.1 Overview

A fish-out program will be carried out for any lakes that are lost as a result of the Project (i.e., Llama and Umwelt lakes). The fish-out program will follow DFO's General Fish-Out Protocol for Lakes and Impoundments in the Northwest Territories and Nunavut (Tyson et al. 2011). A fish-out or the removal of fish from a waterbody offers a unique opportunity to gather information on lake productivity and the fish community, as well as avoid any "wastage" by making the fish available for traditional use by local

communities (Tyson et al. 2011). It is important to note that the detailed Final Fish-Out Plan will be developed during the water licencing phase of the Project.

9.1.2 Data Collection

9.1.2.1 Fish Community

In accordance with the General Fish Out Protocol, the fish out at Llama and Umwelt lakes will proceed in two major phases: a CPUE phase, and a final removal phase. The first (CPUE) phase is expected to begin mid-June immediately after "ice-out" and before dewatering later that summer. The final removal phase will occur immediately following the CPUE phase and during dewatering. The final removal phase is expected to be completed by late summer. Field sampling efforts will include community input to support the fish-out program.

The goal of the CPUE phase is to enumerate fish community CPUE data for each fish population in the lake and is intended to remove a substantial proportion of the fish biomass prior to changes in Llama and Umwelt lakes occurring. The CPUE phase also represents the period where most of the large-bodied fish are removed before the dewatering phase begins. Based on the General Fish-Out Protocol, the CPUE phase will exclusively use multi-panel (index) gill nets (small and large mesh sizes) configured as double-gangs for fish capture. The sampling will follow a stratified random design to allow for later calculation of population sizes. The transition from the CPUE phase to the final removal phase will be based on DFO's General Fish-Out Protocol.

Phase 2 will begin immediately following Phase 1 and will consist of a targeted gill netting program (i.e., not required to follow the sampling design in Phase 1) that will target habitats likely supporting fish as determined during the Phase 1 effort. Additional fish capture methods (e.g., electrofishing, angling, set lines, minnow traps, seine nets, fyke net traps) will be deployed where necessary to also target small-bodied fish and species (e.g., Burbot) not effectively captured using gill nets. Phase 2 may include fishing efforts concurrent with initial phases of dewatering and is expected to be completed by mid to late summer.

<u>Diving Bird Mitigation</u>

The fish-out program will aim to be completed outside of periods where there is high migratory bird use of the lake (i.e., nesting, brood rearing and migration periods) to avoid the incidental take of migratory birds through entanglement in any gill nets. Mitigation measures for minimizing mortalities of diving birds will include increasing the visibility of gill nets, use of visual or auditory deterrents to prevent birds from landing on the lake during active gill-netting, monitoring migratory bird usage of the lake and determining high use feeding areas prior to setting gill nets and avoiding these areas, and reporting of by-catch to adjust mitigation measures.

9.1.2.2 Aquatic Biology and Limnology

The Aquatic Biology and Limnology component of the fish-out program includes physical limnology measurements, water quality, chlorophyll a, and zooplankton samples. All samples will be collected multiple times during the fish-out program (including sampling before the fish-out in late spring/early summer, during the fish-out and just prior to dewatering in late summer). Benthic invertebrate sampling will be collected once from four different depth intervals mid-summer and sampling methods will be the same as those outlined in the Aquatic Effects Monitoring Program (Volume, Chapter 19 of the FEIS). Information on habitat (e.g., substrate, depth) will be collected at all sampling locations.

10. Summary

The purpose of the Conceptual Fish Offsetting Plan (Chapter 21) was to summarize anticipated serious harm to fish based on the assessment provided in the Final Impact Statement (FEIS), and to describe the offsetting option to counterbalance the unavoidable serious harm to fish, as defined in the *Fisheries Act*. The plan was constructed as per the guiding policies of Fisheries and Oceans Canada (DFO), with the goal of maintaining or improving the productivity of the commercial, recreational, or Aboriginal (CRA) fishery. In addition to the offsetting plan, a number of mitigation measures will be in place for the Back River Project (Project) to avoid or minimize the potential effects on the productivity of the CRA fishery. These mitigation measures will be supplemented by the use of adaptive management, as required. For any lakes that are lost as a result of the Project (i.e., Umwelt and Llama lakes), a fish-out will be conducted and will offer a unique opportunity to gather information on lake productivity and the fish community, as well as avoid any "wastage" by making the fish available for traditional use by local communities.

The Conceptual Fish Offsetting Plan for the Project is the result of continued community and regulatory engagement associated with the Project. The outcome of engagement activities identified an offsetting measure or option focused on improving the productivity of an Arctic Char fishery at Bernard Harbour (i.e., the Hingittok Lake-Nulahugyuk Creek system), which is located approximately 100 kilometres (km) directly north of the hamlet of Kugluktuk, Nunavut, along the south coast of the Dolphin and Union Strait. Bernard Harbour was once the site of a traditional domestic fishery for Arctic Char.

The Bernard Harbour offsetting option for the Back River Project was identified in response to reports by local harvesters in the 1990s that the traditional fishery was in decline. Follow-up investigations concluded that conditions of the creek may be deteriorating because of natural causes (e.g., changes in climate, resulting in low water levels, and boulder barriers), affecting the upstream migration success of adult Arctic Char to spawning areas in Hingittok Lake. Investigations also provided evidence that migration conditions could be remediated at problem locations by creating low-flow channels using low-impact construction methods. During 2014 to 2015, a Traditional Knowledge (TK) study combined with environmental monitoring provided a better understanding of the Arctic char fishery at Bernard Harbour (and related historic and contemporary environmental conditions). The baseline studies, all of which included Kugluktuk Hunters and Trappers Organization (HTO) as full partners, demonstrated how the proposed approach to stream remediation is grounded in historic Aboriginal fisheries management strategies that have been used at Bernard Harbour (i.e., seasonal stream channel manipulation and rock weir construction). This 'made in the north' approach represents a unique opportunity for fisheries offsetting and community benefits to be realized simultaneously. To estimate the potential benefits of the offsetting option to fisheries production (as a surrogate of fisheries productivity), changes in migration success were estimated and then related to changes in the biomass of adult Arctic Char in Nulahugyuk Creek. The predicted gains in biomass following remediation may be substantial, magnifying over time when offspring return as adults (by offsetting year 8 or 9). It is also predicted that gains in biomass at Bernard Harbour will exceed losses in fisheries production resulting from temporary drawdowns of small lakes (Llama and Umwelt lakes), and related infrastructure (e.g., Tailings Storage Facility) at the Goose Property Area.

The Conceptual Fish Offsetting Plan will be finalized and presented as a Final Fish Offsetting Plan during the permitting phase of the Project and submitted as part of the Application for Authorization under the Fisheries Act. The plan would be approved by DFO as a condition of the Authorization required for the development of the Project.

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Appendix A

Bernard Harbour Restoration Project Agreement between the Kugluktuk Hunters and Trappers Organization and Sabina Gold & Silver Corp.

Sabina
GOLD & SILVER CORP.

BERNARD HARBOUR RESTORATION PROJECT

AGREEMENT BETWEEN:
THE KUGLUKTUK HUNTERS AND TRAPPERS ORGANIZATION AND
SABINA GOLD & SILVER CORP.

Purpose of the Agreement:

The purpose of this Agreement is to outline the relationship between the Kugluktuk Hunters and Trappers Organization (HTO) and Sabina Gold & Silver Corp. (Sabina) in executing the Bernard Harbour Restoration Project.

Background:

Stream restoration activities in the Nulahugyuk Creek - Hingittok Lake area (also known as Bernard Harbour) were initially proposed in the early 2000s by the Kugluktuk HTO. These activities were proposed with the goal of restoring a traditional Inuit Arctic char fishery, which has suffered from significant harvesting declines in recent years. The Kugluktuk HTO has worked closely with Golder Associates (Golder) to advance early stages of the project (e.g. initial environmental baseline and stream restoration work), and the two have recently applied to the Canadian Northern Economic Development Agency (CanNor) for additional project funding. The two organizations have also been seeking an industry partner to help advance the project to completion. Sabina has now been identified as this industry partner, who will support stream restoration work in the Nulahugyuk Creek - Hingittok Lake area in order to satisfy Fisheries Act offsetting requirements for its Back River Project while supporting the desires of the Kugluktuk HTO and the community members of Kugluktuk.

Objectives of the Agreement:

There are two primary objectives of this agreement:

1. ***Short term objective (2-3 years)***: To enable Sabina to satisfy a Department of Fisheries and Oceans (DFO) requirement to offset fisheries habitat effects at the Back River Project. This objective would be achieved by improving the viability of the Nulahugyuk Creek - Hingittok Lake traditional Arctic char fishery. To the greatest extent practicable, local community members will be involved throughout the process to help support this objective. Selected local high school students will also be involved in the project where possible, so that skills and knowledge may be transferred to them.

2. ***Long term objective (3+ years)***: To enable the Kugluktuk HTO and Sabina to restore a historic, locally-utilized Arctic char fishery, for the benefit of Kugluktuk residents. This will be accomplished, in part, by the provision of resources and training by Sabina.

Structure of the Relationship between the Kugluktuk HTO and Sabina:

The Bernard Harbour Restoration Project is envisioned as a partnership between the Kugluktuk HTO and Sabina. This partnership will be structured in the following ways:

- The Bernard Harbour Restoration Project is to remain a Kugluktuk HTO-led initiative. Sabina will support the Kugluktuk HTO in achieving their objectives for the Bernard Harbour Restoration Project, but control and ownership of the project will ultimately reside with the Kugluktuk HTO.
- A Traditional Knowledge (TK) study on the Arctic char fishery in the Nulahugyuk Creek - Hingittok Lake area (see following section) will be conducted to support the objectives of this agreement. This study will be coordinated and executed by Sabina, although the Kugluktuk HTO will remain the owners of all TK data that is collected and reports that are issued. The Kugluktuk HTO and Sabina are currently exploring options for the funding of this TK study. In the event third party funding cannot be obtained, Sabina will provide all necessary resources for the TK study to be completed.
- Environmental baseline work, stream restoration work, and DFO-required follow-up monitoring and reporting will all be funded by Sabina. However, these particular work areas will be coordinated and executed by Golder (or other similar consultant), who will act as the Kugluktuk HTO / Sabina representative onsite at Bernard Harbour.
- The Bernard Harbour Restoration Project will, to the greatest extent practicable, provide opportunities for the involvement of summer students hired by the Kugluktuk HTO.
- Once the Bernard Harbour Restoration Project's short term objective has been met (see above), Sabina intends to phase-out its involvement in the project. In the long-term, full management of this project will be turned over to the Kugluktuk HTO. The timing of this phase-out will be determined in consultation with DFO, Sabina, the Kugluktuk HTO, and possibly other organizations like the KIA. As a rough estimate, this phase-out would likely occur 3 years after all stream restoration work has been completed (e.g. 4-6 years after the signing of this agreement).
- Sabina acknowledges the Kugluktuk HTO's strong desire to learn the skills and knowledge necessary in order to manage all future stream restoration and monitoring work themselves. Sabina will work with the Kugluktuk HTO to provide this training and will help develop a management plan/document and workshop that addresses these objectives.

Traditional Knowledge Study

In an effort to develop a better appreciation of historic and contemporary environmental conditions in the Nulahugyuk Creek - Hingittok Lake area, a TK study will be conducted. While additional details on the TK study are included in the TK study proposal document that was shared with the Kugluktuk HTO in early April 2014 (see Appendix A), the following points are of particular relevance to this Agreement:

- All TK data and reports that result from the TK study will be owned by the Kugluktuk HTO. However, all TK data collection, analysis, and reporting activities will be conducted by Sabina on behalf of the HTO.
- Opportunities for youth involvement in the TK study (e.g. as research assistants) will be investigated on an ongoing basis.
- All TK data and reports that result from the TK study will be made available to the Kitikmeot Inuit Association (KIA) for inclusion in their Naonaiyaotit Traditional Knowledge Project (NTKP) database, with the

understanding the KIA may utilize and distribute this data and information for their own purposes. The data and results of the TK study are also intended to be freely shared with other Nunavut organizations that may benefit from its use.

- Sabina reserves the right to publish the final TK study report in the Back River Project Final Environmental Impact Statement (FEIS) and / or in other regulatory submissions. TK study results may also be presented by Sabina and / or its representatives in other public forums (e.g. conferences, company publications and presentations).

Implementation Schedule

This Agreement will be implemented over three periods:

1. ***2014 - 2015***
    - TK study (to be conducted by Sabina in Kugluktuk)
        - Potential Bernard Harbour site visit with selected TK study participants
    - Baseline fieldwork (to be conducted by Golder at Bernard Harbour)
        - Potential Bernard Harbour site visit with partners and DFO
2. ***2015 - 2016***
    - Fisheries offsetting plan to be drafted by Golder for Sabina's FEIS (submission of this plan will initiate the DFO approval process)
3. ***Future considerations***
    - Conduct stream restoration work, pending DFO approval of offsetting plan. This work will include:
        - Identifying main stream channels
        - Removal of fish passage barriers
        - Relocation of in-stream boulders to create low-flow channels
    - Project monitoring requirements to be determined in consultation with DFO; Sabina will follow all monitoring requirements as set out by DFO
    - At this time, it is expected that monitoring programs will be conducted by Sabina (or a consultant) at *Year 1* and *Year 7* following initial stream restoration activities. Sabina will also negotiate appropriate funding with the Kugluktuk HTO, so that interim monitoring activities (i.e. monitoring during the years when Sabina / a consultant are not present) can be conducted directly by the Kugluktuk HTO. Longer-term funding arrangements may also need to be arranged in the future.
    - Sabina to eventually phase out corporate involvement in Bernard Harbour Restoration Project; role of HTO in long-term management of stream restoration activities to be determined in consultation with DFO and Sabina.

Duration of the Agreement

This Agreement will be effective as of the signing date in the Endorsement section below. The initial term of this Agreement will be for two years, but the Agreement will be subject to renewal after this time. During the two years of this initial Agreement a number of tasks will be completed by Sabina to better define long-term project requirements. These will include:

- Collection of baseline data.
- Analysis of baseline data and development of plans in Sabina's Final Environmental Impact Statement (FEIS) to determine specifically what will be required for Sabina to meet its fisheries offsetting obligations.
- Finalization of fisheries offsetting terms and conditions with DFO (Note: project plans may change somewhat as a result of this process).

Upon completion of this initial two-year Agreement, it is anticipated that Sabina and the Kugluktuk HTO will negotiate a new, longer-term project agreement.

Endorsement

The following parties endorse this agreement:

For the Kugluktuk Hunters and Trappers Organization:
David Nivingalok
Chairperson
Kugluktuk Hunters and Trappers Organization
P.O. Box 309
Kugluktuk, Nunavut, X0B 0E0
kugluktukhto@qiniq.com

Signature _____ Date June 5/2014

For Sabina Gold & Silver Corp.:
Matthew Pickard
Vice President, Environment & Sustainability
Sabina Gold & Silver Corp.
202 - 930 West First Street
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Signature _____ Date June 3, 2014

22. Tailings Management Plan

Sabina
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BACK RIVER PROJECT
Tailings Management Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 22	All	Topic Waste Rock & Tailings	Divided the combined DEIS report with WR and tailings managed in a single report to two separate reports. The Waste Rock Management Plan can be found in Vol 10, Ch 9.
	All	Tailings deposition strategy	Changed from single surface TSF to maximizing in-pit tailings disposal. Small purpose-built TSF still on surface.
	All	Tailings location	TSF location moved from DEIS to FEIS.
	All	Tailings discharge	Change from zero discharge facility to TSF with a lined upstream berm and seepage is managed within the site water management plan.

BACK RIVER PROJECT
TAILINGS MANAGEMENT PLAN

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Glossary and Abbreviations

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

ARD	acid rock drainage
CDA	Canadian Dam Association
EMP	Environmental Management Plan
FEIS	Final Environmental Impact Statement
GCL	geosynthetic clay liner
HDPE	high-density polyethylene
IDF	inflow design flood
MAC	Mining Association of Canada
MCRP	Mine Closure and Reclamation Plan
ML	metal leaching
MMER	Metal Mining Effluent Regulations
NIRB	Nunavut Impact Review Board
NPAG	non-potentially acid generating
NWB	Nunavut Water Board
OMS	operation, maintenance, and surveillance
PAG	potentially acid generating
PGA	peak ground accelerations
QA	quality assurance
QC	quality control
SOP	standard operating procedure
TF	tailings facility
TSF	Tailings Storage Facility
TSM	Towards Sustainable Mining
VEC	Valued Ecosystem Component
WRSA	waste rock storage area

1. Introduction

This chapter describes the Tailings Management Plan (the Plan) that Sabina Gold & Silver Corp. (Sabina) will follow in the development and operation of the Back River Project (the Project). The Plan and other management plans are intended to describe the ways in which Sabina will address or mitigate issues identified in the Final Environmental Impact Statement (EIS). This plan outlines the approach for managing tailings that will be produced from the Project at the Goose Property; no tailings will be produced at the Marine Laydown Area (MLA) in southern Bathurst Inlet.

The Plan has been prepared in accordance with Section 9.4.6 of the EIS Guidelines issued by the Nunavut Impact Review Board (NIRB) to Sabina (NIRB 2013). This Plan was prepared in conformance with current Federal and Territorial statutory requirements.

The Tailings Management Plan for the Back River Property (the Property) includes the following:

- Applicable legislation and guidelines;
- The roles and responsibilities of the environmental team;
- Environmental protection measures;
- Mitigation to avoid or minimize potential adverse effects on air and water quality;
- Checking and corrective actions;
- Record keeping and environmental reporting;
- A framework for the evaluation of plan effectiveness; and
- A quality assurance/quality control program to be applied to the monitoring program.

The Tailings Management Plan is a “living document” and the information herein is current as of August 2015. It will be regularly updated based on engineering design, management reviews, incident investigations, regulatory changes, or other Project-related changes. The Plan will be included in Sabina’s future Type A Water Licence Application and may be updated prior to submitting the application pending comments from review of the FEIS. The Plan may be updated again prior to construction if instructed to do so by the NWB during the licensing process. The Plan will be reviewed on a regular basis to incorporate any lessons learned, major changes to facility operation or maintenance, and environmental monitoring results.

Following this, the Plan can be further updated based on detailed engineering design prior to the start of Construction, incorporating engineering drawings of the Tailings Storage Facility (TSF), mined-out open pit Tailings Facilities (TFs), embankments, and associated water management infrastructure. 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 Tailings Management Plan is a discipline-specific management plan that forms part of Sabina’s overall Environmental Management Plan (EMP) developed for the Project. The scope of the Plan covers

operational procedures, the implementation of environmental protection measures, and monitoring of the effectiveness of mitigation. The Plan applies to the Construction and Operations phases of the Project during which time tailings will be produced, as well as the Closure/Post-Closure phases as tailings will be permanently disposed of on the Property. The Plan is meant to ensure that the Project is conducted as proposed, predicted adverse environmental effects are promptly mitigated, mitigation measures are successful, and relevant laws and regulations are complied with. Closure and reclamation of tailings management facilities are also addressed in detail in the Mine Closure and Reclamation Plan (MCRP).

The main environmental concerns related to tailings storage are the potential for dust to spread to the surrounding land and water, as well as effects of runoff and seepage on local water quality. Progressive reclamation is also considered as it presents an important opportunity to reduce environmental liabilities associated with mine closure while the mine is in operation.

The measures identified in this plan are intended to protect the following Valued Ecosystem Components (VECs):

- Air quality;
- Surface hydrology;
- Water quality;
- Sediment quality;
- Aquatic habitat; and
- Fish (primarily Arctic Grayling and Lake Trout).

As a member of the Mining Association of Canada (MAC), Sabina will develop a future Operation, Maintenance and Surveillance (OMS) Manual consistent with MAC's Towards Sustainable Mining (TSM) Initiative requirements. More detail on this is provided in Section 4.

3. Planning and Implementation

3.1 TAILINGS PRODUCTION AND STORAGE

The Project will produce about 19.8 million tonnes (Mt) of tailings over the 10-year mine life. Tailings will be discharged to multiple facilities, and tailings storage management dictates how water is managed on the Project. The Operations phase is described in stages according to the tailings storage and water management plans, as follows:

- Stage 1 – Tailings Storage Facility – For the first two years of Operations (Years 1 and 2), a purpose built TSF will be utilized;
- Stage 2 – Umwelt Tailings Facility (Umwelt TF) – From Years 2 to 6, the mined-out Umwelt Pit will be used for the tailings deposition; and
- Stage 3 – Goose Main Tailings Facility (Goose Main TF) – From Year 6 onward, tailings will be disposed of in the mined-out Goose Main Pit.

The Tailings Management System (TMS) has been developed based on the principle of maximizing the use of open pits for tailings storage. To that end, tailings will be stored in mined-out open pits as soon as the pits are available for tailings deposition. The purpose-built Tailings Storage Facility (TSF) will consist of a frozen foundation dam with an integral liner; this TSF is located about 2 km south of Goose Main Open Pit (Figure 3.1-1). Tailings deposition will transition from the TSF to in-pit deposition in the mined-out Umwelt Open Pit for a period of about four years. Finally, tailings will be deposited in the mined-out Goose Main Open Pit during the remaining four years of the mine life. A summary of the TMS storage requirements is outlined in Table 3.1-1.

Table 3.1-1. Back River Property Tailings Management System Storage Requirements

	Period (Year and Quarter)	Location	Tailings (cubic metres)
TSF	Y-1 Q4 to Y2 Q3	3,777,749	3,148,124
Umwelt TF	Y2 Q4 to Y6 Q3	8,581,468	7,151,223
Goose Main TF	19,805,296	16,504,413	6,205,066
Total Project	Y-1 Q4 to Y10 Q2		

After tailings deposition transitions from the TSF to the Umwelt TF in Year 2, the TSF will be converted to a waste rock storage area (namely, the TSF WRSA) and used to dispose of potentially acid-generating (PAG) and non-potentially acid generating (NPAG) waste rock.

Sabina considered the need for contingency tailings storage. The TSF is expected to have sufficient storage during its relatively brief life, and contingency storage is available if necessary in other exhausted open pits.

Llama is also considered an option for a TF. Llama TF is an already effected body of water (for saline water management) and may serve as a contingency should an additional TF being required or preferred.

3.1.1 Tailings Physical Characteristics

Physical properties of the tailings include the following:

- Solids Content: 49% solids (by weight);
- Tailings Solids Specific Gravity: 2.88;
- Settled Density: 1.2 t/m^3;
- Plasticity: non-plastic; and
- Particle size: 50 µm (P_{80}).

3.1.2 Tailings Geochemical Characteristics

Tailings geochemical characterization confirms that, with the exception of some samples from the Goose Main deposit, tailings are PAG, albeit with very slow reaction rates (Appendix V2-7D). All tailings samples exhibit some level of metal leaching. Therefore tailings will need to be managed to prevent acid rock drainage and manage metal leaching. During Operations, it is likely that the process water will need to be treated prior to discharge to the environment. Further details on water treatment can be found in the Site Water Monitoring and Management Plan (Volume 10, Chapter 7).

Exposed tailings beaches are likely to be an ongoing source of sulphate and arsenic leaching, and if they are left exposed for an extended period of time (estimated to be decades), pH changes may result in increased concentrations of other trace elements. However, the development of acidic conditions is expected to be delayed considerably by the cold temperatures, with the alkalinity from the deposition of fresh tailings helping to maintain neutral pH conditions. At Closure, NPAG waste rock will be used to cover tailings material. The resulting aggradation of permafrost will minimize infiltration and development of metal leaching / acid rock drainage (ML/ARD) conditions.

3.2 TAILING STORAGE FACILITY

3.2.1 TSF Design Basis

The design of the TSF has incorporated the following requirements:

- Permanent, secure, and total confinement of tailings solids within an engineered disposal facility;
- Control, collection, and recovery of tailings pore water and runoff water from within the tailings facility for recycling to the mill operations as process water;
- Minimizing seepage losses from the facility and providing seepage collection systems below the impoundment structures to minimize adverse downstream water quality impacts;
- Integration of the tailings facilities into the overall mine site water management requirements;
- Designing for closure;
- The inclusion of freeboard allowance for ice entrainment, storm water management, wave run-up, potential embankment settlement, and other contingencies such as sloping tailings beaches; and
- The inclusion of monitoring features for all aspects of the facility.

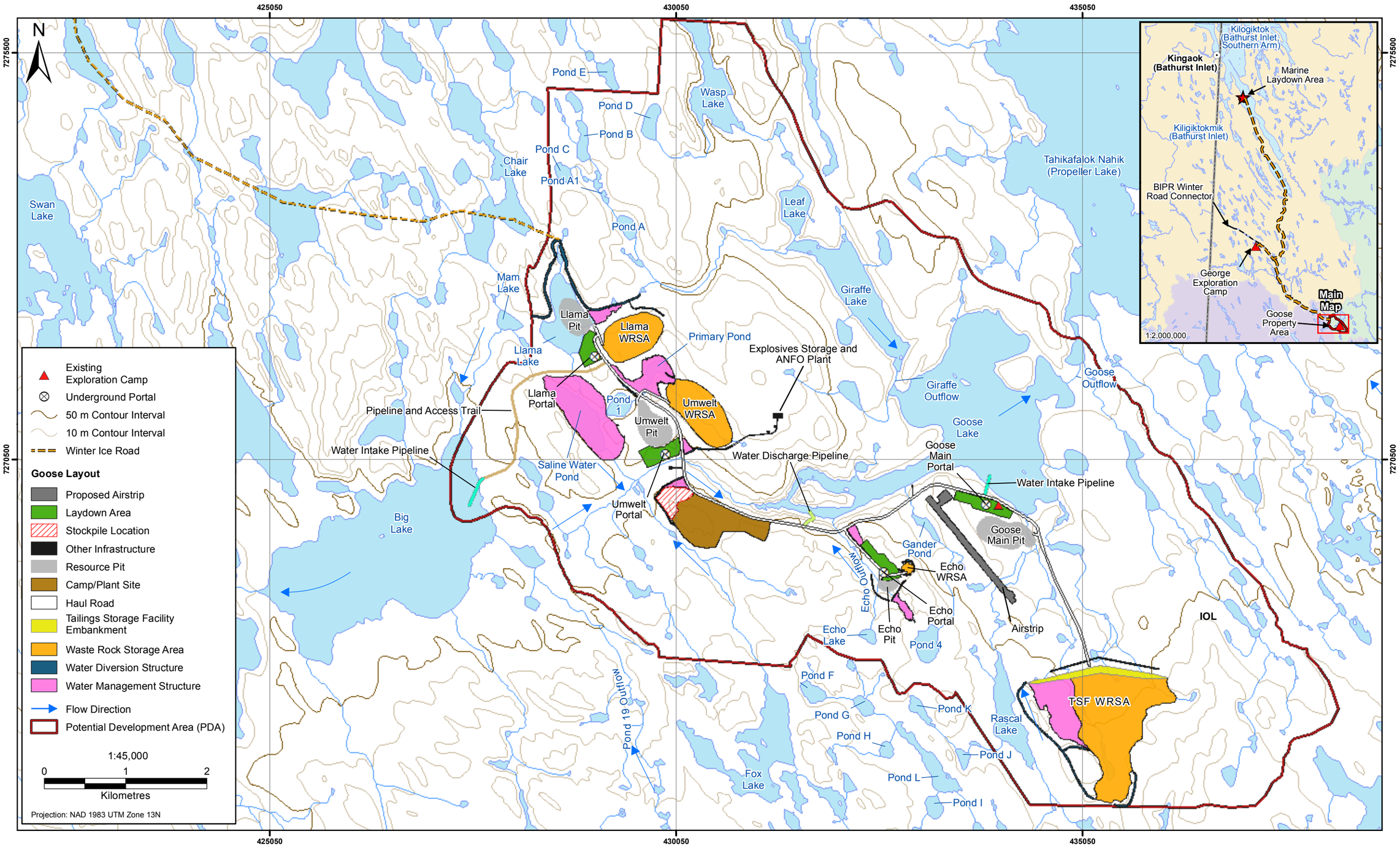
The design basis is summarized in Table 3.2-1.

3.2.2 Dam Hazard Classification

The design, construction, operation, and monitoring of dams, including tailings dams, have to be completed in accordance with appropriate Provincial and Federal regulations and industry Best Management Practices. The primary guidance document in this regard was developed by the Canadian Dam Safety Association (CDA), including the 2013 Canadian Dam Safety Guidelines (CDA 2013), and the dam safety guidelines specific to mining dams (CDA 2014).

Assessment of the dam hazard classification was carried out to determine the appropriate design earthquake and flood events for the TSF. Selection of the design earthquake is based on the classification criteria provided by the CDA and summarized in Table 3.2-2.

The TSF dam classification is carried out by considering the potential incremental consequences of an embankment failure. The incremental consequences of failure are defined as the total damage from an event with dam failure minus the damage that would have resulted from the same event had the dam not failed. Three categories of losses are considered: loss of life; environmental and cultural values; and infrastructure and economics, as shown on Table 3.2-2.



Sabina GOLD & SILVER CORP.

General Arrangement Plan

Figure 3.1-1

Table 3.2-1. TSF Design Basis Summary

Component	Criteria
Dam Hazard Classification	High
Design Life • Active use period as water retaining structure • Use as temporary water retaining structure • Total life until breach	 2 years 16 years 18 years
Dam staging	None
Tailings production rate	Ramp up period, with a maximum rate of 6,000 t/d
Tailing slurry content	49% solids (by weight)
Tailings solids specific gravity	2.9
Tailings settled density	1.2 t/m^3
Tailings storage requirement • By Mass • By Volume	 3.8 Mt 3.2 Mm^3
Ice entrainment allowance • Percentage of tailings capacity • By Volume	 20% 0.63 Mm^3
Contact water storage requirement	Average during operations 2,802,000 m^3 Average at TSF closure 335,160 m^3 95^{th} percentile during operations 3,641,000 m^3 95^{th} percentile at TSF closure 723,435 m^3
Total TSF storage requirement (tailings, ice entrainment & contact water)	Average during operations 5,950,000 Mm^3 95^{th} percentile during operations 6,789,000 Mm^3
Tailings beach slope • Subaerial tailings • Subaqueous tailings	 1% 1%
Tailings deposition method	Single point spigot subaerial discharge (three locations over the life of mine)
Maximum design earthquake	1:2,475 year recurrence event; PGA of 0.036 g
Inflow design flood	probable maximum flood, approx. 221 mm
Freeboard requirement: • Wind Setup and Wave run-up allowance • Probable maximum flood storage allowance • Total freeboard (sum of above)	 1.2 m 0.6 m 1.8 m
Stability Factors of Safety (Static)	1.3 during construction 1.5 during operation and closure
Stability Factors of Safety (Pseudo-Static)	1.0

The Property is located in an extremely remote area with no major development other than those associated with the Project itself. The potential for loss of life due to a dam failure is therefore very low. A Dam Classification of "High" has been selected for the TSF based on the impact to environmental and cultural values, i.e., expected significant loss or deterioration of important fish or wildlife habitat where restoration or compensation in kind is highly possible.

Table 3.2-2. TSF Dam Classification

Dam Class[2]	Population at Risk	Incremental Losses[1]		
		Loss of Life[3]	Environmental and Cultural Values	Infrastructure and Economics
Low	None	0	Minimal short-term loss. No long-term loss.	Low economic losses; area contains limited infrastructure or services.
Significant	Temporary only	Unspecified	No significant loss or deterioration of fish or wildlife habitat. Loss of marginal habitat only. Restoration or compensation in kind highly possible.	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes.
High	Permanent	10 or fewer	Significant loss or deterioration of *important* fish or wildlife habitat. Restoration or compensation in kind highly possible.	High economic losses affecting infrastructure, public transportation, and commercial facilities.
Very High	Permanent	100 or fewer	Significant loss or deterioration of *critical* fish or wildlife habitat. Restoration or compensation in kind is possible but impractical.	Very high economic losses affecting infrastructure or services (e.g., highway, industrial facility, storage facilities for dangerous substances).
Extreme	Permanent	More than 100	Major loss of *critical* fish or wildlife habitat. Restoration or compensation in kind impossible.	Extreme losses affecting critical infrastructure or services (e.g. hospital, major industrial complex, major storage facilities for dangerous substances).

Notes:
[1]Reproduced from Table 2-1 of the Canadian Dam Association's Dam Safety Guidelines (CDA, 2007a).
[2]Definitions for Population at Risk:
***None** - There is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure.*
***Temporary** - People are only temporarily in the dam-breach inundation zone (e.g., seasonal cottage use, passing though on transportation routes, participating in recreational activities).*
***Permanent** - The population at risk is ordinarily located in the dam-breach inundation zone (e.g., as permanent residents); three consequence classes (High, Very High and Extreme) are proposed to allow for more detailed estimates of potential loss of life (to assist in decision-making if the appropriate analysis is carried out).*
[3]Implications for Loss of Life:
***Unspecified** - The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.*

Inflow Design Flood

The selection of an Inflow Design Flood (IDF) is governed by the dam classification. Based on the dam hazard classification of High, the guidelines (CDA 2013) recommend the use of an inflow design flood (IDF) of 1/3 between the 1:1,000 return period 24-hour duration precipitation event and the probable maximum precipitation (PMP) for this region.

Notwithstanding this criterion, the TSF has been designed to contain 100% of the probable maximum flood (PMF) of 221 mm, resulting in a freeboard requirement of 0.6 m to accommodate this extreme precipitation. This freeboard allowance has been considered to avoid the requirement of a constructed permanent spillway for a facility with such a short lifespan.

Design Earthquake

Based on the dam hazard classification of High, the Dam Safety Guidelines (CDA 2013) recommend the seismic stability analysis be completed assuming the PGA for 1:2,475 year event. For the Property, this event results in a PGA of 0.036 g.

3.2.3 Seepage Analysis

The water retention capability of the dam relies on the geosynthetic clay liner (GCL) being keyed into the permafrost foundation or competent bedrock. Thermal modeling has confirmed the viability of this, thus the seepage through the foundation is negligible.

In the case of the liner, the swelling of the bentonite in the liner ensures that once hydrated, a properly installed liner becomes virtually defect-free. A comprehensive calculation of the seepage through the liner was completed, which concluded that if the TSF was at full supply level (FSL), seepage of up to 1,210 m^3/year could occur; this equates to seepage rates of 10^{-5} m^3/s. This will decrease as the tailings consolidate, the supernatant pond is removed, and a surface cover is constructed.

Some small zones of fractured bedrock (2 to 3 m thick) were found in some of the drill holes near the west abutment of the dam, which may become a pathway for seepage through the foundation of the dam. However, the thickness of dam bulk fill present in this specific portion of the dam will far exceed the minimum thermal cover requirement to maintain the underlying materials frozen state; therefore seepage is unlikely to occur.

3.2.4 Stability Analyses

A comprehensive stability analysis was carried out to confirm whether the TSF meets the appropriate design requirements outlined above. The stability assessment took into consideration the location and layout of the GCL as the potential weakest element of the dam.

Analysis was completed on two models; the first (Model A) assumed the TSF was empty (i.e. immediately following construction), and the second (Model B) considered the TSF operations phase. Both static and pseudo-static scenarios were assessed for each model using a Peak Ground Accelerations (PGA) of 0.036g (1/2,475 year seismic event). The results (Table 3.2-3) confirm that in all cases the design FOS complies with the minimum required FOS.

Table 3.2-3: TSF Embankment - Minimum Factors of Safety

Model	Slope Assessed	Analysis Type	Factor of Safety
Model A	Upstream	Static	1.5
Model B	Upstream	Static	1.5
Model B	Upstream	Pseudo-static	1.2
Model B	Downstream	Static	1.6
Model B	Downstream	Pseudo-static	1.4
Model B	Upstream	Static Drawdown	1.4

3.2.5 TSF Embankment Construction

Construction Schedule

The dam will be completed before the Goose Process Plant starts production. Construction of the TSF Containment Dam and South Dyke will start at the end of Year -2. The key trench excavation and backfill will be completed in the winter to eliminate potential issues caused by thawing of the soft overburden soils as well as to ensure that a thermal blanket is completed to protect the permafrost in the foundation.

Site and Foundation Preparation

Prior to construction of the TSF, some preparation work is necessary, specifically the foundations of the TSF embankments. Overburden material will be stripped and disposed of in a waste rock storage area (WRSA). Excavation of the key trench must be completed in the winter when the ground is completely frozen. This is necessary to ensure that the ground is as cold as possible before backfilling starts, to facilitate the bond between the foundation and the GCL. Drill and blast methods will be required to excavate the key trench, and due to the possible high ice content and nature of the soils, a tight drill pattern and high blast load factor will be required. The excavated material will be hauled away and disposed of in a WRSA.

For the shallow bedrock foundation zone, the key trench will terminate on clean exposed bedrock. If fractured rock is encountered it will be examined and tested and if deemed highly permeable, the fractured rock will be excavated. In the deep overburden foundation zones, the key trench will terminate on frozen overburden soil; however, should any massive ice or high interstitial ice zones (more than 10%) be encountered, the key trench will be deepened until all the massive ice has been removed.

TSF foundation preparation will require establishing sediment and erosion control best management practices throughout the construction area. Other preparation work will include the construction of a downstream berm, seepage collection and recycling measures, and TSF access roads.

Embankment Components

Plan views of the TSF and a typical cross section during Operations is provided in Appendix A.

The main components of the TSF embankments are as follows:

- Key Trench:
  - The key trench will be excavated in the frozen overburden underlying the dam to a depth up to 4 m.
  - For the shallow bedrock foundation zone, the key trench will terminate on clean exposed bedrock. In the deep overburden foundation zones, the key trench will terminate on frozen overburden soil.
- Pony Wall:
  - In the shallow bedrock foundation zone, a reinforced concrete pony wall will be cast to attach the GCL to. The pony wall will be doweled to bedrock to ensure a good bond and will span the length of the foundation zone.

- Geosynthetic Clay Liner (GCL):
  - The GCL will be the water retaining element of the dam and will be frozen into the key trench to provide the necessary seal. The top edge of the GCL will be terminated in an appropriately sized anchor trench.
  - Where the pony wall is present, the GCL will be attached to the pony wall with a metal strip and anchor bolts.
  - In the base of the key trench, the GCL will be placed directly onto the prepared and clean foundation, with imperfections filled with granular bentonite.
  - In all other areas, the GCL will be sandwiched between two compacted layers of crushed gravel (pea gravel size).
- Dam Bulk Fill:

  The bulk fill of the TSF dam, including the key trench, will consist of run-of-mine (ROM) waste rock. The waste rock will be well graded with a good mix of fines, and size will be limited to a maximum of 600 mm.
- Transition Zone:
  - The GCL is protected using a fine crushed gravel (pea gravel) produced from ROM waste rock. To minimize losses of this bedding material, a transition zone of 150 mm minus crushed ROM waste rock will be placed between the bedding and dam bulk fill zones.
- Bedding Layer:
  - The GCL will be sandwiched between two 0.3 m thick compacted layers of bedding material for protection. This material will be crushed ROM waste rock. The gravel will be pea gravel size.
- Dam Shell:
  - The dam shell will be constructed using the same ROM waste rock as the dam bulk fill. Consideration should however be given to using more gap-graded material on the outer shell, with less fines; this will stand up better over the long term avoiding fines washout, especially on the upstream slope.
- South Dyke:
  - To ensure that the tailings within the TSF are constrained to the PDA, a small retaining dyke is required along the southern end. This structure will be a saddle dyke built of ROM waste rock with a length of approximately 200 m and a maximum height of just over 3 m.
  - No key trench is planned for this structure and no impermeable liner is required because the tailings deposited against the dyke will push the water away from the structure and direct it downstream towards the north end of the facility.

Instrumentation

A series of ground temperature cables and survey prisms will be installed at the TSF dam to monitor the thermal regime of the foundation and deformation performance. Vertical ground temperature cables will be installed in bore holes drilled through the dam fill after the completion of the dam. Horizontal ground temperature cables will be placed within the bedding zone along the upstream side of the key trench. The instrumentation will be monitored to assess embankment performance and to identify any conditions different to those assumed during design and analysis. Amendments to the

ongoing designs and/or remediation work can be implemented to respond to the changed conditions, should the need arise.

3.2.6 TSF Operations

Tailings water from the TSF will be recycled to the mill operations as process water, with no planned discharge from the TSF during Operations. The supernatant water has an integral role in recycling water from tailings back into the Process Plant. The tailings distribution system is designed for a daily production rate of 6,000 tpd. Water will be reclaimed from the TSF through a reclaim barge at an average rate of 4,914 m^3/d. The water balance is presented in the Site Water Monitoring and Management Plan.

Seepage collection systems downstream of the TSF structure will minimize seepage losses and adverse water quality impacts downstream. The seepage collection system includes a downstream berm with an impermeable liner keyed into the permafrost. Depending on the water quality, seepage may be directed to sumps, from where it will be pumped back into the TSF, or discharged to the environment, as appropriate. The design of the TSF has incorporated a freeboard allowance for ice entrainment, storm water and wave action, and other contingencies such as sloping tailings beaches.

TSF Tailings Deposition Plan

The TSF tailings deposition plan proposes discharge from three points within the TSF, representing three periods in the deposition and tailings beach development. Deposition at the first and third discharge points are short in duration (2.5 months and 3 weeks, respectively), with the bulk of the tailings deposited in the second period.

In the first period, tailings will be deposited from the crest of the South Dyke to fill in the southern end of the TSF, and create a sloped surface that will direct the tailings and the water towards the north end of the TSF. During the second period of the deposition, tailings will be discharged from an elevation of 310 masl, which is 3 m higher than the crest of the South Dyke; however, the first period tailings will limit the footprint of this cone. During the third period of deposition, tailings will be discharged from an elevation of 306 masl, which is the northern most discharge point and 1 m lower than the crest of the South Dyke. Beach development will be controlled in the beginning of the second period, and local ponding will be prevented by trenching along the west embankment.

3.2.7 TSF Closure

Following completion of tailings deposition in the TSF, the facility will continue to be used as temporary contact water storage. During this period, Goose Main Open Pit will be in development and waste rock from this source will be used to cover the tailings surface. This entire covered surface, whether waste rock or tailings, will receive a final NPAG waste rock cover at least 5 m thick. This cover will ensure that the tailings surface will freeze back. Once covered, only a portion of the west limb of the dam will be visible. That portion of the TSF will continue to function as a normally empty event pond (TSF WRSA Pond) until the Post-Closure phase. Water from this pond will be pumped to Goose Main TF as required.

3.2.8 Tailings Management Alternatives

A multiple accounts analysis was completed for tailings locations and disposal technologies. The chosen TSF location was selected based on proximity to the plant site and local topography, foundation conditions, and input from the landowners. The analysis also concluded that the most appropriate tailings deposition method is conventional slurry tailings. Details of this analysis are found in Appendix V2-4A in Volume 2.

3.3 TAILINGS FACILITIES IN OPEN PITS

As described in Section 3.1, the Umwelt and Goose Main open pits will be used for the storage of tailings after Year 2 when the TSF will cease operations and will be converted into a WRSA.

3.3.1 TF Construction and Operation

The open pits will be readily convertible to store tailings and will operate similar to conventional above-ground tailings storage facilities.

Tailings will be deposited in the mined-out open pits by using a single spigot discharge point. This discharge location will be changed over the life of deposition to ensure that a near struck tailings surface is created. A reclaim barge will be located within each TF during its operation to return tailings supernatant to the Process Plant. Reclaimed water from the Goose Main TF will be treated year-round during the Operations phase, and seasonally during the Active and Passive Closure stages. There will be no discharge of effluent from the TFs during Operations and Active Closure.

The TFs will be filled to a maximum of 5 m below the overflow elevation to ensure that sufficient water passively accumulates to form a permanent water cover.

3.3.2 TF Closure

Umwelt TF will be closed once tailings deposition in this location ceases. The closure will entail a permanent water cover of 5 m which is deemed sufficient to prevent resuspension of tailings solids due to wave action, surge following storm events, and ice scour. Water treatment is not expected to be necessary at the Umwelt TF.

The closure plan for the Goose Main TF is similar to Umwelt TF; however, once tailings deposition is complete, there will be a much greater water cover. Water from the Goose Main TF will continue to be treated in accordance with the Project water management plan until such time as the discharge meets water quality objectives for the external receiving environment. The Goose Main TF may also be used to store non-hazardous waste from the final mine closure activities.

4. Applicable Legislation and Guidelines

The Tailings Management Plan has been prepared to comply with existing regulations and follow the available guidelines provided by the federal government and the government of Nunavut. The applicable regulations include:

- *Fisheries Act* (1985), including the *Metal Mining Effluent Regulations* (SOR/2002-22).
- *Nunavut Environmental Protection Act* (1988).
- *Nunavut Land Claim Agreement Act* (1993).
- *Nunavut Waters and Nunavut Surface Rights Tribunal Act*, S.C. 2002, c 10 (Canada, 2002); *Nunavut Waters Regulations* (2013).

Water use and waste disposal in Nunavut is regulated by the Nunavut Water Board (NWB) through the water licensing process. The Project will be subject to a Type A Water Licence.

In addition, through Sabina's membership in the Mining Association of Canada, the company commits to meeting the requirements of the Towards Sustainable Mining (TSM) Initiative. A component of the TSM Initiative is adherence to the TSM Tailings Management Protocol, which includes the following elements:

- Development of a tailings management policy and commitment (either as a stand-alone policy or as part of an overall environmental policy);
- Development of a tailings management system;
- Assignment of accountability and responsibility for tailings management;
- Conducting an annual tailings management inspection; and
- Preparation of an OMS Manual.

The following are TSM Guidance Documents that Sabina will refer to as the Project moves through the design and permitting phase and into construction:

- Tailings Management Protocol (MAC, 2011a);
- A Guide to the Management of Tailings Facilities (MAC, 2011b);
- A Guide to Audit and Assessment of Tailings Facility Management (MAC, 2011c); and
- Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities (MAC, 2011d).

It should be noted that the scope of this management plan prescribed by the Nunavut Impact Review Board overlaps with the scope and content of a future OMS Manual that Sabina will develop as a member of the Mining Association of Canada. It is Sabina's preference to replace this plan with a future OMS Manual that is compliant with MAC requirements.

5. Roles and Responsibilities

The General Manager is ultimately responsible for the success of the Plan and approves all relevant policies and documents, auditing, action planning, and the verification process.

The General Manager along with his/her direct reports is responsible for specifics of this Plan including:

- Overall management of the Plan;
- Operational aspects; and
- Internal reporting.

The Environmental Superintendent along with his/her direct reports is responsible for the implementation of this plan including:

- Monitoring;
- External reporting; and
- Ensuring compliance and adaptive management.

Further definition of the site management structure, organizational chart, and a list of designated personnel responsible for aspects of this plan will be provided in future revisions of the Plan or a replacement OMS Manual in compliance with MAC requirements (see Section 4).

6. Environmental Protection Measures

6.1 MANAGEMENT OF SEEPAGE FROM THE TSF

The inferred foundation conditions at the TSF containment dam are not conducive towards constructing seepage collection ditches or drains. Seepage collection will therefore be completed by constructing a berm downstream of the dam. The berm will incorporate an impermeable liner keyed into the permafrost. Depending on the quality of the water, seepage may be directed to sumps from where it will be pumped back into the TSF or discharged to the environment, as appropriate.

This process will continue into the Closure phase but will be reduced to negligible seepage over time with the cessation of tailings deposition and the removal of the supernatant pond. Placement of the final cover will promote the aggradation of permafrost into the tailings over time. The TSF will be instrumented to confirm ground temperatures below the TSF, within the tailings, and within the final waste rock cover (see Section 7).

6.2 EFFLUENT DISCHARGES

Water (supernatant) contained in the TSF and the two TFs will be reclaimed and reused in the Process Plant, a net consumer of water. Discharges from the TSF are not planned while it is operational, and supernatant will be removed prior to the TSF being converted into a WRSA. Discharges from the TFs are not possible until the pits have passively filled as part of intended closure. Post-closure discharges from the TFs are discussed in the Site Water Monitoring and Management Plan and the Mine Closure and Reclamation Plan.

6.3 DUST CONTROL

Dust from the TSF and TFs is not expected to make a significant impact; however, dust will be monitored and managed to the best extent possible. The TSF will be operated with a water cover during operations to supply the Process Plant, and therefore a small tailings beach will be exposed that can generate wind-blown tailings. In the unlikely event that an unacceptable amount of dust is generated from a lack of ice or water cover on the tailings, additional dust mitigation measures will be applied as identified in the Air Quality Management Plan.

6.4 AVOIDANCE OF NAVIGABLE WATERS

The TSF is not sited within any waterways and therefore does not have the potential to affect navigation.

6.5 ADDRESSING CLIMATE CHANGE

Climate change considerations were incorporated into the design of the Project, including the TSF and TFs (Appendix V2-7E and Appendix V2-7G). The life of the Project is such that climate change impacts are most relevant to these project components in the Post-closure Phase.

The TSF cover consisting of 5 m of NPAG waste rock will ensure that the tailings surface will freeze back even under conservative climate change models (Appendix V4-3B).

Other climate change impacts such as increased hydrology are not expected to meaningfully impact the TSF or the TFs in the Post-Closure Phase.

7. Monitoring Program

Routine inspections of the TSF during the construction and operations of the facility will include:

- Regular monitoring of the tailings discharge and tailings beach formation;
- Regular monitoring of the tailings supernatant water level;
- Visual inspections of the tailings embankment and, during periods of flow, seepage in downstream berms, etc.; and
- Monitoring geotechnical instrumentation installed in the TSF dam embankment and foundation over the life of the Project. The instrumentation will be monitored to assess embankment performance and to identify any conditions different to those assumed during design and analysis. Amendments to the on-going designs and/or remediation work can be implemented to respond to the changed conditions, should the need arise.

Runoff water quality monitoring will be conducted as described in the Site Water Monitoring and Management Plan and will be prescribed in the Type A Water Licence. For details on TSF monitoring during closure, please see the Mine Closure and Reclamation Plan.

8. Mitigation and Adaptive Management

Additional mitigation or adaptive management may be required as an outcome of monitoring activities described in Section 7. This may include changes to TSF or TF operation as a result of operational, engineering, and environmental monitoring.

9. Checking and Corrective Action

The General Manager or designate will conduct checks of the monitoring activities and any trends in the data collected. Corrective action will be undertaken if mine waste management is not being conducted in accordance with this plan or any SOPs developed for tailings management.

10. Record Keeping

Record keeping will be conducted by the site environmental compliance supervisor. Field and laboratory data will be entered into suitable electronic databases and checked for quality control.

11. Environmental Reporting

Environmental reporting will be conducted as identified in future permits, approvals, and authorizations relevant to mine waste management. The Type A Water Licence is expected to be the primary regulatory instrument governing mine waste management for the Project.

12. Plan Effectiveness

The General Manager and Environmental Superintendent will conduct an evaluation of the Plan and its effectiveness on an annual basis. This plan may be updated as required if additional methods for construction, operation, maintenance, and monitoring are found to be more appropriate.

13. Quality Assurance / Quality Control

Quality Assurance / Quality Control for the tailings monitoring program will include the preparation of Standard Operating Procedures (SOPs) developed for mine waste management operations, and auditing operations against this plan and any relevant SOPs.

References

1985. *Fisheries Act*. R.S.C. 1985, c. F-14.

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Appendix A

Tailings Storage Facility Drawings

Sabina
GOLD & SILVER CORP.

TSF Containment Dam

N

N 7267500

N 7267000

N 7266500

E 434500

E 435000

E 435500

E 436000

295

298

300

302

304

305

306

308

310

315

320

Stage 3 (El. 306m)

Stage 2 (El. 310m)

Stage 1 (El. 307m)

South Dyke

LEGEND

- Containment Dam
- Tailings Surface
- Water El. 305m
- Tailings Discharge Point

0m 50 100 150 200 250 300

1 : 7500

srk consulting

SRK JOB NO.: 1CS020.008

FILE NAME: BR-TMSD FIGURE 6.dwg

Sabina GOLD & SILVER CORP.

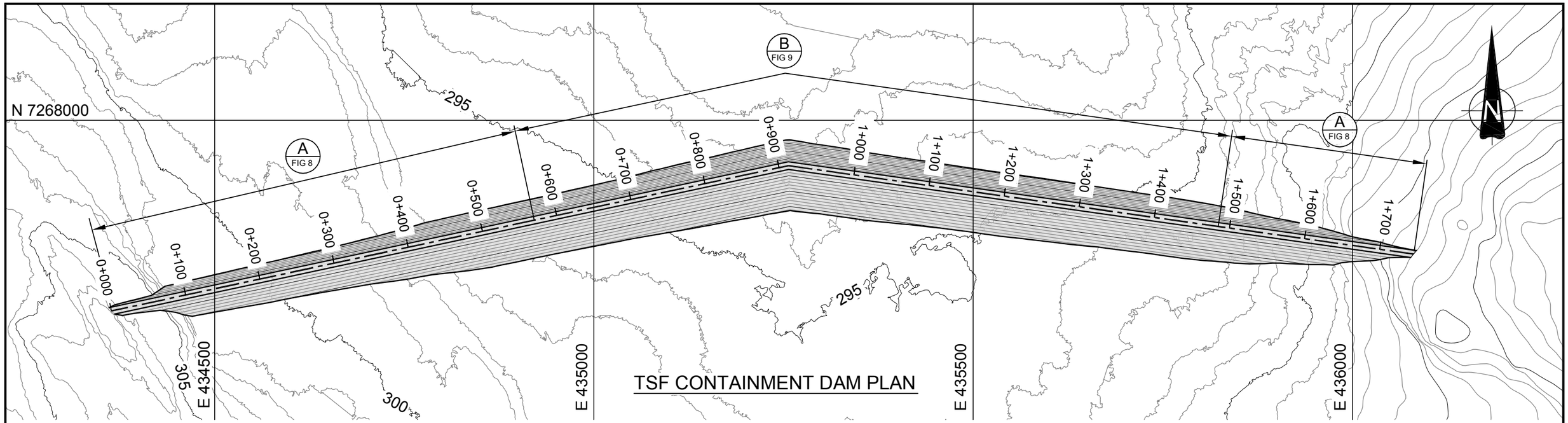
BACK RIVER PROJECT

PRELIMINARY TSF DESIGN

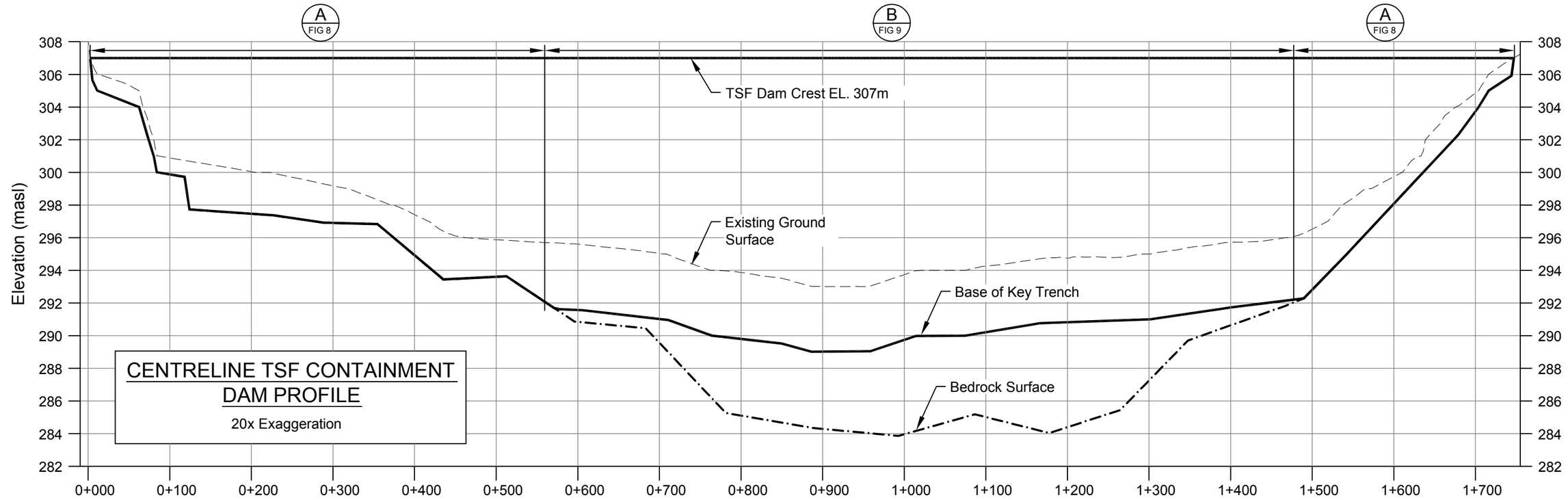
Final Tailings Site Plan

DATE:	APPROVED:	FIGURE:
SEPT. 2015	IM	1

C:\MD\DSI\NC\CLIENTS\SRK\2014\BACK RIVER TAILINGS\DRAWINGS\FIGURES SEPT 2015\BR-TMSD FIGURE 6.dwg



TSF CONTAINMENT DAM PLAN



CENTRELINE TSF CONTAINMENT DAM PROFILE

20x Exaggeration

0m 50 100 150 200
1 : 5000 (Horizontal Scale)

0m 2 4 6 8 10
1 : 250 (Vertical Scale)

srk consulting

SRK JOB NO.: 1CS020.008

FILE NAME: BR-TMSD -FIGURE 7-11.dwg

Sabina GOLD & SILVER CORP.

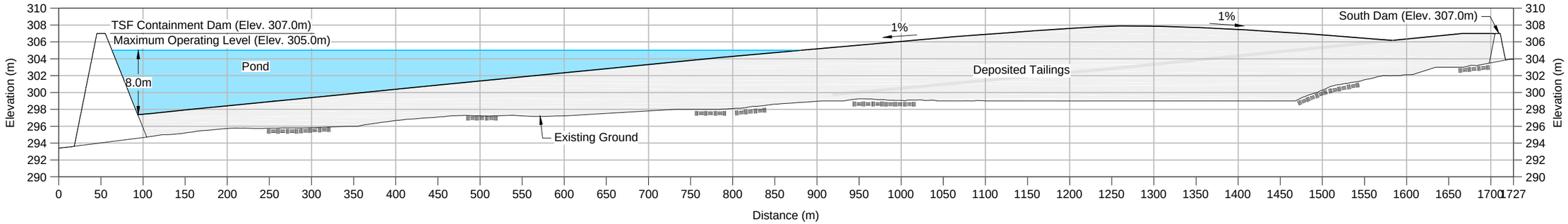
BACK RIVER PROJECT

PRELIMINARY TSF DESIGN

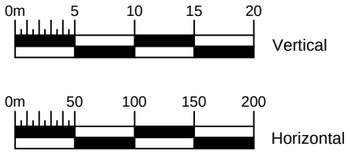
TSF Containment Dam Plan and Elevation

DATE:	APPROVED:	FIGURE:
SEPT. 2015	IM	2

C:\MD\SIN\C\CLIENTS\SRK\2014\BACK RIVER TAILINGS\DRAWINGS\FIGURES SEPT 2015\BR-TMSD_FIGURE 7-11.dwg



BB' 3 PROFILE SECTION



NOTES

1. Maximum depth of pond is approximate 8.0m, which is located at the west abutment of the TSF Containment dam.
2. Available pond capacity at the end of operations is 2.9Mm³.

srk consulting	Sabina GOLD & SILVER CORP.	PRELIMINARY TSF DESIGN
SRK JOB NO.: 1CS020.006 FILE NAME: 1CS020.008 - Typ XS.dwg	BACK RIVER PROJECT	Typical Cross Section DATE: Oct. 2015 · APPROVED: TPP · FIGURE: 3

\\VAN-SVR0\van\na.srk.ad\Projects\01_SITES\Black River\1CS\020.008_FEIS\080_Deliverables\FEIS Chapters\Tailing\pt\Appendix A_Drawings\1CS020.008 - Typ XS.dwg

23. Socio-economic Monitoring Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Socio-economic Monitoring Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 23	Appendix V10-23A	Draft TOR for Socio-economic Monitoring Program	Addition of new appendix.
	1	Introduction	Collaborative process for development of the draft SEMP TOR (new appendix) identified and reference to new appendix added to text of SEMP.
	1	Introduction	Statement added on Sabina's ongoing participation in the Kitikmeot SEMP.
	2	Scope and Objectives	Statement added on how IQ will be considered/ incorporated into the monitoring program.
	4	Roles and Responsibilities	Statement added on Sabina's ongoing participation in the Kitikmeot SEMP, with specific reference to aspects of Population Demographics and Community Infrastructure.
	5	Monitoring Program	Statement added to confirm membership of the Back River Project Socio-economic Monitoring Committee (SEMC).
	5.1	Scope of Monitoring Program	Statement added on commitment to socio-economic monitoring throughout all phases of the project/ post final closure (and corresponding deletion of previous inconsistent text).
	5.2	Approach to Monitoring	Statement added on how IQ will be considered/ incorporated into the monitoring program.
	5.3	Indicator Selection, Rationale and Assumptions	Statement added to confirm membership of the Back River Project Socio-economic Monitoring Committee (SEMC).
	Table 5.3-1	SEMP Indicators	Indicator added on "number of employees who relocate including community of origin and destination", re: housing demand.
	5.3	Indicator Selection, Rationale and Assumptions	Statement deleted referencing subsequent process for development of TOR for SEMP.

BACK RIVER PROJECT
SOCIO-ECONOMIC MONITORING PLAN

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Appendix V10-23A. Back River Socio-economic Monitoring Working Group and Socio-economic Monitoring Program Draft Terms of Reference

1. Introduction

This chapter describes the Socio-economic Monitoring Program (SEMP) that Sabina Gold & Silver Corp. (Sabina) will follow in the development and operation of the Project. The SEMP, and other management plans, are intended to describe the ways in which Sabina will address or mitigate issues identified in the Final Environmental Impact Statement (EIS).

Sabina has collaborated with the Government of Nunavut (GN), Aboriginal Affairs and Northern Development Canada (AANDC), and the Kitikmeot Inuit Association (KIA) to develop the "Socio-economic Monitoring Program Draft Terms of Reference" (TOR; Appendix V10-23A). The following SEMP has been informed by and is complementary to the draft TOR.

The SEMP has also been developed in accordance with internal company and government regulatory requirements, and to be aligned with the current efforts of the Kitikmeot Region Socio-economic Monitoring Committee (SEMC). Sabina will continue to participate in the Kitikmeot Region SEMC which is actively engaged in the monitoring of conditions in communities. The SEMP has been further informed by community-based research and a review of literature discussing the lessons learned of other proximally located mine projects. Sabina is committed to managing the social and economic impacts of the Project in such a way so as to maximize potential positive and beneficial outcomes and reduce, or where possible eliminate, negative or adverse effects. To this end, the following SEMP has been developed for the Project.

The SEMP is related to a number of specific management plans developed to respond to, manage and/or mitigate the potential social and economic effects identified in the EIS. The primary socio-economic management plans that have been identified for the Project include the following:

- Business Development Plan (Volume 10, Chapter 24).
- Human Resources Plan (Volume 10, Chapter 28.
- Community Involvement Plan (Volume 10, Chapter 26).

The development and effective implementation of these management plans depends on good measurement and tracking of socio-economic change. Monitoring is important to confirm baseline status of social and economic conditions in the communities and across the Kitikmeot Region, and to measure and track changes over time. Such monitoring allows for the identification, evaluation and, ultimately, a management response to social and economic changes, as and where appropriate. Monitoring enables Project managers, governments, and community leaders alike to assess the extent to which such changes are related in whole or in part to the development of the Project. In this way, the SEMP supports the effective implementation of management plans for the Project.

2. Scope and Objectives

The SEMP was developed to comply with the relevant sections of the Nunavut Land Claims Agreement (NLCA), and the relevant directives as outlined in the EIS guidelines (NIRB 2013). Beyond regulatory compliance, the purpose of the monitoring program is to help ensure that the Project fulfills best practices in social responsibility as it relates to community engagement, capacity building, and realization of benefits from the Project, especially for Inuit. Equally, monitoring will provide relevant

and timely information to enable Project managers, governments, and community leaders to respond proactively to potential risks and adverse socio-economic effects. Data and analysis generated by the monitoring program will support an adaptive management approach.

This report describing the SEMP is a "living document". It will be regularly updated based on management reviews, incident investigations, regulatory changes, or other Project-related changes. The SEMP may be revisited and updated or adapted on an annual basis. As Sabina works to address impacts and enhance benefits identified over time, changes may be made to this program to better achieve desired outcomes. The adaptive management strategy enables engaged parties to instigate change where required and to employ the use of new data and best practices as they become available, using information generated by the monitoring program throughout the life of the Project.

In support of these broad aims, there are three overarching objectives of the monitoring program:

1. Verify the accuracy of key predictions made in the EIS with respect to the direction and magnitude of socio-economic effects, gauge the efficacy of mitigation measures, and facilitate early identification of any unanticipated effects.
2. Contribute to and support adaptive management through evaluation of planned mitigation measures. Monitoring results will be used to provide a basis from which to develop additional or alternative mitigation plans in cases where initial mitigation measures are insufficient or ineffective.
3. Help ensure that, wherever possible, the monitoring program design and methodologies themselves are culturally appropriate and relevant to the issues and concerns of local Inuit, including respect for the confidentiality of certain socio-economic information. In part, this objective will be achieved by the consideration and incorporation of Inuit Qaujimajatuqangit (IQ, or Inuit knowledge) into the SEMP, when and as appropriate. The appropriate incorporation of IQ will be guided by and determined in consultation with the Back River Project SEMC.

3. Applicable Legislation and Guidelines

3.1 SABINA OPERATING RULES AND PRACTICES

Sabina is committed to contributing to the social, cultural, and economic development of sustainable communities near our operations. To this end, socio-economic monitoring is important to:

- Help ensure that the Project impacts and benefits are being realized according to or better than predicted.
- Inform adaptive management should changes be required to Project activities, such that Project benefits are maximized and adverse effects on communities are minimized.

Sabina supports the sharing of monitoring information with governments, communities, and other stakeholders, and their participation in evaluating and responding to changing socio-economic conditions.

3.2 GOVERNMENT LEGISLATION AND POLICIES

Article 12, Part 7 of the NLCA provides for the establishment of a project-specific monitoring program as part of the terms and conditions contained in a NIRB Project Certificate. Subsection 12.7.2 describes the purpose of such a monitoring program as:

a. to measure the relevant effects of projects on society, the economy, and ecosystems in the Nunavut Settlement Area;

b. to determine whether or not and to what extent the land or resource use in question is carried out within the predetermined terms and conditions; and

c. to assess the accuracy of the predictions contained in the project impact statements.

The NIRB requirements specific to the environmental assessment of the Project are defined in the final EIS guidelines for the Back River Project (NIRB 2013). This SEMP was developed in anticipation of their being a requirement for the development of a Project-specific SEMP, consistent with current practice in Nunavut.

4. Roles and Responsibilities

Implementation of the SEMP, as well as on-going performance evaluations, updates or revisions to the SEMP, will be the responsibility of the Manager of Community Affairs or similar position, or another designated management personnel with requisite skill set and experience. The Manager of Community Affairs may also delegate responsibility for specific components of the SEMP to other personnel. Other supporting roles and responsibilities of staff will be identified during implementation based on needs.

Sabina is committed to regular engagement of the NIRB, Community Advisory Groups, the Back River Project SEMC, the Kitikmeot Region SEMC, the Kitikmeot Inuit Association (KIA), and Kitikmeot communities and seeking feedback on potential areas for improvement in the SEMP over the life of the Project. The Kitikmeot Region SEMC is actively engaged in the monitoring of conditions in communities, including aspects of Population Demographics and Community Infrastructure and Public Services. Sabina will continue to participate in this ongoing initiative. In this regard, the role of these organizations, community stakeholders, and the public is important to support continual improvement and adaptive management.

5. Monitoring Program

The monitoring program is for use by the Manager of Community Affairs and the Back River Project SEMC, in collaboration with the Manager of Procurement and the Manager of Human Resources, as a means to track the accuracy of impact predictions and to guide implementation and, when necessary, the modification of various mitigation and adaptive management measures. As described in the draft TOR for the SEMP (Appendix V10-23A), the Back River Project SEMC will be comprised of individuals representing Sabina, the GN, the Government of Canada (AAANDC), and the KIA. This section outlines the scope and approach of the monitoring program.

5.1 SCOPE OF MONITORING PROGRAM

The scope of the SEMP includes both spatial and temporal dimensions. The spatial boundaries for monitoring socio-economic effects reflects the communities and region of the local study area (LSA) and the regional study area (RSA) as defined for the Socio-economic Effects Assessment (Volume 8, Chapter 3). For consistency, indicators will be developed in line with the jurisdictions for which necessary data and statistical information are collected and tracked. For the purposes of this program, data will be tracked, whenever possible, at the local level for both the Project itself and for the communities identified in the LSA. Regional data will be collected, tracked, and monitored, where relevant and available, for both the Kitikmeot Region and for Nunavut as a whole.

Through the SEMP and annual reporting to NIRB, Sabina commits to socio-economic monitoring throughout all phases of the Project as long as there is a reasonable expectation of Project-related impacts to the socio-economic environment. The temporal extent of the monitoring program will include construction, operation, and reclamation and closure phase, as well as temporary closure and care and maintenance phases of the Project. Regular and systematic collection of data will take place annually. Analysis and reporting will be done on an annual basis or as required by NIRB. The socio-economic monitoring program will continue for no less than three years post final mine closure, as specified within the draft TOR (Appendix V10-23A).

5.2 APPROACH TO MONITORING

The SEMP is organized according to the valued socio-economic components (VSECs) established for the EIS and, where possible, aligned with reporting practices used by the Kitikmeot Region SEMC. Central to the monitoring program is the identification of appropriate indicators that can be used to measure and track changes in social and economic conditions (i.e., community characteristics/components) especially with respect to those that may in whole or in part be a result of or in response to impacts and effects of the Project.

The monitoring program relies on quantifiable measures of social and economic components or phenomena. Official government statistics and census data will be the primary sources of data for indicators related to the territory, region or communities including, for example, demand on social services, crime statistics, or migration patterns. Sabina will collect data related to Project-specific information such as employment numbers and lost-time incidents. The Government of Nunavut tracks a variety of data, much of which is used by the Kitikmeot Region SEMC in their reports (Kitikmeot Socio-Economic Monitoring Committee n.d.). The current program will also draw on Government of Nunavut data for consistency with Kitikmeot Region SEMC reporting. Proponent generated data will help to isolate specific effects and changes related to the Project.

The indicators will consist of measureable criteria that can be linked either directly or indirectly to potential Project effects. Where possible, the focus will be on those effects of greatest interest or concern to communities, and appropriate indicators will be linked to various policies, guidelines, or other initiatives put forth by Sabina so as to be able to measure and track the efficacy of such efforts.

The proposed monitoring program, in keeping with the Kitikmeot Region SEMC and industry practice, is built around quantifiable phenomena which are assumed to give an objective, value-free measure of change. Quantifiable metrics, as noted, are generally proxies for potentially less tangible aspects of social or economic change. It is desirable to support the use of quantifiable indicator data and trends with input and feedback from key stakeholders. Information collected through the activities of the Community Involvement Plan (Volume 10, Chapter 26) will add important qualitative detail and context necessary to ensure the reliability and accuracy of both the selection of specific indicators

and the interpretation of trends and results. In addition, the participation of individuals on the Back River Project SEMC, including the KIA, is expected to facilitate the consideration and inclusion of IQ throughout the socio-economic monitoring process and in subsequent reporting. Discussion to identify opportunities to consider and include IQ within the monitoring process will be an important function of SEMC.

5.3 INDICATOR SELECTION, RATIONALE, AND ASSUMPTIONS

The proposed indicators for the SEMP, and the corresponding social or economic phenomena that are to be measured or tracked, are defined in Table 5.3-1. These metrics are selected as a proxy measurement of potential changes in community characteristics or components that may be linked to the activities of the Project. For each indicator, the adjacent cells in Table 5.3-1 provide brief description of: 1) the objective of the indicator or rationale behind its selection; 2) the key source for associated data including the responsible body or organization; and 3) the level of analysis appropriate and/or available for each indicator. In this context, the territorial level refers to Nunavut, the regional level refers to the Kitikmeot Region, and the local level reference to the presentation of data for each of the Kitikmeot Region communities.

Indicators are used within each framework element to characterize community impacts. Indicators were selected based on a number of criteria:

- The link between the indicator and impact of concern.
- The correspondence of the indicator to community and corporate values.
- The sensitivity of the indicator to changes in socio-economic conditions.
- The ability of the indicator to be measured accurately.
- The feasibility of data collection from existing sources.
- The adequacy of spatial and temporal coverage.
- The ease of interpretation of the results.

The selected indicators are used to identify potential community development changes of concern, not to fully characterize those changes or explain the reasons behind the observed changes. Changes in monitored elements of the community may be directly or indirectly as a result of Project activities, or may ultimately be unrelated to the Project. As is the purpose of a monitoring system, the indicators are used to identify areas of potential concern for further investigation.

Selection of the indicators provided below is based on past experience and examples from other Projects in the Kitikmeot Region and the initiatives of the Kitikmeot Region SEMC. It must be emphasized that the proposed SEMP indicators are subject to revision prior to finalization. It is anticipated that a Back River Project SEMC will be established, including definition of an operational TOR (Appendix V10-23A), with membership from Sabina, the GN, AANDC, and the KIA. In collaboration with the NIRB and the Back River Project SEMC, the selected indicators, data sources and collection methods, and analysis methods will be confirmed. This will help ensure that the indicators are appropriate and complete, where possible, and capable of measuring socio-economic changes in the communities that are of concern to stakeholders.

Table 5.3-1. Back River Project Socio-economic Monitoring Program Indicators

VSEC	Sub-component	Indicator	Rationale/Objective	Data Source	Level of Data Collection
Economic Development	Territorial, Regional, and Local Growth	Total annual spending on direct employment (payroll)	Overall economic benefit of the Project, contribution to territorial, regional, and local economies	Sabina Gold & Silver	Total, territorial, and regional
		Total annual spending on direct employment (payroll) by Kitikmeot community			By community
		Total annual spending on contracts and supplies			Total
		Total number, value, and percentage of contracts awarded to Inuit-owned businesses			Total, territorial, regional, and by community
Employment	Direct Employment	Number of persons directly employed with the Project	Changes to the levels of employment in the region and the general economic benefit of the Project	Sabina Gold & Silver	Territorial, regional, and by community
		Number of person days worked by all employees			
		Number of person days worked by Inuit employees			
		Percentage of direct employees by gender	Gender equity in project employment		
		Number of Inuit employees from the Kitikmeot Region and the number of Inuit employees from elsewhere in Nunavut	Preferential hiring of and economic benefit to Kitikmeot and Nunavut Inuit		
		Percentage of Inuit in each job category			
Business Opportunities	Direct Employment and Procurement	Total value of contracts awarded to Inuit-owned businesses	Local and regional economic benefits of the Project to Inuit-owned businesses	Sabina Gold & Silver	Total, territorial, regional, and by community
		Number of contracts, including percentage of total contracts, awarded to Inuit-owned businesses			
		Total value of contracts awarded to business in the Kitikmeot Region	Local and regional economic benefits of the Project to the Kitikmeot Region		
		Number of contracts, including percentage of total contracts, awarded to businesses in the Kitikmeot Region			

(continued)

Table 5.3-1. Back River Project: Proposed Socio-economic Monitoring Program Indicators (continued)

VSEC	Sub-component	Indicator	Rationale/Objective	Data Source	Level of Data Collection
Education and Training	Capacity Building and Employee Retention	Number of Inuit filled apprenticeships supported by Project	Commitment to local, Inuit education and training/building community capacity	Sabina Gold & Silver	Total, regional, and by community
		Number of employees that complete on-the-job training courses	Commitment to provide training and increase employee retention		Total and by community
		Number of Inuit employees that complete on-the-job training courses			
		Number of person-courses completed by employees by type of course	Commitment to provide opportunities for career advancement and to increase employee retention		Total and by community
		Number of person-courses completed by Inuit employees by type of course			
		Average number of years of mining experience as a result of the Project	Changes to the work experience of the local and regional workforce		Total and by community
		Number of high school graduates by community	Changes to high school completion rates	Nunavut Bureau of Statistics	By community
		NAC enrollment by program type and campus	Changes to demand for education and training	NAC	Regional and by community
Health and Community Well-being	Delivery of Health Care and Social Services	Number of annual health centre visits by community	Changes to demand on health care and service providers	Nunavut Bureau of Statistics	Regional and by community
		Proponent use of community Emergency Health Services (EHS) by Project employees and/or contractors		Sabina Gold & Silver	Total and by community
		Number and percentage of direct employees that are Kitikmeot residents by community	Population stability and demographic changes		Regional and by community
		Total number of police calls by community	Changes to demand on police services	Nunavut Bureau of Statistics	By community
		Total value of social assistance by community	Promote levels of self-reliance		Regional and by community

(continued)

Table 5.3-1. Back River Project: Proposed Socio-economic Monitoring Program Indicators (completed)

VSEC	Sub-component	Indicator	Rationale/Objective	Data Source	Level of Data Collection
Health and Community Well-being *(cont'd)*	Individual Lifestyle and Family Structure and Function	Inuit employee retention rate	Maintenance of long-term employment within Inuit culture and lifestyle	Sabina Gold & Silver	Total, Regional, and by community
		Utilization rate of Employee and Family Assistance Program (EFAP)	Demand and need for support services		Total and by community
		Total annual dollar value of the sale of alcoholic beverages	Positive changes to consumption and spending patterns	Nunavut Bureau of Statistics	Kitikmeot Region
		Total annual impaired driving and drug violations by community	Positive changes to individual lifestyle		By community
	Family Well-being and Food Security	Number of employees who relocate including community of origin and destination	Demand and need for housing	Sabina Gold & Silver	By community
		Number of annual lost time incidence	Occupational health and safety of Project related work	Sabina Gold & Silver	By community
		Overall annual crime rate and type	Change to levels of crime and number of police incidents in Kitikmeot communities	Nunavut Bureau of Statistics	By community
		Revised Northern Food Basket (RNFB)	Stabilize consumer prices	Nutrition North	By community
Subsistence Economy and Land Use	Traditional Land Use	Average number of days on the land per Inuit employee (while not on shift)	Maintain or enhance traditional land use by Project employees	Sabina Gold & Silver	Project level
		Number of times unauthorized use of Project roads reported	Prevent increase in access to land using Project roads		Project level
		Number of times land users utilized Project camp facilities	Maintain or enhance traditional land use		Project level

References:

Consolidation of Economic Development Agreements Act (1988)
GN Department of Economic Development and Transportation. n.d. Strategic Investments Program Policy.
Miscellaneous Statutes Amendment Act (2011), No. 3

Of the 39 indicators proposed for the monitoring program, the Project will provide data for 30 indicators. The remaining 9 indicators will be based on Government of Nunavut data, Nunavut Arctic College (NAC), Nutrition North Canada, and/or data obtained from the federal government, primarily through Statistics Canada Census data, as provided and reported by the Kitikmeot Region SEMC initiative.

5.4 INTERPRETATION, EVALUATION, AND REPORTING

Interpretation and analysis of indicator data is a core dimension of the Back River Project SEMP and requires rigorous evaluation of assumptions. One of the key challenges will be to determine the meaning of change. That is, does a particular change in the indicator variable or metric indicate a change for the better or worse? What is the relative influence of the Project as a driver of change in any one or series of indicator data? Technical expertise and traditional/community knowledge and experience will inform the analysis of indicator data and the interpretation of trends.

In the Kitikmeot Region SEMC Fall 2012 Report (GN DED&T 2013), committee members stated a preference for information on rates and trends to assist with the comparability of indicator statistics. There is also a preference for community-level data over more general territorial data when possible, although the availability of community data is more limited and dependent on what is published and available from government.

As far as is possible, reporting will be consistent with the format and approach developed by the Kitikmeot Region SEMC for efficiency and comparability. In the monitoring report, indicators will be defined in plain language including what is being measured, how it is being measured, and the meaning and reliability of the findings. Where appropriate, results from the monitoring program will be discussed and assessed in the context of community development goals and anticipated stakeholder benefits as these relate to specific commitments and expected outcomes from the Project.

The findings of the SEMP will be reviewed in collaboration with other members of the Back River Project SEMC, as well as to the larger Kitikmeot Region SEMC, and will be used to inform modifications and updates of the SEMP as necessary. Internally, the findings of the SEMP will also be reviewed by the Manager of Community Affairs, Manager of Procurement, and Manager of Human Resources with respect to the use of the SEMP to monitor the performance of Project mitigation and management plans. Key findings and recommendations will be incorporated into an annual report to the NIRB. Reporting of monitoring results will also be provided to the Back River Project SEMC and the Kitikmeot Region SEMC. The monitoring report will be produced on an annual basis and distributed in electronic and hardcopy format to all stakeholders and interested parties.

The SEMP has been developed to help ensure that the Project fulfills best practices in social responsibility as it relates to community engagement, capacity building, and realization of benefits from the Project, especially for Inuit. Equally, monitoring will provide relevant and timely information to enable Project managers, governments, and community leaders to respond proactively to potential risks and adverse socio-economic effects.

Sabina recognizes that the Project will present Inuit communities with both substantial opportunities as well as changes to current social and economic conditions. Sabina is committed to implementing measures to enhance the benefits of the Project for individuals residing in the Kitikmeot Region communities. Mitigating existing and potential impacts, and promoting individual, family, and community well-being is a shared responsibility of Sabina, the KIA, the hamlets, and the Government of Nunavut. Commitments to enhance regional employment and training and the provision of community programs and services to enhance community well-being do not impose responsibility on Sabina to assume the role of government. Sabina will cooperate in these efforts. For the benefits of

the Project to be fully realized at the local level the communities must be engaged in the implementation of strategies to build capacity to enhance well-being, which contributes to the ability of communities to deal with current and future challenges and to retain the benefits beyond the life of the Project. There is inherently some uncertainty associated with predicting the social impacts prior to the implementation of Project activities. Sabina will work to address impacts and enhance benefits as they are identified over time. Adaptive management as a method used for the creation and implementation of management plans and the monitoring program enables the engaged parties to instigate change where required and to employ the use of new data and best practices as they become available. Data and analysis generated by the monitoring program will support an adaptive management approach within each of the plans. Further, the adoption of adaptive management practices enables the engaged parties to adjust plans based on the findings of the monitoring program throughout the life of the Project.

6. Summary

The Project aims to provide employment that will attract, develop, and retain qualified personnel, and business opportunities that support the development of suppliers in the region's communities, while supporting the health and well-being of Kitikmeot Region communities and the continuation of traditional activities and practices. The SEMP details methods and indicators for use in tracking the results and outcomes of the Business Development Plan, Human Resources Plan, and Community Involvement Plan, as well as other aspects of socio-economic performance. This SEMP incorporates the monitoring of all three plans and aligns with existing regional monitoring in Nunavut.

The objective of the SEMP is to collect and analyze information on socio-economic conditions and trends to inform the ongoing management and mitigation of the potential social and economic effects identified in the EIS and to facilitate best practices in social responsibility as it relates to community engagement, capacity building, and realization of benefits from the Project. The monitoring program is based on an approach of adaptive management designed to enable Project managers and community leaders to respond proactively and in a timely manner to any undesirable changes to socio-economic conditions.

References

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Appendix V10-23A

Back River Socio-economic Monitoring Working Group and Socio-economic Monitoring Program Draft Terms of Reference

Sabina
GOLD & SILVER CORP.

Date: July 28, 2015

BACK RIVER SOCIO-ECONOMIC MONITORING WORKING GROUP
AND
SOCIO-ECONOMIC MONITORING PROGRAM

DRAFT TERMS OF REFERENCE

1. PURPOSE

1.1 This document sets out Terms of Reference for the Back River Socio-Economic Monitoring Working Group (the "Working Group") in their activities in the Back River Socio-Economic Monitoring Program (the "Program"). This Working Group aims to support the Kitikmeot Socio-Economic Monitoring Committee's (KtSEMC) regional monitoring initiatives through the development of the Program. Working Group members will contribute to the work of the KtSEMC through identification of areas of mutual interest and socio-economic monitoring priorities related to the Back River Gold Project (the "Project"), communities, and the Kitikmeot region as a whole.

1.2 The Program is designed to meet the intent of Article 12, Part 7 of the Nunavut Land Claims Agreement. From a socio-economic monitoring point of view, the Program is primarily concerned with fulfilling sections 12.7.2.a and 12.7.2.d:

> *(a) to measure the relevant effects of projects on …. socio-economic environments of the Nunavut Settlement Area;*
> *(d) to assess the accuracy of the predictions contained in the project impacts statements.*

1.3 The Working Group aims to fulfill the Terms and Conditions set out in the Back River Project Certificate that relate to socio-economic monitoring.

2. WORKING GROUP MEMBERSHIP AND MEMBER ROLES AND RESPONSIBILITIES

2.1 The Working Group will include as members:

a. Sabina Gold & Silver Corp. (Sabina) or the current owner/operator of the Project;
b. Government of Nunavut;
c. Government of Canada; and
d. Kitikmeot Inuit Association.

2.2 Each member organization is responsible for their own costs of participating in activities of the Working Group.

2.3 Role of Sabina or current owner/operator of the Project:

a. Identify indicators and share project-specific data that contribute to the Program, and which contribute to priorities identified by KtSEMC, where appropriate;
b. Participate in the analysis of data arising from collaborative monitoring;
c. Review the effectiveness of socio-economic mitigation measures;

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d. Participate and prepare presentations of project-related monitoring results for the KtSEMC.

2.4 Role of the Government of Nunavut:

a. Identify indicators and share data that contribute to the Program, and which contribute to priorities identified by the KtSEMC, where appropriate;
b. Participate in the analysis of data arising from collaborative monitoring;
c. Participate in the analysis of effectiveness of socio-economic mitigation measures.

2.5 Role of the Government of Canada:

a. Work with the Working Group to align indicators and share relevant data from the Nunavut General Monitoring Plan (NGMP);
b. Participate in the analysis of data arising from collaborative monitoring;
c. Participate in the analysis of effectiveness of socio-economic mitigation measures.

2.6 Role of the Kitikmeot Inuit Association:

a. Identify indicators and share data that contribute to the Program;
b. Participate in the analysis of data arising from collaborative monitoring;
c. Participate in the analysis of effectiveness of socio-economic mitigation measures.

2.7 Protection of Personal Information

It is recognized that, in collecting and sharing of any information and data under these Terms of Reference, each of the members of the Working Group is required to comply with any rules governing the collection, use, and disclosure of personal or commercial information, applicable to each member respectively, in accordance with applicable legislation or any legal agreements that may be in place.

2.8 Information

The parties acknowledge that:

a. Sabina is best able to collect and provide data concerning workforce demographics, employment, and training, as well as procurement, in relation to the Project;
b. the Government of Nunavut and the Government of Canada are best able to report public statistics on health and well-being, food security, demographics and other socio-economic indicators at the community and territorial level; and
c. the Kitikmeot Inuit Association is best able to provide information and data relating to Inuit land use and culture at the community and regional level.

3. OBJECTIVES

3.1 The Working Group aims to create a monitoring program and to undertake collaborative monitoring in order to identify and access priority data that will be useful in improving the

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socio-economic outcomes of the Project. This will involve combining Project-specific performance data with data generated by other member agencies. The resulting insight will be useful in supporting adaptive management measures implemented by member agencies to minimize adverse effects and maximize benefits from the Project.

3.2 The goals will be to: analyze the monitoring data in order to verify the accuracy of socio-economic impact predictions in the Back River Final Environmental Impact Statement (FEIS) and assess the effectiveness of current practices to mitigate adverse effects and enhance positive impacts of the Project; obtain early warning should mitigation of adverse effects or measures to enhance positive impacts not be achieving their intended outcome; and provide timely detection of unanticipated outcomes.

4. PROGRAM FRAMEWORK

4.1 In order to fulfill project-specific monitoring obligations and to verify impact predictions contained in the FEIS, the Working Group will endeavour to:

a. Review impact predictions for each Valued Socio-Economic Component contained in the Back River FEIS.
b. Select indicators to determine predicted changes (for example, up/down, toward/away from expectation, magnitude, etc.).
c. Gather the most recent data available for selected indicators to create a baseline, should the data provided in the FEIS not be current, for understanding future impact predictions and trends.
d. Regularly collect data needed to verify impact predictions. Project-specific data is expected to be generated by the Proponent. Other information will be acquired from external sources.
e. If under the advice of the Working Group, the indicator data is considered not sufficient to verify impact predictions, provide advice to the Company with respect to additional data collection and analysis that may include qualitative data collection (e.g., employee satisfaction or exit surveys, traditional lifestyle questionnaires, community wellness focus groups, etc.), in an attempt to gain additional community level perceptions, comments, and information on the Project, and it's predicted impacts.
f. Analyze all collected information and based on the information collected for the SEMP assess the accuracy of impact predictions as contained in the Back River FEIS, as well as the positive and negative impacts of the Project on the affected communities.
g. Provide advice with respect to mitigation through adaptive management in the event of unanticipated impacts. This shall be developed through a consultation process for which all members of the Working Group are invited to participate.
h. Report to the KtSEMC to ensure efforts are consistent and regional priorities are incorporated as relevant, as well as communicating with regional stakeholders on Project-specific monitoring/mitigation activities.

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5. Reporting and Communication

5.1 Sabina or the current owner/operator of the Project will prepare an annual socio-economic report, presenting performance data, to the Nunavut Impact Review Board for review. These annual reports will be due on March 31 of each year, containing data on the indicators selected by the Working Group for the previous calendar year (January to December, or the most current data that may otherwise be available). These reports will further describe the Company's participation on the KtSEMC, other collaborative monitoring processes, and any activities related to understanding socio-economic impacts and changes.

5.2 Following Project Certificate issuance and Sabina's decision to proceed with the Project, annual reporting will commence following the start of construction activities.

5.3 As appropriate, the Working Group may communicate with, and request data from, issues-specific working groups that may arise throughout the life of the Project to address specific socio-economic issues.

5.4 Annual socio-economic monitoring reports shall be completed and submitted to the NIRB by Sabina or the current owner/operator of the Project for no less than three (3) years post final mine closure. Any additional reporting will be identified in the Mine Closure Plan and consider the advice of the Working Group.

6. Meetings

6.1 The first official meeting will be held within six (6) months of Project Certificate issuance or at the next KtSEMC following issuance, whichever is first. The Working Group will meet to progress the creation and application of the Working Group and the development of initial project-specific indicators as identified in the Project Certificate.

6.2 The Working Group is to meet preferably twice a year, to correspond to the timing of KtSEMC meetings. Should the KtSEMC meet less frequently than twice a year, alternate Working Group meetings may be arranged if agreed to by all members, and at a minimum should include at least one conference call. This meeting schedule may be changed at a later date if agreed to by all members.

6.3 The GN will designate a Chair and Secretary for these meetings.

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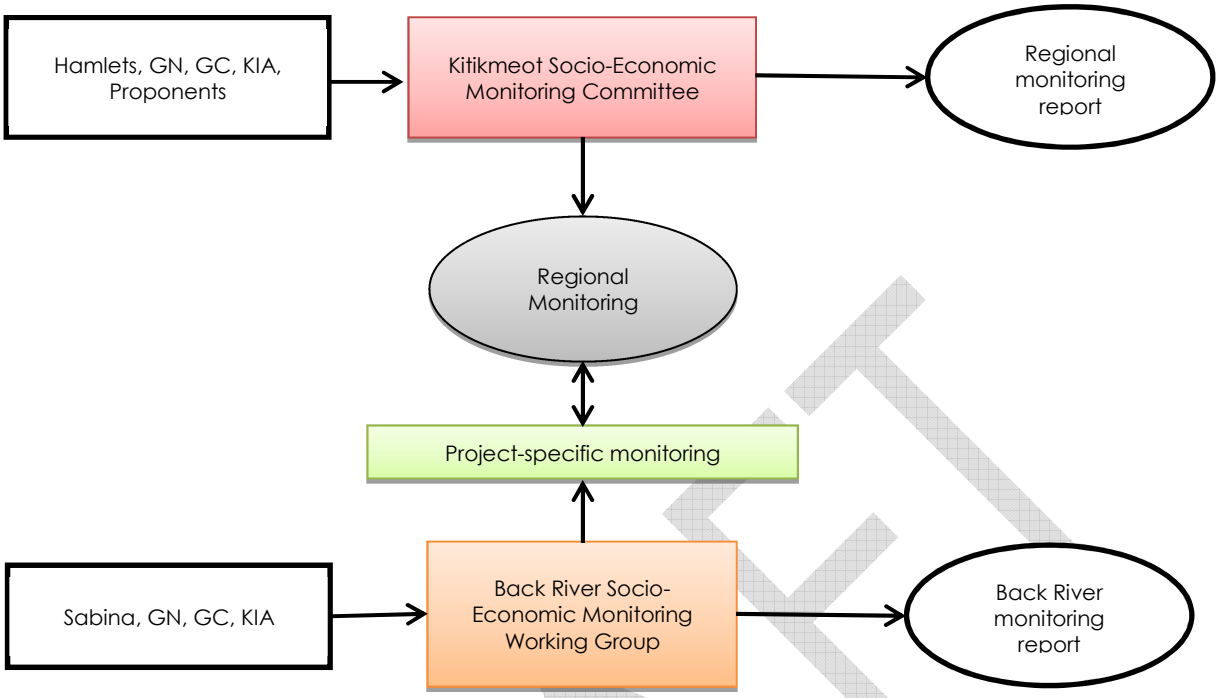

7. PROJECT CLOSURE

7.1 Final Mine Closure

The Working Group, in collaboration with the KtSEMC, will begin socio-economic planning no less than two years before the expected date of final closure. Planning will detail specific measures that may mitigate, at least to some extent, the potential for negative effects as a result of Project closure.

7.2 Premature Mine Closure

In the event of premature (temporary or final) closure of the Project, the Working Group will continue all socio-economic monitoring responsibilities and agree on appropriate measures, to ensure that the impacts of premature closure are managed as best as possible.

8. IIBA PRECEDENCE

8.1 The provisions of the Back River Inuit Impact and Benefit Agreement (IIBA) shall take precedence over these Terms of Reference, and the mandate of the Working Group shall not include the monitoring of the Back River IIBA.

9. REVIEW OF TORS

9.1 These Terms of Reference will be reviewed by Working Group members annually for any required changes that may be applicable as the Project evolves from construction, through operations and closure.

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24. Business Development Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Business Development Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 24	Appendix 1	Business Development Management Plan – Appendix 1: Inuit Business Registry	Updated the Inuit Business Registry
	Appendix 2	Business Development Management Plan – Appendix 2, Kitikmeot Inuit Businesses	Deleted Appendix 2: Kitikmeot Inuit Businesses

BACK RIVER PROJECT
BUSINESS DEVELOPMENT PLAN

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1. Introduction

This chapter describes Business Development Plan (the Plan) that Sabina Gold & Silver Corp. (Sabina) will follow in the development and operation of the Project. This Plan, and other management plans, are intended to describe the ways in which Sabina will address or mitigate issues identified in the Final Environmental Impact Statement (EIS).

The Plan has been developed in accordance with internal company and regulatory requirements. The Plan has been further informed by community-based research and a review of literature discussing the lessons learned of other northern mine projects. The measures set out in the Plan correlate directly to potential socio-economic effects of the Project which were identified during the environmental assessment process (see Volume 8, Chapters 3 and 4 of the Back River Project Draft EIS).

The Plan is a living document and will be regularly updated based on management reviews, incident investigations, regulatory changes, or other Project-related changes. In order to effectively support business development in the Kitikmeot Region, community input and the results of ongoing engagement with local businesses and entrepreneurs will provide additional content to reflect changing realities over the life of the Project. As Sabina works to address impacts and enhance benefits identified over time, changes may be made to this Plan to better achieve desired outcomes. The adaptive management strategy enables engaged parties to instigate change where required and to employ the use of new data and best practices as they become available.

2. Scope and Objectives

The Project aims to provide contract opportunities that will attract, develop and retain effective businesses, and provide business opportunities that support the development of suppliers in the region's communities. The objective of the Plan is to encourage the involvement of local and regional Inuit-owned businesses in Project work to both enhance benefits and to promote the retention of Project benefits with the Kitikmeot Region and within Nunavut.

The Plan has been focused to: 1) ensure regional businesses are aware of the Project and understand Project procurement practices and opportunities; 2) increase the ability of regional businesses to respond to procurement notices and become suppliers to the Project; and 3) maximize contract and subcontract opportunities for regional businesses.

The Project is predicted to positively impact the regional economy and business activities. The Plan is aimed at maximizing benefits in the Kitikmeot Region through contracting opportunities. The specific elements of the Plan include: a Procurement Strategy; a Local Business and Entrepreneur Capacity Building Strategy; and Community-based Investments for Business Development. Sabina will work to implement these strategies over the life of the Project.

The Plan would apply from the time of approval of all required licences and permits to allow construction of the Project to begin. The temporal extent of the Plan will be the life of the Project itself, including construction, operation, reclamation and closure, and temporary closure/ care and maintenance phases.

3. Applicable Legislation and Guidelines

3.1 SABINA OPERATING RULES AND PRACTICES

Sabina supports the sustainable development of the communities that are impacted by its projects. This is enacted through various project plans focused on minimizing adverse effects and enhancing positive effects of the Project. The activities defined by the Plan will help to maximize the regional benefits of procurement. This includes enabling local businesses to respond to bid notices and encouraging the development of local businesses for the realization of long-term economic benefits to the region.

3.2 GOVERNMENT LEGISLATION AND POLICY

Economic development, including business promotion and the provision of support programs to businesses in the Kitikmeot Region, is led by the Government of Nunavut Department of Economic Development and Transportation (GN DEDT).

Economic development in Nunavut was previously guided by the consolidation of the *Economic Development Agreements Act* (1988), adopted in 1999 from the NWT when Nunavut become a territory and amended in 2010. The Act was repealed in 2011 and has not yet been replaced with new legislation. Rather, the Nunavut Economic Forum and Co-Management Committee is spending two years (2012 to 2014) conducting a communication consultation process that aims to explore specific elements that should be included in the next ten year Nunavut Economic Development Strategy (NEDS), slated to be released in 2015.

Relevant government policy and programs includes Nunavut's Development Partnership Agreement (DPA) Policy, Nunavut Economic Development Strategy, and the Small Business Support Program Policy.

Nunavut's DPA Policy sets out the framework for the development of voluntary agreements between the Government of Nunavut and resource companies. DPAs are to set out how proponents and government will work together to help Nunavut, their businesses and their communities benefit from resource development projects in Nunavut. To enable flexibility for the subsequent initiation of DPA negotiations, Sabina will work to negotiate a DPA with the Government of Nunavut that may be linked to any one or more of the following outcomes:

- Education and training for Nunavummiut, resulting in transferrable skills and recognized credentials that will allow them to participate in the economy.
- Infrastructure development and investment (potentially including physical, energy, communications, and organizational infrastructure) that strengthens the community.
- Developing and diversifying local businesses.
- Collecting and sharing information about the local community or region.
- Investing in new or existing programs to build capacity, social well-being, and economic strength of communities to help employees, their families, and the community address challenges that may arise as result of the Project.
- Other benefits identified by relevant stakeholders in the communities and across the Kitikmeot Region.

The Nunavut Economic Development Strategy (NEDS; 2003) is based on four areas prioritized for strategic planning including: 1) the land; 2) the people; 3) the community; and 4) the territorial

economy. This prioritization indicates that respect for the land and the people is first and foremost, and community decision-making and control are placed next in priority, with the Nunavut economy as the final consideration. This approach to strategic planning provides a foundation for the decision-making process that ensures the economy is based on sustainability, families, and communities. The NEDS is currently (2012/2013) under review by Nunavut's Economic Forum with the aim of renewing the NEDS over the next two years.

The GN DEDT's Small Business Support Program Policy includes the Small Business Opportunities Fund and the Entrepreneur Development Fund that support new and expanding small businesses managed by entrepreneurs who have identified promising business opportunities. The fund provides accountable contributions to offset costs associated with a wide range of planning, start-up, expansion, and marketing activities. The fund also provides assistance for small businesses facing viability or wind-down challenges.

In addition, government services are provided to local businesses at the hamlet level through the community Economic Development Officers (EDOs). The EDOs are funded through the GN DEDT and provide a community-level link to the administration of DEDT programs. In addition, EDOs provide other services including assistance in the development of business proposals and plans, referrals to business management, accounting and financial services, and general assistance in accessing necessary licensing, permits, training programs, and funding. At a broader scale, EDOs are responsible for implementing a hamlet's Economic Development Plan. This often includes community-wide initiatives focused on developing and diversifying the local economy with identified specific sectors of focus (e.g., tourism, fisheries development).

A Memorandum of Understanding (MOU) between the Canadian Economic Development Agency and the KIA (2012) confirms the commitment of each party in supporting responsible resource and regional infrastructure development in the Kitikmeot Region through cooperation and respectful engagement. The objective of the MOU is to identify potential opportunities and challenges related to participation in major projects so the Kitikmeot Region can grow and prosper as a result of their involvement.

4. Roles and Responsibilities

Implementation of the Plan, as well as on-going performance evaluations, updates or revisions to the Plan, will be the responsibility of the Manager of Procurement for the Project or similar position, or another designated management personnel with requisite skill set and experience. The Manager of Procurement may also delegate responsibility for specific components of the Plan to other personnel. Aspects of the Plan associated with community investments and donations will be the responsibility of the Manager of Community Affairs (see Community Involvement Plan, Volume 10, chapter 26). Other supporting roles and responsibilities of staff will be identified during implementation based on needs.

Sabina is committed to regular engagement of the NIRB, the KIA, and Kitikmeot communities and seeking feedback on potential areas for improvement in the Plan over the life of the Project. In this regard, the role of these organizations, community stakeholders, and the public is important to support continual improvement and adaptive management.

5. Management Measures

A Socio-economic Monitoring Program (Volume 10, Chapter 23) has been developed to help ensure that the Project fulfills best practices in social responsibility as it relates to community engagement, capacity building, and realization of benefits from the Project, especially for Inuit. Equally, monitoring will provide relevant and timely information to enable Project managers and community leaders to respond proactively to potential risks and adverse socio-economic effects.

In order to support management measures associated with the Plan, a number of Project-specific indicators have been defined to monitor Plan performance and achievement of management objectives with respect to business development and business opportunities (Table 5-1). Thresholds for each indicator will be determined in consultation with the NIRB, Community Advisory Groups, and the Back River Project Socio-economic Monitoring Committee (see Socio-economic Monitoring Program, Volume 10, Chapter 23). Where Project performance is addressed by the Inuit Impact and Benefit Agreement (IIBA), it is anticipated that applicable thresholds will be defined in reference to the provisions of the IIBA. For all indicators, management action will be triggered when annual performance is below threshold. Specific actions will be determined in consultation with the NIRB and the KIA (when applicable to the IIBA). This will involve an evaluation of the existing mitigation and management measures, and identification of appropriate adjustments to the Plan.

Table 5-1. Indicators, Thresholds, and Triggers to Support Management Measures

Valued Socio-economic Component (VSEC)	Indicator	Threshold	Trigger	Suggested Action
Socio-Economics: Economic Development	Total annual spending on direct employment (payroll)	Determined in consultation with the NIRB, Community Advisory Groups, and the Back River Project Socio-economic Monitoring Committee	Annual performance below threshold	Determined in consultation with the NIRB. Evaluate mitigation and apply additional/ adjust mitigation as appropriate.
	Total annual spending on direct employment (payroll) by Kitikmeot community	Determined in consultation with the NIRB, Community Advisory Groups, and the Back River Project Socio-economic Monitoring Committee	Annual performance below threshold	Determined in consultation with the NIRB and the KIA. Evaluate mitigation and apply additional/ adjust mitigation as appropriate.
	Total annual spending on contracts and supplies	Determined in consultation with the NIRB, Community Advisory Groups, and the Back River Project Socio-economic Monitoring Committee	Annual performance below threshold	Determined in consultation with the NIRB. Evaluate mitigation and apply additional/ adjust mitigation as appropriate.
Socio-Economics: Business Opportunities	Total value of contracts awarded to Inuit-owned businesses	Determined in reference to the IIBA provisions.	Annual performance below threshold	Determined in consultation with the NIRB and the KIA. Evaluate mitigation and apply additional/ adjust mitigation as appropriate.

(continued)

Table 5-1. Indicators, Thresholds, and Triggers to Support Management Measures (completed)

Valued Socio-economic Component (VSEC)	Indicator	Threshold	Trigger	Suggested Action
Socio-Economics: Business Opportunities *(continued)*	Number of contracts, including percentage of total contracts, awarded to Inuit-owned businesses	Determined in reference to the IIBA provisions.	Annual performance below threshold	Determined in consultation with the NIRB and the KIA. Evaluate mitigation and apply additional/ adjust mitigation as appropriate.
	Total value of contracts awarded to business in the Kitikmeot Region	Determined in consultation with the NIRB, Community Advisory Groups, and the Back River Project Socio-economic Monitoring Committee	Annual performance below threshold	Determined in consultation with the NIRB. Evaluate mitigation and apply additional/ adjust mitigation as appropriate.
	Number of contracts, including percentage of total contracts, awarded to businesses in the Kitikmeot Region	Determined in consultation with the NIRB, Community Advisory Groups, and the Back River Project Socio-economic Monitoring Committee	Annual performance below threshold	Determined in consultation with the NIRB. Evaluate mitigation and apply additional/ adjust mitigation as appropriate.

6. Monitoring Program

Sabina will track outcomes of the Business Development Plan and report results as described by the Back River Socio-Economic Monitoring Program (Volume 10, Chapter 23).

7. Mitigation and Adaptive Management

7.1 PROCUREMENT STRATEGY

7.1.1 Mitigation and Targeted Outcomes

Sabina recognizes the potential the Project has to positively affect local and regional economic development and is committed to enhancing this potential through both the direct and indirect expenditures through the purchase of goods and services on a competitive basis. Sabina is committed to providing contracting and procurement opportunities within Nunavut and, more specifically, the Kitikmeot Region. An internal policy covering contracting and procurement will be established which will ensure regional businesses receive first opportunity, where competitive. First opportunity hiring and contracting is one means though which Project benefits will remain in the Kitikmeot Region and Nunavut. Sabina is committed to sourcing goods and services needed for the Project locally, where possible. More specifically, a Procurement Strategy will be developed to facilitate regional business

involvement in the Project to maximize benefits. In the evaluation of contract bids, the level of Inuit content will be one of the primary considerations.

In addition, Sabina will support the development of a fund and/or access to expertise and business development models through work with community and other third party partners (e.g., the Nunavut Arctic College, NAC) which may promote economic diversity through the establishment of new businesses with the Kitikmeot Region.

An important part of the Procurement Strategy will be communication of procurement opportunities. Sabina is committed to providing accessible and timely provision of contracting opportunities information to the Inuit-owned businesses and others in the Kitikmeot Region.

Specific commitments for the hiring and contracting of Inuit (e.g., workforce percentages) will be a topic of discussion during IIBA negotiations between Sabina and the KIA. Strategies to enhance the participation of Inuit businesses in contract and subcontract work with the Project are discussed below.

7.1.2 Actions and Adaptive Management

Sabina aims to establish a contracting environment that actively attracts and encourages Inuit firms to contract and subcontract work with the Project, and will work to maximize the contracting and subcontracting opportunities for qualified Inuit firms though the construction, operation, and reclamation and closure phases of the Project. These measures are included with the aim of retaining project specific benefits within the Kitikmeot Region.

To enhance Inuit participation in Project contract work, Sabina will actively target Inuit businesses through the use of the Nunavut Tunngavik Inc.'s (NTI's) Inuit Firms Registry (Appendix 1) and other sources. Contractors will be invited via email to view the Back River Project website (www.backriverproject.com) and express interest in Project work. The Back River Project website is publically available and may house current notifications for upcoming work, as well as notification of work awarded, to promote transparency and accountability. Where Inuit firms have expressed an interest in Project work, Sabina will request a skills and experience inventory to match that company with current and potential future Project contracts. Further communication methods aimed to share information with local and regional business is provided in the Community Involvement Plan (Volume 10, Chapter 26).

Similarly, Sabina will develop an Inventory of Regional Suppliers able to provide goods and/or services required by the Project. Sabina will also, where appropriate, provide early notice of opportunities within a specified timeframe to so that Inuit firms have an extended period to develop proposals. The inventory of suppliers will be in the form of a Supplier Prequalification List that will include those suppliers that have been pre-screened for meeting standard supplier requirements (e.g., health and safety, management systems).

In the evaluation of all bids, the extent to which Inuit beneficiaries will be employed and/or Inuit-based businesses will be used (either as the proposed prime contractor or as a subcontractor) will be included in evaluation criteria. Those pre-qualified suppliers that employ Inuit beneficiaries will be given preference over suppliers who employ non-residents. In addition, those awarded contracts with the Project will be encouraged to use the Supplier Prequalification List to identify potential indirect suppliers or subcontractors for procurement opportunities. This will be a full and fair opportunity for suitable and registered regional companies to bid for the supply of Project good and services.

Sabina will work to ensure access to information related to contracting opportunities are available to regional business and will provide information sessions that assist regional businesses in understanding how to access their opportunities through the use of an online information sharing system that provides transparent and consistent information such as: qualifications requirements, health and safety requirements, current and future supply opportunities, quality and business conduct expectations, and required technical standards. This information sharing system will be based within Sabina's Back River Project website. Sabina will also host group presentations or workshops, as requested, to enable better understanding of business opportunities, standard supplier requirements, and the process of obtaining Project contracts. Sabina will also communicate information on procurement practices, requirements, and opportunities to businesses through print and electronic means (e.g., email distribution). In sum, these workshops aim to assist Inuit firms in obtaining work with the Project, through the development of capacity as related to the bidding process and means through which contracts with the Project will be carried out. Lastly, these workshops will be available to interested entrepreneurs and local business owners with the intent of also providing support to those interested in business initiatives unrelated to the Project.

More specifically, Sabina will hold workshops in Kitikmeot communities to familiarize local business on how to obtain contracts and at that time will begin to pre-screen businesses to become prequalified suppliers. This will include provision of information on requirements for business insurance and bonding. The workshops will detail what is required to take advantage of small, medium, and large contracts, as well as details on the Project opportunities available. Larger contractors that obtain Project work will also be encouraged to breakdown contracts into smaller subcontracts to increase the accessibility of Project work for smaller Inuit firms. In other words, the creation of smaller contracts that can be fulfilled by local Inuit firms will be encouraged and larger contractors that can oversee this process will be preferred over those who are not willing to follow this approach. The workshops will also include sessions to discuss information related to successful business structure and operation fundamentals, and assist in the preparation of bids for contracts currently available, from the perspective of what would be expected from a Project supplier.

Bid solicitation methods that target increased participation by Inuit firms include early communication of opportunities, communication of preference for bids with Inuit content, and capacity building workshops for Inuit entrepreneurs and business owners. Capacity building as related to the bidding process might include assistance with the general approach to the preparation of contract bids, early review of information describing the requirements businesses must meet to be considered for Project work, and the provision of information related to the process of fulfilling contract obligations.

In sum, first opportunity contracting and procurement methods will include the following:

- Inviting Inuit firms to view to contract opportunities on the Back River Project website and to encouraging expressions of interest.
- Developing an Inventory of Regional Suppliers who are pre-screened and able to provide goods and services to the Project.
- Providing early notification of contract opportunities to Inuit firms included in the Inventory of Regional Suppliers.
- Providing preference to employers and suppliers who employ Inuit beneficiaries over those who employ non-residents.
- Encouraging firms that obtain contracts with the Project to use the Inventory of Regional Suppliers list to identify indirect suppliers and/or subcontractors for procurement opportunities.

- Providing ready access to information related to project opportunities through 1) the Back River Project website, 2) group presentations, 3) targeted email, and 4) print materials that will be distributed locally and available at the Sabina office in Cambridge Bay.
- Inviting local Inuit firms to attend workshops aimed to increase business capacity and inform interested parties of the requirements that must be met to be considered for Project work.

Additional specifics related to contracting and Inuit-owned companies, including procurement targets, will be discussed during the IIBA negotiations between Sabina and the KIA. The relevant terms and conditions of the IIBA, where applicable to procurement of Inuit-owned businesses and where agreed to with the KIA, will be directly communicated to businesses through the Inventory of Regional Suppliers.

7.2 LOCAL BUSINESS AND ENTREPRENEUR CAPACITY BUILDING STRATEGY

7.2.1 Mitigation and Targeted Outcomes

There are many small and medium-sized businesses in the Kitikmeot Region. Some businesses, mainly located in the communities of Cambridge Bay and Kugluktuk, have been successful in the past in competitively supplying the mining sector. Others have found it difficult to bid on larger projects due to their small size and limited capital for investment (related to the high capital costs of operating a business in Nunavut), lack of, or inability to retain, skilled employees, lack of prior experience, and/or lack of experience with the bidding process. Through the process of awarding contacts for Project work Sabina aims to increase the number of Inuit firms engaged with the Project and enhance the capacity of those firms further contributing to regional economic development.

7.2.2 Actions and Adaptive Management

The capacity of local businesses and entrepreneurs will be increased through their involvement with the Project in the following ways:

- Provision of opportunities for long-term contracts, where feasible, to encourage the formation and/or expansion of local and regional contractors and suppliers.
- The tailoring of schedules to meet local and regional business capabilities (e.g., packaging contacts or the restructuring of large contracts into smaller pieces that smaller firms are able to accommodate).
- The provision of early notice to Inuit businesses about upcoming contracts, including details on proposal/bid requirements.
- Provision of information to potential suppliers that will strengthen the ability of local and regional businesses to tender effectively for contracts (e.g., sources of training and certification).
- Cooperation with local economic development agencies and educational institutions to encourage local business development (e.g., sponsor courses and workshops on business development and contract tendering) and develop supplier networks.

Sabina may request designated Inuit firms provide information that enables Sabina to access their qualifications and experience or may communicate directly with firms regarding their qualifications as related to Project work. For services that normally require bonding, an Inuit firm from the Kitikmeot Region must be bondable to be considered. Sabina will track the distribution of contract work to Inuit-owned companies in the Kitikmeot Region in order to understand the share of contracts being awarded to businesses based in each community. Sabina will work to ensure equitable distribution of

contracts between communities, where possible. This will include consideration of businesses located in the eastern Kitikmeot Region.

In addition, Sabina will provide support to individuals and small corporations to grow their businesses and increase their capacity through work with third party partners (e.g., the NAC) and existing GN DEDT, KIA, or hamlet administered business development programs. This type of support may include assistance to coordinate available resources, provision of personnel with business expertise, and/or guidance related to meeting the requirements associated Project contract work. Assistance can also be made available to develop new skills related to the provision of goods and/or services to the Project, through available education and training programs. Sabina will support the development of Inuit firms interested in contract work with the Project by assisting them to develop capacity in the following areas:

- Business management.
- Financial management.
- Performance assurance (e.g., health and safety).
- Contracts and procurement.
- Human resources management.

Additionally, some education and training opportunities available in the Kitikmeot communities as a result of the Project can be made available to the employees of local businesses and entrepreneurs through pre-arrangement. This might include certificate-based training programs already scheduled for mine employees (e.g., heavy equipment operator, WHIMIS, first aid, and other relevant training programs). Employees of local Inuit owned business can submit an application to participate in one or more programs through Sabina's CLO located in Cambridge Bay.

7.3 COMMUNITY-BASED INVESTMENTS FOR BUSINESS DEVELOPMENT

7.3.1 Mitigation and Targeted Outcomes

Sabina is committed to promoting economic development and diversity in the Kitikmeot Region communities. Sabina recognizes there is potential for a general increase in wealth in the Kitikmeot Region as a result of the Project and related spin-offs. In order to maximize economic benefits to local communities, Sabina will actively promote a diversification of economic development through community-based investments that are focused to increase the capacity of local businesses to broadly meet the demands associated with the increase in economic activity.

Community-based investments will complement the Local Business and Entrepreneur Capacity Building Strategy (Section 7.2) by targeting broader-based community development initiatives that promote business development.

7.3.2 Actions and Adaptive Management

Sabina will work to ensure access and use of available funding for community-based investments for local business development. This includes the following actions:

- Defining, in a clear and transparent manner, the criteria and expectations for program or project funding support.
- Appointing a single point of contact to assist small businesses and non-government organizations (NGOs) in completing the necessary applications and steps to access funding.

- Developing informational materials that describe funding available for applicable business activities and providing to community EDOs and other interested parties.
- Identifying potential partnerships and funding opportunities for community investments, with a priority given to co-funded opportunities.
- Developing and/or sponsoring projects in partnerships with communities to enhance facilities, programs, and/or services.
- Maintaining a register of community development projects and commitments including a description of the objectives, community partners, schedule, contribution, and outcomes.
- Reviewing and analyzing the outcomes and lessons learned of Sabina-funded community development projects.

Sabina will provide community investments and funding that is demand driven and based on the needs and wants of communities and is in line with Sabina's community engagement policy. Contributions will be made to communities based on requests from representative organizations (e.g., requests for funding for community feasts, youth camps, and requests to provide equipment for students). Sabina will sponsor select community events, particularly those intended to showcase trade and economic activity in the Kitikmeot Region. Particular consideration will be provided to community-based investments for youth and/or youth groups with the aim of providing support to further enhance youth capacity both generally and as related to training, education and healthy lifestyle. Types of support might include youth camps, annual awards, workshops, and other education sessions.

Further, Sabina has established a donations policy that aims to enhance livelihoods and socio-economic development in the Kitikmeot Region. The donations policy is applicable to initiatives pertaining to 'youth and education' and 'community wellness and traditional lifestyles' in Kitikmeot communities. Where possible, Sabina's donation policy will complement existing programs and funding to maximize the benefits of and provide support for local initiatives. Donation requests will be considered by Sabina's Manager of Community Affairs. Sabina will also partner with local hamlets and other organizations in partnership with other mining companies, as appropriate, for larger projects and/or contributions.

8. Reporting and Plan Effectiveness

Reports on Plan outcomes and performance, as well as any recommended additional adaptive management actions, will be prepared at a minimum annually for internal company distribution and use. The Plan will be evaluated against the defined scope and objectives (Section 2).

As part of the Back River Socio-Economic Monitoring Program (Volume 10, Chapter 23), the relevant findings will be reviewed in collaboration with other members of the Back River Project Socio-Economic Monitoring Committee (SEMC) and the NIRB. Key findings and recommendations will be incorporated into an annual report to the NIRB. Reporting of monitoring results will also be provided to the Back River Project SEMC and the Kitikmeot Region SEMC.

9. Summary

The Project aims to provide contract opportunities that will attract, develop and retain effective businesses, and provide business opportunities that support the development of suppliers in the region's communities. The objective of the Plan is to encourage the involvement of local and regional Inuit-owned businesses in Project work to maximize the benefits of the Project within the Kitikmeot Region. To meet the objective, the Plan includes: 1) a Procurement Strategy; 2) a Local Business and Entrepreneur Capacity Building Strategy; and 3) a Community-based Investments for Business Development.

Concurrent with the Plan, the Socio-economic Monitoring Program (Volume 10, Chapter 23) is to collect and analyze information on socio-economic conditions and trends to inform the ongoing management and mitigation of the potential social and economic effects identified in the EIS and to facilitate best practices in social responsibility as it relates to community engagement, capacity building, and realization of benefits from the Project. This includes monitoring the achievement of objectives associated with the Business Development Plan. The monitoring program will be established to enable Project managers and community leaders to respond proactively and in a timely manner to any undesirable changes to socio-economic conditions.

Sabina recognizes that the Project will present Inuit communities with both substantial opportunities as well as changes to current social and economic conditions. Sabina is committed to implementing measures to enhance the benefits of the Project for individuals residing in the Kitikmeot Region communities. Mitigating existing and potential impacts, and promoting individual, family, and community well-being is a shared responsibility of Sabina, the KIA, the hamlets, and the Government of Nunavut. Commitments to enhance regional employment and training and the provision of community programs and services to enhance community well-being do not impose responsibility on Sabina to assume the role of government. Sabina will cooperate in these efforts. For the benefits of the Project to be fully realized at the local level the communities must be engaged in the implementation of strategies to build capacity to enhance well-being, which contributes to the ability of communities to deal with current and future challenges and to retain the benefits beyond the life of the Project.

There is inherently some uncertainty associated with predicting the social impacts prior to the implementation of Project activities. Sabina will work to address impacts and enhance benefits as they are identified over time. Adaptive management as a method used for the creation and implementation of the Business Development Plan and the monitoring program enables the engaged parties to instigate change where required and to employ the use of new data and best practices as they become available. Further, the adoption of adaptive management practices enables the engaged parties to adjust plans based on the findings of the monitoring program throughout the life of the Project.

References

1988. *Economic Development Agreements Act*, RSNWT (Nu)

NIRB. 2013. *Guidelines for the Preparation of an Environmental Impact Statement For Sabina Gold & Silver Corp.'s Back River Project*. (NIRB File No. 12MN036). Cambridge Bay, Nunavut.

Appendix 1

Kitikmeot Region Inuit Firm Registry Database (as at November 4, 2015)

Sabina
GOLD & SILVER CORP.

Appendix 1. Kitikmeot Region Inuit Firm Registry Database (as at November 4, 2015)

ID	Name	Summary	Location	Phone	Email
			CAMBRIDGE BAY		
IFR0053	Kitikmeot Corporation	Construction, property management, land surveying, real estate	(*Kitikmeot*) Cambridge Bay	867-983-2200	davidgeneral@qiniq.com
IFR0270	Kitikmeot Air Ltd	Fixed wing Aircraft charter service	(*Kitikmeot*) Cambridge Bay	867-983-2569	cambridgebay@adlair.ca
IFR0273	Kitikmeot Cleaning Services	Janitorial cleaning & retail	(*Kitikmeot*) Cambridge Bay	867-983-2006	egotik@qiniq.com
IFR0384	Kitikmeot Helicopters Ltd	Helicopter contracting service	(*Kitikmeot*) Cambridge Bay	867-983-2705 or 2544	manager.ikaluktutiak@arcticco-op.com
IFR0554	Kitikmeot Caterers Ltd	Camp Catering, Camp Management and Janitorial Services	(*Kitikmeot*) Cambridge Bay	867-983-2200	davidgeneral@qiniq.com
IFR0567	Kitikmeot Cementation Mining and Development	Underground Mine Development and Training	(*Kitikmeot*) Cambridge Bay	867-983-2200	davidgeneral@qiniq.com
IFR0633	Kitikmeot Blasting Services Ltd.	Provide explosives and explosive-related services	(*Kitikmeot*) Cambridge Bay	867-983-2200	davidgeneral@qiniq.com
IFR0739	Kitikmeot Region Properties Inc.	Real Estate Development	(*Kitikmeot*) Cambridge Bay	867-983-2200	davidgeneral@qiniq.com
IFR0383	Kitnuna Expediting Services Ltd	Expediting Services	*(Kitikmeot)* Cambridge Bay	867-983-7500	acole@kitnuna.ca
IFR0642	Advanced Medical Solutions Inc. [Medic North Nunavut Ltd.]	Emergency medical services, medical equipment supply	*(Kitikmeot)* Cambridge Bay	867-983-2200	davidgeneral@qiniq.com
IFR0388	Nunavut Expediting Services Ltd	Expediting, camp building & supply	*(Kitikmeot)* Cambridge Bay	867-983-2544	manager.ikaluktutiak@arcticco-op.com
IFR0538	Kalvik Enterprises Incorporated	Construction, Renovations, Repairs, Rentals	*(Kitikmeot)* Cambridge Bay	867-983-2996	kalvikenterprises@netkaster.ca
IFR0665	QDC Logistics Ltd	Contractor for logistical services, aviation brokering, expedition, remote site management, camp buildings, remote site set up & maintenance	*(Kitikmeot)* Cambridge Bay	867-983-2818	sgillis@qillaq.ca

ID	Name	Summary	Location	Phone	Email
IFR0672	Sura Safety & Contracting Ltd	Safety Supplies and Paramedical Services	*(Kitikmeot)* Cambridge Bay	867-446-2810	mike@surasafety.com
IFR0622	5136 Nunavut Ltd	Support Services for Exploration, Medical Staff, Kitchen Staff, Local Training & Programs	*(Kitikmeot)* Cambridge Bay	867-983-7367	navaliktologanak@gmail.com
IFR0629	Qillaq Innovations [5140 Nunavut Ltd]	General Contracting and Retail Sales of Modular Buildings	*(Kitikmeot)* Cambridge Bay	867-983-2818	sgillis@qillaq.ca
IFR0314	Angulaalik & Associates – Inuinnaqtun Language Services [Angulail, Gwen]	Language Consulting, Teaching, Interpreting and Translating	*(Kitikmeot)* Cambridge Bay	983-2054	gangulalik@qiniq.com
IFR0623	Arctic Closet Inc	Retail, Arts and Crafts, Souvenirs, Giftware, Sportswear	*(Kitikmeot)* Cambridge Bay	867-983-2555	arctic_closet@qiniq.com
IFR0320	Aurizon Investments Ltd	Real Estate Investment, Residential Housing Complex	*(Kitikmeot)* Cambridge Bay	867-983-2806	tatqiq@netkaster.ca
IFR0569	Elu Inlet Lodge Ltd	Tourism Lodge	*(Kitikmeot)* Cambridge Bay	867-983-5174	peterkapolak@netkaster.ca
IFR0194	Arctic Islands Lodge [Ikaluktutiak Co-operative Ltd.]	Store, Inns North Hotel and other hotel	*(Kitikmeot)* Cambridge Bay	867-983-2201	manager@Ikaluktutiak.coop
IFR0574	Kiilliniq Corporation Ltd	Property Management	*(Kitikmeot)* Cambridge Bay	867-983-2806	tatqiq@netkaster.ca
IFR0084	Kitnuna Projects Inc	Construction	*(Kitikmeot)* Cambridge Bay	867-983-7500	acole@kitnuna.ca
IFR0378	Kitnuna Corporation	Trade & Services	*(Kitikmeot)* Cambridge Bay	867-983-7500	acole@kitnuna.ca
IFR0170	Kitnuna Petroleum Ltd	Trade & Services	*(Kitikmeot)* Cambridge Bay	867-983-7500	acole@kitnuna.ca
IFR0639	Kitnuna Pharmacy Ltd.	Pharmacy Services, Medical Supplies	*(Kitikmeot)* Cambridge Bay	867-983-7500	acole@kitnuna.ca
IFR0741	NATCO [Nunavut Arctic Transportation Company]	Marine Transportation Industry	*(Kitikmeot)* Cambridge Bay	867-983-2818	sgillis@qillaq.ca
IFR0139	Inukshuk Enterprises Ltd	Construction, Cartage, Garage, Property Management, Arcade	*(Kitikmeot)* Cambridge Bay	867-983-2806	tatqiq@netkaster.ca
IFR0718	Nanook Woodworking Ltd.	Carpentry and Furniture Manufacturing, Renovation	*(Kitikmeot)* Cambridge Bay	867-983-2774	rjancke@netkaster.ca
IFR0614	5093 Nunavut Ltd. [Jago Services Inc]	Plumbing, Heating, and Electrical	*(Kitikmeot)* Cambridge Bay	867-983-2268	wwilcox@xplornet.com
IFR0787	Kiilinik Construction Inc	Construction	*(Kitikmeot)* Cambridge Bay	867-983-5321	jkomak13@gmail.com

ID	Name	Summary	Location	Phone	Email
IFR0797	Northwest Passage Mechanical [5364 Nunavut Ltd]	Plumbing & Heating	*(Kitikmeot)* Cambridge Bay	867-983-2268	wwilcox@xplornet.com
IFR0814	Kitnuna BBE Expediting Ltd.	Expediting and Logistics	*(Kitikmeot)* Cambridge Bay	867-983-7500	gmitchell@kitnuna.ca
IFR0817	Nunavut Resources Corporation	Exploration Finance, Mine-related Infrastructure Development, Regional Infrastructure Development and Financing, Investment Banking & Corporation Finance Advisory Services	*(Kitikmeot)* Cambridge Bay	867-983-2458	snorthey1637@rogers.com
IFR0819	Nuna West Mining Ltd	Site Preparation & Infrastructure Development, Construction Management & Site Earthworks & Infrastructure	*(Kitikmeot)* Cambridge Bay	867-983-2200	stevenson@qiniq.com
IFR0821	Geotech Ekutak Ltd.	Drilling and underground Drilling	*(Kitikmeot)* Cambridge Bay	867-983-2200	davidgeneral@qiniq.com
		KUGLUKTUK			
IFR0743	Ryfan Kitikmeot Ltd.	Construction and Contracting	(*Kitikmeot*) Kugluktuk	867-982-3201	stanley.anablak2@gmail.com
IFR0735	Sanakatiit Kitikmeot Ltd.	General Contractor	(*Kitikmeot*) Kugluktuk	867-982-3201	stanley.anablak2@gmail.com
IFR0482	JMS Supplies Ltd	Retail sales of building supplies, residential furniture, recreational vehicles and outdoor equipment	*(Kitikmeot)* Kugluktuk	867-982-3324	jms_joanne@yahoo.ca
IFR0731	5296 Nunavut Ltd	General Office Support Services	*(Kitikmeot)* Kugluktuk	867-982-3102	stanley.anablak2@gmail.com
IFR0640	Aivgak Services Ltd	Convenience Store, Restaurant, Taxi	*(Kitikmeot)* Kugluktuk	867-982-3280	aivgak@qiniq.com
IFR0624	Kikiak Contracting Ltd	Trade and Services	*(Kitikmeot)* Kugluktuk	867-982-4713	Kikiak-cw@netkaster.ca
IFR0114	Kugluktuk Co-operative Ltd	Store, Cable, TV, POLI	*(Kitikmeot)* Kugluktuk	867-982-4231	manager@kugluktuk.coop
IFR0758	Ikakvik Kitikmeot Ltd.	Bridge Design and Installation	*(Kitikmeot)* Kugluktuk	867-982-3102	stanley.anablak2@gmail.com
IFR0818	Koda Adventure Tours	Adventure Tours, Guide Services, Camp Site Security Services, Marine Cargo Handling, ATV/Skidoo Rentals	*(Kitikmeot)* Kugluktuk	867-446-1944	chrissywestwood@yahoo.com
IFR0827	JSL Kitikmeot Ltd.	Mechanical Contractor	*(Kitikmeot)* Kugluktuk	867-982-3102	okkuk@hotmail.com
		TALOYOAK			
IFR0239	Lyall Construction Ltd	Gravel hauling and general contracting	*(Kitikmeot)* Taloyoak	867-561-5500	lyallconstruction@netkaster.ca
IFR0559	Lyall & Associates Ltd	Automobiles and Automobile parts and services	*(Kitikmeot)* Taloyoak	867-561-5500	lyallconstruction@netkaster.ca

ID	Name	Summary	Location	Phone	Email
IFR0238	Boothia Ventures Ltd	Hotel	*(Kitikmeot)* Taloyoak	867-561-5300	boothia@live.ca
IFR0237	Aqsaqniq Ltd	Hotel and restaurant, cable, general contracting	*(Kitikmeot)* Taloyoak	867-561-5300	boothia@qiniq.com
IFR0662	Aqsaqniq Airways Ltd	Air Charter Services	*(Kitikmeot)* Taloyoak	867-561-5300	boothia@qiniq.com
IFR0117	Paleajook Co-operative Ltd	Retail, Inns North Hotel and other hotel, Cable TV, Post Office	*(Kitikmeot)* Taloyoak	867-561-5221	manager.Paleajook@arcticco-op.com
IFR0807	Tuqanie Truck Rental	Truck Rental	*(Kitikmeot)* Taloyoak	867-561-5084	davie_irqiut@qiniq.com
IFR0824	Matrix Kitikmeot Logistics Ltd	Aviation	*(Kitikmeot)* Taloyoak	867-561-1984	charlie@matrixaviation.ca
		GJOA HAVEN			
IFR0805	North Star Taxi	Taxi	*(Kitikmeot)* Gjoa Haven	867-360-7070	stanley_porter@qiniq.com
IFR0478	CAP Enterprises Ltd	Good and Services for Gjoa Haven	*(Kitikmeot)* Gjoa Haven	867-360-6272	nunavut@huskydog.com
IFR0477	4660 Nunavut Ltd [Central Arctic Ventures]	Outfitting and Tourism	*(Kitikmeot)* Gjoa Haven	867-360-6272	nunavut@huskydog.com
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IFR0768	Tamarvik Suites [Porter, Megal and Aglukkaq Sylvia]	Hotel Accommodations	*(Kitikmeot)* Gjoa Haven	867-360-6362	Tamarvik.ltd@gmail.com
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		KUGAARUK			
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25. Occupational Health and Safety Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Occupational Health and Safety Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 25	All	Various	Overview and location figure added. Various minor clarifications, updates, and changes made.

BACK RIVER PROJECT
OCCUPATIONAL HEALTH AND SAFETY PLAN

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1. Introduction

1.1 INTRODUCTION

This chapter describes the Occupational Health and Safety Plan (OHSP) that Sabina Gold & Silver Corp. (Sabina) will follow in the development and operation of the Project. The OHSP, and other management plans, are intended to describe the ways in which Sabina will address or mitigate issues identified in the Final Environmental Impact Statement (EIS).

Sabina and its contractors will provide a safe and healthy workplace for all persons, during all phases of the Project. This Health and Safety Management Plan is a living document and will continue to evolve as the Project advances. It will be adapted to the scope of activities at every phase of Project development. The elements of the OHSP apply equally to the engineering, procurement and construction phases of the project.

1.2 SCOPE AND OBJECTIVES

Sabina will support and work with managers, supervisors, workers and contractors to attain effective health and safety programs that comply with and, when possible, exceed legislated requirements in order to strive for best possible working conditions and behaviour.

The following objectives have been identified and are part of Sabina's Core Safety Values:

- Make zero harm the primary goal in all our places of work.
- Prevent incidents or workplace accidents and injuries.
- Ensure a consistent approach to safety.
- Maintain productivity by directly or indirectly enhancing social conditions to positively affect the well-being of workers.
- Provide a safe and healthy workplace for all employees, contractors and visitors.
- Provide the necessary resources, information, training, and leadership to protect our workforce against injury, illness and hazards.
- Integrate the most effective safety standards through exploration, design, construction, operations and closure.
- Apply "best practice" to health and safety activities.
- Comply with all applicable health and safety laws, regulations and industry standards.
- Strive for continuous improvement in health and safety.
- Hold all people working on the project accountable for health and safety.
- Ensure all people understand that "no task is so important that time cannot be taken to complete work safely."
- Target zero accidents.
- Target high worker satisfaction with all health and safety programs.

- Meet stakeholders' expectations to ensure the health and safety of all persons on-site, including meeting training needs.
- Identify and make provisions to address the needs of all individuals with respect to health and safety; in a manner that their ability to do work is not compromised.
- Share information related to the health and safety of workers so they can share and contribute to the achievement of goals.

1.3 PLANNING AND IMPLEMENTATION

Planning for the OHSP started with the development of the DEIS, which identified existing (baseline) conditions, assessed potential impacts of the Project, developed conceptual mitigation strategies and developed specific mitigation measures to execute these strategies.

This (OHSP) has been built focusing on accident prevention and risk management. This is a living document in the sense that strategies and procedures will continue to be refined and implemented throughout the duration of the different phases of the Project.

1.4 SABINA OCCUPATIONAL HEALTH AND SAFETY POLICY

People who work for Sabina are the key to the Company's success and Sabina management is committed to providing the resources necessary to support the health, safety and well-being of our entire workforce. We believe that any loss due to accidents or incidents is preventable.

Sabina requires and enables each of its employees and contractors to provide safety leadership in order to support the health and safety of all individuals engaged in Sabina's operations.

Sabina provides its employees and contractors with the necessary resources to:

- Promote, prescribe and implement, health and safety practises and standards throughout the Company's operations in every stage of exploration, development, production and closure.
- Meet and, where reasonably practical, exceed regulatory requirements and continually strive to achieve health and safety best practises, notwithstanding any absence of legislation.
- Educate and train, on an ongoing basis, the individuals involved in Company operations to protect against injury, accidents and hazards.
- Institute health and safety reporting and accountability requirements and monitor same on an ongoing basis.
- Thoroughly investigate accidents, incidents and near misses and implement procedures and policies in a timely fashion to prevent re-occurrence.
- Work proactively with the public, contractors and governmental agencies to foster collaborative working relationships.

1.5 APPLICABLE LEGISLATION AND GUIDELINES

Specific knowledge of legal and other requirements and associated tasks are necessary to establish objectives and targets as well as to develop adequate management plans and operational controls to achieve the objectives and targets.

The significant current legislation governing occupational health and safety is as follows:

- *Mine Health and Safety Act* and Regulations; S.N.W.T. (Nu.) 1994, c. 25.
- Environmental Tobacco Smoke Worksite Regulations, Nu. Reg. 029-2003.
- Mine Health And Safety Regulations, N.W.T. Reg. (Nu.) 125-95.
- Mine Health and Safety Regulations, Amendment, Nu. Reg. 016-2003.
- *Safety Act* and Regulations, R.S.N.W.T. (Nu.) 1988, c. S-1.
- Asbestos Safety Regulations, N.W.T. Reg. (Nu.) 016-92.
- Environmental Tobacco Smoke Work Site Regulations, Nu. Reg. 027-2003.
- General Safety Regulations, R.R.N.W.T. (Nu.) 1990 c. S-1.
- General Safety Regulations, Amendment, Nu. Reg. 021-2000.
- Safety Forms Regulations, N.W.T. Reg. (Nu.) 102-91.
- Silica Sandblasting Safety Regulations, N.W.T. Reg. (Nu.) 015-92.
- Work Site Hazardous Materials Information System Regulations, R.R.N.W.T. (Nu.) 1990 c. S-2.
- *Workers' Compensation Act*, R.S.N.W.T. (Nu) 1988 c. W-6.
- Assignment of Statutes Administration Order, N.W.T. Reg. (Nu.) 040-96.
- Workers' Compensation General Regulations, R.R.N.W.T. (Nu.) 1990 c. W-21.
- *Workers' Compensation Act* (Consolidation) S.Nu. 2007,c.15, 2007 - Workers' Compensation General Regulations, R-022-2008.
- Assignment of Statutes Administration Order, N.W.T. Reg. (Nu.) 040-96.
- *Transportation of Dangerous Goods Act*, 1990, R.S.N.W.T. (Nu.) 1988, c. 81 (Supp.).

Sabina health and safety staff will continually monitor legislation for any amendments and implement compliance program and employee communication, with these changes, as required.

1.6 SITE DESCRIPTION

The Back River Project is currently an advanced exploration gold project located in the West Kitikmeot region of Nunavut. Following future approval and implementation, the Project will include one primary mining area (Goose Property), and a Marine Laydown Area (MLA) in southern Bathurst Inlet, and connecting local all-weather roads and a winter access road.

2. Roles and Responsibilities

Employee involvement is essential. Involvement of employees at all levels is needed for effective performance of health and safety related tasks. All employees are required to understand and comply with all regulations. In addition workers are to practice good housekeeping, use personal protective equipment suited to the work task, participate in training, report unsafe acts as well as identify any hazards or injuries. Employees are encouraged to recommend ways to eliminate hazards, use the appropriate tools and equipment for the task, keep tools in good condition and practice safe work habits. It is necessary that all roles, responsibilities, and accountabilities be defined, documented, and communicated.

The **General Manager** is ultimately responsible for the success of the plan and approves all relevant policies and documents, auditing, action planning and the verification process.

The **Mine Manager** along with his/her direct reports are responsible for the implementation of this OHSP including:

- Overall management of OHSP.
- Monitoring.
- Operational aspects.
- Internal reporting.

The **Safety Superintendent** along with his/her direct reports are responsible for the implementation of this plan including:

- External reporting.
- Compliance and adaptive management.

Sabina will regularly review and update any changes in roles, responsibilities, and accountabilities.

3. Risk Assessment and Management

3.1 HAZARD IDENTIFICATION

Knowledge of hazards and evaluation of associated risks are necessary requirements for establishing health and safety objectives and targets, and for setting priorities to control the identified risks to employees and others on an ongoing basis. All contractors and subcontractors involved in the exploration, construction, and operation of the Project are required to carry out hazard identification.

For all phases of the Project, Sabina will have knowledge of potential hazards through such sources as:

- Legal and regulatory requirements.
- Company sustainable development policy and supporting policies.
- Records of incidents, accidents and non-conformances.
- Health and safety management system audits.
- Company health and safety audits.
- Communications from employees and others.
- Information from health and safety consultations.
- Information on best practices, typical hazards for the industry, and incidents and accidents in other organizations.
- Details of changes in occupations, facilities and activities.
- Inventory of hazardous materials and the toxicology of the hazardous materials.
- Monitoring data.

- Existing administrative, engineering and personal protective equipment controls.
- Workplace knowledge and other data.
- Professional judgment.
- Process hazard analysis.
- Management of change process.

Sabina uses its Hazard Identification, Risk Assessment, and Controls Methodology to document ongoing identification of hazards and classification of risks for routine and non-routine events associated with activities, occupations, and facilities for all phases of the project. Based on this methodology, Sabina creates a list of associated hazards with established priorities for risk control and action. Some of these hazards are elevated noise levels requiring hearing protection as well as areas where particulate matter may require filtration. Onsite laboratory work may require PPE in certain areas which will be directed by the Manager and will be part of the overall OHSP.

The result of the hazard identification and risk assessment is a basis for establishing and documenting health and safety objectives and targets, and subsequent action to achieve established objectives and targets. Each hazard classified as representing a priority risk requires an action plan with recommendations to control the risk. Recommendations include consideration for operational controls, training and awareness, and performance measurement and monitoring.

The action plan and recommendations are forwarded to the area management responsible for follow-up. In all cases, the action plan and recommendations are communicated to the interested and affected employees (and others as required). Typically, the recommendations are implemented in consultation with interested and affected employees (and others as required).

3.2 OCCUPATIONAL HEALTH AND SAFETY COMMITTEE

Involvement of everyone in health and safety activities is the most powerful way to develop personal appropriate values and build awareness and commitment. Sabina encourages employee participation by providing mechanisms that:

- Support participation (by identifying and removing barriers to participation).
- Establish a workplace health and safety committee(s) including a representative mix of employee and management representatives.
- Ensure that employees and employee representatives are trained in, and consulted on, all aspects of health and safety associated with their work.

In order to conform with the Canada Labour Code, Part II, as well as the *Nunavut Mines Act*, a health and safety Committee(s) will be established at the operation/facility immediately upon the start of construction activities and will carry on through the duration of the project when people are working at site. Sabina will ensure that:

- Meetings are held regularly, at least every 30 days.
- Employees are represented in health and safety committees through all levels of the organization and criteria for minimum participation (i.e., attendance) of committee members are established and enforced.

- Health and safety committees have goals and objectives that support the overall operational goals and objectives.
- Minutes of committee meetings and follow-up action plans are documented and are posted and available to all employees. Minutes include attendance and follow-up action plans to identify outstanding issues, recommendations to management, planned action, assigned responsibility, and timeframes for completion. Action plans are reviewed at subsequent health and safety meetings. Action plan items are to be completed within a prescribed timeframe.

3.3 HAZARD AND RISK IDENTIFICATION REVIEWS

Sabina determines and communicates appropriately a timeframe to complete written initial hazard identification and risk assessment of identified occupations, activities, and facilities that might present health hazards. These are identified as JHA's (job hazard analyses) or THA's (task hazard analyses) and these are done prior to any work task in order to accommodate any risks that may be present, into the work plan.

Sabina has written operational controls to review hazard identification, risk assessment, and risk control. Reviews will be conducted quarterly and the review documented and made available for all employees.

Sabina has a written operational control to necessitate a review of any occupation, facility, and activity when there has been a change in the occupation, facility, or activity, or any other change that could affect the initial hazard identification and risk assessment.

3.4 HEALTH AND SAFETY STRATEGIES

Senior Management:

- Senior management must provide leadership for health and safety activities and assumes overall responsibility for success of the Health and Safety Management System.

Line Management driven:

- Line supervisors play a pivotal role in the success of the health and safety programs.
- Health and safety policies, programs, and procedures are consistently applied throughout the Project by Sabina's supervisors as they direct the workforce in their daily duties.

Visibly demonstrated commitment:

- Health and safety excellence only occurs when supervisors, managers, and executives demonstrate their values through actions and their credibility by engaging employees to actively participate in the program.

Annual target reductions:

- By establishing annual leading and lagging indicators for health and safety improvements, Sabina will strive for continuous improvement by meeting these reductions.

High level of accountability:

- Every employee is held accountable for exercising sound judgment and skills in a reasonable, practical, and timely way to prevent accidents and injuries.

3.5 HEALTH AND SAFETY PRINCIPLE

All incidents can be prevented. Sabina believes that:

- All injuries and environmental incidents are preventable.
- Injuries and incidents are not mere chance occurrences, but represent a system failure.
- Employee involvement is essential. Employees are required to practice good housekeeping, participate in training, report hazards and injuries, use personal protective equipment, and practice safe work habits.
- Management is responsible and accountable for preventing injuries. Leadership is all about people, and safety, at its essence, is respect through action for the well-being of people.
- Working safely is a condition of employment. Each employee is held accountable for using sound judgment to prevent injuries.
- All operating exposures can be controlled. Sabina will continually analyze its process and procedures to maximize efficiency and reduce safety risks.
- A "world-class" health and safety program is achieved when incidents and injuries are unacceptable, responsibilities and expectations are clearly defined, communication is open, and the organization is employee-centred.

3.6 GOALS AND OBJECTIVES

Objectives and targets are necessary and can be established at all levels of the company. They are documented and measurable objectives and targets to monitor and improve health and safety performance regarding health and safety risks, and environmental aspects and impacts.

3.6.1 Objectives and Targets

Each operating department will establish and document specific objectives and targets and are to be aligned with Sabina objectives and targets, demonstrate continuous improvement in health and safety performance and achieve the goal of "zero harm."

Each operating department will establish health and safety targets and objectives annually. Each target and objective is to have an associated action plan. The plan for achieving objectives and targets includes:

- Identifying the planned action.
- Designating responsibility for achieving objectives and targets.
- Determining a timeframe within which the objectives and targets are to be achieved.
- Verifying completion.

3.6.2 Review of Objectives and Targets

Targets and objectives are reviewed regularly (at least annually) and progress toward meeting established objectives is measured and tracked (e.g., key performance indicators for health and safety).

3.6.3 Communication of Targets and Objectives

Objectives and targets for the operating department are communicated to employees throughout the organization, and facility or department objectives and targets are communicated throughout the respective areas.

3.7 HEALTH AND SAFETY BEST PRACTICES

A "world-class" health and safety workplace incident rate is considered 2 or less, with a severity rate of 1 or less. Incident rate is commonly calculated by multiplying the number of total recordable injuries by 200,000 and divide by the hours worked. Severity rate is usually calculated by multiplying the number of lost-time workdays by 200,000 and dividing by the hours worked.

Sabina will strive to target these rates to the lowest possible level.

Sabina strives to continuously improve to achieve world-class performance. The company intends to be the leader in Nunavut Mining by ensuring strict adherence to the following strategies:

- Health and safety is line management-driven.
- Annual target reduction for health and safety.
- Performance accountability (covered in annual performance review).
- High visibility for health and safety (site inspection and job observations).
- Compliance auditing (planned inspections).
- Practical risk assessment.
- Team communication and consultation (health and safety meetings, OHSC meetings).
- Training and awareness (all employees).
- Recognition for individual and team health and safety performance.
- Document and data control.
- Emergency preparedness and response.
- Audits and assurance.
- Management reviews.

3.8 TRAINING AND AWARENESS

All employees need some level of training depending on whether they manage, perform, or verify activities affecting health and safety risks or environmental aspects. A key factor is to match training provided with training needed. Training and awareness needs are determined by:

- Results of hazard identification, risk assessment, and risk control.
- Results of the environmental aspects evaluation.
- Company sustainable development policy and supporting policies.

- Legal and regulatory requirements.
- Established objectives and targets.
- Management Plans.

Sabina identifies and documents training needs and delivers appropriate training to all employees whose work might affect risks to health and safety in the workplace and whose work might create a significant environmental impact. All Sabina contractors are required to abide by this requirement.

Employees and others are made aware of:

- Importance of conformance to requirements of the health and safety Management System and health and safety policies.
- Risk associated with work in a remote environment.
- Risk associated with work in extreme climatic conditions.
- Risk to the environment and to health and safety of their work activities.
- Risk to the environment and to health and safety of deviations from specified operational controls.
- Benefits of a healthy and safe workplace.
- Specific roles and responsibilities in achieving compliance.

Sabina's training and awareness plan considers:

- The differing levels of risk.
- The remoteness of the site and the climate.
- The different responsibilities, abilities, and literacy of employees.
- The culture.
- Trainers.
- Training methods and settings.
- Training frequency.
- Contractors.
- Documentation of training.
- Evaluation of training.

Sabina regularly reviews and updates the training and awareness plan based on changes in training needs related to Health and Safety Management System awareness, occupation-specific training, and regulatory-required training.

3.9 REPORTING AND DOCUMENTATION

Reporting and documentation requirements are outlined in Back River - Incident Investigation and Reporting Policy. During all phases of the project the company will implement a reporting and documentation system that satisfies Sabina's health and safety documentation and reporting standards.

3.10 OPERATIONAL CONTROL

Operational controls include administrative, engineering, and personal protective equipment controls and other protective measures (e.g., machine guarding, railing). Administrative controls include programs, standard operating procedures, practices, guidelines, and instructions. Operational controls are the significant means and actions to control health and safety hazards and risks, and environmental aspects and significant impacts. They help achieve the requirements of the company Occupational Health and Safety Policy and supporting policies, established objectives and targets, and compliance with legal and other requirements.

Sabina will regularly review:

- Legal and regulatory requirements.
- Occupations, facilities, and activities where the level of risk is such that further control measures are needed.

When considering the outcome of such reviews, Sabina develops operational controls:

- To control identified health and safety risks (including those that could be introduced by others such as contractors and visitors) and the significant environmental impacts.
- That stipulate operating criteria.
- For the design of workplace, process, installations, machinery, operational controls, and the work organization (e.g., 8-hour and 12-hour shifts), including their adaptation to human capabilities to eliminate or control adverse environmental impacts, and health and safety risks at their source.
- To cover situations where their absence could lead to non-conformance with legal and other requirements, the company sustainable development policy and supporting policies, and established objectives and targets.

Sabina regularly reviews and updates the operational controls for suitability and effectiveness in controlling health and safety risks, and adverse environmental impacts.

3.11 EMERGENCY PREPAREDNESS AND RESPONSE

Emergencies that could result in an accident or incident causing injuries, illnesses, or environmental impacts, or that could cause health and safety risks need to be considered in the Health and Safety Management System.

Sabina establishes and maintains operational controls to identify the potential for and responses to accidents, incidents, and emergency situations, and to prevent and mitigate the likely associated injury, illness, and adverse environmental impacts (see Risk Management and Emergency Response Plan).

Sabina regularly reviews its emergency preparedness and response plans and operational controls. In addition, a timely review will be undertaken after accidents, incidents, or emergency situations.

3.12 INTERACTION WITH NUNAVUT'S MEDICAL SYSTEM

The current intervention procedure for injuries will be as follows:

- Stabilize the injured person and administer medical treatment within the capabilities of the medical professionals at site.
- Depending on the nature of the injuries, the patient might be flown to Cambridge Bay for stabilization and then flown by medivac aircraft to Yellowknife.
- If the patient is stabilized and is low risk to transfer to the Yellowknife Regional Hospital, they will be taken by aircraft chartered by Sabina.
- Depending on the severity of the injury, the patient will be flown to a major hospital (Edmonton) as soon as possible.

Key responders and medical professionals will be trained in current first aid and cardiopulmonary resuscitation (CPR) techniques.

In addition automated external defibrillators (AED) will be located in strategic locations and all responders and medical professionals will be properly trained in its use.

During all phases of the project, Sabina will establish and maintain an appropriate first aid room at Goose property which will continue in operation where qualified medical staff will attend to medical emergencies. These facilities will remain functional for the entire duration of the project. The existing medivac procedure will continue to be used.

Sabina recognizes and will adhere to the Government of Nunavut's policy on medical evacuation of non-Nunavummiut. Should a medivac situation arise at our site, Sabina will accept responsibility for the fees related to these events.

In addition, Sabina will actively monitor the immunization status of site employees and will offer influenza-type immunizations in a timely manner in order to support the well-being of our employees. Any medical incidents or occurrences tied to any rabid animal incident, will be addressed, where a qualified on-site Nurse/Medic will assess the situation and where necessary consult with our Medical Doctor to manage the situation.

3.13 PERFORMANCE MEASUREMENT AND MONITORING

It is important to identify key parameters to measure and communicate performance internally and externally, including compliance with relevant legal and other requirements, incident trends and progress toward objectives and targets.

The ultimate indicators of the effectiveness of the Health and Safety Management Plan are shown in Table 3.13-1.

Table 3.13-1. Ultimate Indicators of the Effectiveness of the Health and Safety Management Plan

Indicator (as Defined by OSHA)	Sabina Performance Target
Recordable incident rate	Less than 2
Lost-time injury rate	Less than 1

Note: OSHA = United States Occupational Safety and Health Administration

Sabina recognizes that there is no single reliable measure of health and safety performance. What is required is a "basket" of measures or a "balanced scorecard" that provides information on a range of health and safety activities. A number of leading indicators, or positive performance measures (PPM), provide information on how the system operates in practice, identifies areas where remedial action is required, provides a basis for continuous improvement, and provides a mechanism for feedback and consequential motivation (Tables 3.13-2 and 3.13-3). Monitoring these leading indicators (PPM) will ensure the effectiveness of the Health and Safety Management Plan and that Sabina's targets and objectives are met.

Table 3.13-2. Examples of Positive Performance Measure for Safety

Objective	Indicator	Measure/Monitor	Results	Improvement
All activities to be subject to hazard analysis and risk assessment	Risk Assessment	% Risk assessment complete % Control measures implemented	Track reported % monthly by area/department	Review progress at monthly senior management meetings, target areas for improvement
Written work procedures in place for critical activities	Work procedures	% Written procedures complete	Track reported % monthly by area/department	Review progress at monthly senior management meetings, target areas for improvement
Provision of safe workplace	Work place inspection target for each frontline supervisor across whole site on a monthly basis each with specific area. Workplace visibility tour by middle and senior managers in their work area once per month.	% Scheduled inspections complete by name and work area/department % Actions arising complete by name and work area/dept. % Visibility/inspection tours complete	Track reported % monthly by area/department	Review progress at monthly senior management meetings, target areas for improvement
Employees working safely	Performance-based observations	% Employees working safely % Personnel protective equipment (PPE) compliance	Track reported % monthly by area/department	Review progress at monthly senior management meetings, target areas for improvement
Incident reporting and implementation of remediation measures	Timeliness of reporting Incident investigation effectiveness Log of corrective actions	% Incidents reported within 24 hours % Near-miss incidents % Incident investigation complete on time % Corrective actions implemented All by area/dept.	Track reported % monthly by area/department	Review progress at monthly senior management meetings, target areas for improvement
Safe and competent employees	Performance assessment including training needs identification Training records	% Performance assessments complete % Scheduled training complete All by area/dept.	Track reported % monthly by area/department	Review progress at monthly senior management meetings, target areas for improvement

Table 3.13-3. Examples of the Application of Positive Performance Measures for Safety

Objective	Indicator	Measure/monitor	Results	Improve
Improve safety awareness	Toolbox talks on targeted topics monthly by all Supervisors	% Toolbox talks complete by department % Employees attending % Actions arising complete All by area/dept. % Safety Representatives Trained	Track reported % monthly by area/department	Review progress at monthly senior management meetings, target areas for improvement
Improve safety culture	Annual climate survey	Overall findings based on selected criteria All by area/dept.	Track trends annually by area/department	Review progress at annual senior management meetings, target areas for improvement

3.14 ACCIDENTS, INCIDENTS, NON-CONFORMANCES, AND CORRECTIVE AND PREVENTATIVE ACTION

Root or basic cause analysis is important for evaluating and investigating accidents, incidents and non-conformance in establishing objectives and targets for a successful corrective action program. Through this process, the actions taken to address non-conformance can result in permanent and positive changes in the Health and Safety Management System and continuous improvement. It is important that employees with health, safety, and environmental responsibility be part of this process to assist in identifying actual and potential health and safety risks, and adverse environmental impacts.

Sabina has written operational controls for handling and investigating potential accidents, incidents, and non-conformance that includes:

- Tracking and recording details of accidents, incidents, and other non-conformance.
- Root or basic cause analysis.
- Mitigating any health and safety risks and adverse environmental impacts that arise from accidents, incidents, or other non-conformance, including corrective and preventive action.
- Where mitigation is necessary, conducting a health and safety risk assessment and significance evaluation of the environmental aspects of the proposed corrective and preventive action(s) to determine appropriateness and effectiveness.
- Implementing, recording, and communicating changes arising from the corrective and preventive action, e.g., changes in operational controls.

3.15 RECORDS AND RECORDS MANAGEMENT

Sabina maintains and preserves internal and external records that are critical to design and performance of the health and safety Management System. These records include:

- Employee training records.
- Inspection reports.
- Consultation reports.

- Accident, incident, and non-conformance reports and follow-up corrective and preventive action reports.
- Medical test reports (medical test reports and health surveillance reports might be considered confidential).
- Health surveillance reports.

3.16 AUDITING, REVIEW, AND UPDATE

Sabina conducts internal audits to determine the degree of implementation and to verify performance of the Health and Safety Management System. Management and labour representatives may undertake audits. The results of audit(s) and management review(s) form the basis for the annual written statement of assurance by management on effectiveness of the Health and Safety Management System.

3.17 MANAGEMENT REVIEW

Senior management reviews the Health and Safety Management System to determine its continued suitability, adequacy, and effectiveness. Outcomes of a management review include recommendations to revise Sabina's Sustainability Policy and supporting policies, to revise established objectives and targets, and to specify corrective actions for individual management with target dates for completion.

- Cases of occupational disease and compensation claims.
- Audits and assurances.
- Management reviews.
- Other reviews.
- Emissions measurements.
- Exposure measurement records.
- Hazard identification, risk assessment and risk control records.
- Government reports.

26. Community Involvement Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Community Involvement Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 26	All	Various	Various minor clarifications, updates, and changes made.
	3. Applicable Legislation and Guidelines	3.1 Sabina Operating Rules and Practices	Addition of corporate commitments pertaining to public consultation and engagement, as found in Sabina's Sustainable Development Policy.
	Mitigation and Adaptive Management	7.5 Communication of Research Results	Inclusion of Sabina's commitment to ensure legislated requirements under the *Scientists Act* are followed when reporting research results.

BACK RIVER PROJECT
COMMUNITY INVOLVEMENT PLAN

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1. Introduction

This chapter describes the Community Involvement Plan (the Plan) that Sabina Gold & Silver Corp. (Sabina) will follow in the development and operation of the Project. This Plan, and other management plans, are intended to describe the ways in which will address or mitigate issues identified in the Final Environmental Impact Statement (EIS).

The Plan is a living document and will be regularly updated based on management reviews, community engagement feedback, incident investigations, regulatory changes, or other Project-related changes. The Plan will be revisited and updated or adapted on an annual basis. As Sabina works to address impacts and enhance benefits identified over time, changes may be made to this plan to better achieve desired outcomes. The adaptive management strategy enables engaged parties to instigate change where required and to employ the use of new data and best practices as they become available, for example, data and analysis generated by the monitoring program throughout the life of the Project. Community involvement will be ongoing and will be implemented by Sabina's community relations and management staff.

2. Scope and Objectives

Sabina is dedicated to working closely with Kitikmeot residents, communities and stakeholders so that the Project is built in a manner consistent with regional needs and aspirations. The Plan will apply from the time of approval of all required licences and permits to allow construction of the Project to begin. The temporal extent of the Plan will be the life of the Project itself, including construction, operation, reclamation and closure, and temporary closure/ care and maintenance phases.

The objective of the Plan is to fulfil Project external public engagement commitments and maintain meaningful relationships with communities and the public. For the purpose of the Plan, the term 'public' refers to populations within the area of influence and the term 'community' will refer the communities within the Kitikmeot Region.

The results of community engagement, Community Advisory Group (CAG) meetings, and community research to date have informed the development of the Plan. Identified topics of interest, common community concerns, and suggestions that were identified as valuable by local individuals have been considered and integrated into the Plan where possible. Sabina's community engagement and outreach activities to date have included meetings with:

- The public.
- Hunter and Trapper Organizations (HTOs).
- Hamlet Mayors, Councils, and staff.
- Community Advisory Groups (CAGs) in Cambridge Bay and Kugluktuk.
- High school students.
- Various other community organizations and stakeholders.

Community engagement methods employed by Sabina are numerous and have included presenting Project related information in public and stakeholder meetings, community newsletters, and during radio shows; the establishment of a community relations office and Community Liaison Officer position in Cambridge Bay; and the use of social media among other methods. Community engagement methods as defined by the Plan are further detailed in Section 7.2.1.

CAGs have been established to maintain clear and open lines of communication about the Project between CAG representatives and Sabina. CAG representatives include individuals associated with local HTOs and Hamlet Councils, as well as local Elders and youth. CAG meetings to date have included Project planning discussions, information sharing and Project updates, and the identification of potential community issues.

Sabina will continue to engage with CAGs, Kitikmeot residents, communities, and stakeholders throughout the Project development process and will ensure the provision of timely Project updates and responses to feedback provided. Inuinnaqtun and Inuktitut interpretation/translation will be provided, and written materials provided in those languages, throughout the consultation process to enable participation of all community members. This Plan details those efforts Sabina will make to communicate and engage with residents, communities, and stakeholders throughout the life of the Project.

3. Applicable Legislation and Guidelines

3.1 SABINA OPERATING RULES AND PRACTICES

Sabina has made corporate commitments to public consultation and engagement, as found in its Sustainable Development Policy. Amongst other commitments discussed in this policy, the Company has committed to:

- Implement proven management systems and procedures to facilitate our sustainable development objectives. A priority will be placed on developing and implementing management structures related to the environment, health and safety, emergency response and stakeholder engagement.
- Work closely with local communities and project stakeholders to understand their needs, address their concerns and provide project-related benefits to create win-win relationships. Our goal is to earn and maintain a social licence to operate at all our operations while building partnerships.
- Utilize a precautionary approach as it applies to potential effects from our activities. Work with employees, contractors and stakeholders to promote a culture of open and meaningful dialogue to ensure that any known or suspected departures from established protocols are reported to management in a timely manner.
- Implement programs at each of our operations to monitor and report compliance and proactively address potential deficiencies in our policies and procedures.

Sabina is also committed to following mining industry best practices in its public consultation and engagement activities and to following the Prospectors Development Association of Canada (PDAC) (2013) basic principles for successful community engagement as follows:

- *Respect* – respect for all parties in the process.
- *Honesty* – full, true, and plain disclosure of information.

- *Inclusion* – maintain an inclusive process, so all parties who should be present are present.
- *Transparency* – establish and maintain complete transparency.
- *Communication* – promote two-way communication with community members.

Sabina will also maintain a community donations policy focused on supporting initiatives pertaining to 'youth and education' and 'community wellness and traditional lifestyles' in Kitikmeot communities. For example, Sabina will provide annual awards to support youth involvement in mining, will support northern training initiatives, and will help facilitate the retention of youth in the North. Sabina will additionally continue to support childcare in the communities through its donations policy and informal visits to assess potential areas of need. Also, Sabina employees will be encouraged to support childcare through volunteering and participation on the associated non-profit boards responsible in each community for the delivery of childcare programming. Donation request forms will be made available at various locations in English, Inuktitut, and Inuinnaqtun. Further engagement of youth may be undertaken with the aim of matching community-based investment with local demand and the needs of the Project. These activities are defined further in Section 7.

In addition, Sabina is committed to acting as a steward of the environment and promoting sustainable development of communities in the Kitikmeot Region. To fulfill this responsibility in regards to community involvement, Sabina has established Socio-economic Management Plans, including the Community Involvement Plan, that commits the Company to communicate openly with employees, contractors, local stakeholders, governments and the public on Project activities and environmental and social programs and performance.

3.2 GOVERNMENT LEGISLATION AND POLICY

Although specific legislation has not yet been developed to guide community involvement or community consultation, there are a number of regulatory bodies that have established requirements which pertain to mining projects in Nunavut. The NIRB, the Nunavut Water Board (NWB), the Government of Nunavut Department of Economic Development and Transportation (GN DEDT), and Nunavut Tunngavik Incorporated (NTI) have each developed guidelines for community consultation and engagement, including:

- As part of their mandate, the NIRB was established so that Inuit have an opportunity to be formally involved in impact assessment in Nunavut, typically through requiring mineral development proponents to consult with all potentially affected communities during the environmental assessment process.
- The NWB requires community involvement in the water licensing process for mining projects, through public comment and public hearing mechanisms.
- The GN DEDT has developed the guide "Consulting with Communities in Nunavut: Guide to Community Consultation for the Mineral Exploration and Mining Sector" to help ensure that meaningful benefits from resource development flow to Nunavummiut. The guide provides a 'who's who' in communities and outlines various cultural differences of which southerners may not be aware.
- NTI's *Mining Policy* (NTI 1997) contains provisions related to community consultation and engagement. NTI requires that all stakeholders be given a meaningful opportunity to participate in mineral development decision-making, and that all these participatory processes be open, transparent, timely, and well-defined.

In addition, there are project-specific guidelines that detail community involvement and consultation for specific projects, for example, those developed by the Nunavut Planning Commission to consult with communities regarding the content of the Draft Nunavut Land Use Plan, and those developed by the NIRB for resource development projects in the region. For the Project, consultation and community engagement requirements as determined by government are specified by the Project Guidelines for the Preparation of an Environmental Impact Statement (NIRB 2013).

4. Roles and Responsibilities

Implementation of the Plan, as well as on-going performance evaluations, updates or revisions to the Plan, will be the responsibility of the Manager of Community Affairs or similar position, or other designated management personnel with the requisite skill set and experience. The Manager of Community Affairs may also delegate responsibility for specific components of the Plan to other personnel. Sabina will maintain an office location in Cambridge Bay staffed by a Community Liaison Officer (CLO), where community members can obtain Project-related information, apply for employment, and have complaints or other issues addressed.

In the implementation of the Plan, the Manager of Community Affairs will also work in collaboration with the Manager of Human Resources and the Manager of Procurement and their staff (e.g., the Inuit Training and Employment Coordinator) to ensure efforts are coordinated as it applies to the Plan. Other supporting roles and responsibilities of staff will be identified during implementation based on needs.

Sabina is committed to regular engagement of the NIRB, the KIA, and Kitikmeot communities and seeking feedback on potential areas for improvement in the Plan over the life of the Project. In this regard, the role of these organizations, community stakeholders, and the public is important to support continual improvement and adaptive management.

5. Management Measures

A Socio-economic Monitoring Program (Volume 10, Chapter 23) has been developed to help ensure that the Project fulfills best practices in social responsibility as it relates to community engagement, capacity building, and realization of benefits from the Project, especially for Inuit. Equally, monitoring will provide relevant and timely information to enable Project managers and community leaders to respond proactively to potential risks and adverse socio-economic effects.

In order to support management measures associated with the Plan, a number of Project-specific and community-level indicators have been defined as detailed in the Socio-economic Monitoring Program. Monitoring is designed to measure social performance broadly with respect to health and community well-being, as well as traditional land use. Other monitoring of achievements with respect to employment, education and training are identified as they apply to the Human Resources Plan (Volume 10, Chapter 28). Monitoring of achievements with respect to economic development and business opportunities are identified as they apply to the Business Development Plan (Volume 10, Chapter 24).

Thresholds for each indicator will be determined in consultation with the NIRB, communities, and the Back River Project Socio-economic Monitoring Committee (see Socio-economic Monitoring Program, Volume 10, Chapter 23). Where Project performance is addressed by the Inuit Impact and Benefit

Agreement (IIBA), it is anticipated that applicable thresholds will be defined in reference to the provisions of the IIBA. For all indicators, management action will be triggered when annual performance is below threshold. Specific actions will be determined in consultation with the NIRB and the KIA (when applicable to the IIBA). This will involve an evaluation of the existing mitigation and management measures, and identification of appropriate adjustments to the Plan.

6. Monitoring Program

The Back River Socio-economic Monitoring Program (Volume 10, Chapter 23) details the approach and methods through which Project outcomes will be monitored and reported.

7. Mitigation and Adaptive Management

Plan activities include the following main elements:

- Methods to promote community involvement.
- Project updates.
- Incorporation of public feedback and community input.
- Promotion of Inuit participation in employment and contracting opportunities.
- Communication of research results.

7.1 METHODS TO PROMOTE COMMUNITY INVOLVEMENT

7.1.1 Community Engagement Methods

Sabina's community engagement methods include public meetings, stakeholder meetings, the Sabina office and Community Liaison Officer (CLO) in Cambridge Bay, CAGs, site visits, social media, a Project newsletter, other distribution materials, radio shows, and trade show participation. These methods will be used to provide project updates (Section 7.2), incorporate public feedback and community input (Section 7.3), promote Inuit participation in employment and contracting opportunities (Section 7.4), and to communicate research results (Section 7.5). Sabina's community engagement methods are summarized in Table 7.1-1.

Table 7.1-1. Community Engagement Methods

Method	Description
Public Meetings	Public meetings are open to all members of a community. Sabina will provide Project information and updates, solicit feedback, and be available to answer the public's questions. Public meetings will be interpreted into local dialects and minutes will be taken by Sabina. Seasonal residents of Bathurst Inlet and Omingmaktok will be engaged in Cambridge Bay.
Stakeholder Meetings	Meetings with key community stakeholder groups (e.g., HTOs, Hamlets, Aboriginal organizations) will be conducted to provide Project updates, discuss particular Project-related topics, and solicit feedback as appropriate. Meetings will be interpreted into local dialects and minutes will be taken by Sabina.

(continued)

Table 7.1-1. Community Engagement Methods (completed)

Method	Description
Sabina Office / Community Liaison Officer	Sabina will maintain an office location in Cambridge Bay where community members can obtain Project-related information, apply for employment, and have complaints or other issues addressed. This office will be staffed by a Community Liaison Officer (CLO). The possibility of adding more offices and CLOs in other Kitikmeot communities will be assessed in the future.
Community Advisory Groups	Meetings will be held with Community Advisory Groups (CAGs) to provide Project information and updates, solicit feedback, and to answer questions. CAGs have been established in Cambridge Bay and Kugluktuk and consist of HTO, Hamlet, Elder, and youth representatives. The Cambridge Bay CAG selected the name 'Kiilinakmiut' for their group and includes representatives from Bathurst Inlet and Omingmaktok. The Kugluktuk CAG selected the name 'Kugluktumi Sabinakut Katimayiit' for their group. Meetings will be interpreted into local dialects as needed and minutes will be taken by Sabina.
Site Visits	Visits to the Project site will be provided to selected stakeholders. Site visit participants will be shown different Project areas, provided with relevant Project information, and introduced to different Project staff.
Social Media	Sabina will continue to maintain a Project website (www.backriverproject.com) that provides up-to-date information on the Project and its community engagement activities. Email distribution lists, and RSS and Twitter feeds will also continue to be utilized to share Project-related information.
Project Newsletter	Sabina will continue to issue a semi-regular Project newsletter to share information and keep communities and other stakeholders informed of Project-related developments. This newsletter will be translated into local dialects and distributed through Sabina's social media outlets and at physical locations throughout the Kitikmeot Region.
Other Distribution Materials	Other informational materials (e.g., handouts, posters, popular summaries, company reports) will be made available to communities and stakeholder groups in order to widely share Project-related information. These will be translated into local dialects were appropriate.
Radio Shows	Radio shows provide a way to share Project-related information with a wide audience. Radio shows can be of a call-in nature where Sabina can answer the public's questions, or of an informational nature where only Project updates are provided.
Trade Show Participation	Trade show participation (e.g., display booths, presentations, sponsorships) provides a way to share Project-related information and interact with the public.

Community engagement will first take place with the residents of those communities located nearest to the Project site, specifically with residents of Cambridge Bay, Kugluktuk, Bathurst Inlet, and Omingmaktok. Meetings will take place and materials will be available in Cambridge Bay and Kugluktuk. Secondly, Sabina will also engage residents of the eastern Kitikmeot Region (Taloyoak, Gjoa Haven, and Kugaaruk) using similar methods.

7.1.2 Community Engagement Activities by Project Phase

Community engagement activities during the construction phase of the Project will focus on:

- Providing communities with Project and construction-related progress updates.
- Informing communities of training and hiring opportunities during construction and operations.
- Identifying community issues and concerns regarding construction-related activities.
- Continuing discussions on the development of community-based monitoring programs.
- Providing information on future Project development plans.

Sabina will actively engage communities during the construction phase of the Project. Construction will be a time of increased activity at the Project site, with an influx of large numbers of construction personnel, new machinery, and infrastructure and building materials. The Project will evolve rapidly during the construction phase, and it will be necessary to keep the local communities informed of Project changes and advancements. Community meetings, ongoing communication with community stakeholders, use of social media, and other forms of engagement will be utilized during this period.

Community engagement activities during the operations phase of the Project will focus on:

- Providing communities with Project updates and informing communities of any proposed operational changes (e.g., mine expansions, new infrastructure development).
- Informing communities of training and hiring opportunities during operations and closure/ post-closure.
- Identifying community issues and concerns regarding operations-related activities.
- Updating communities on the results of Project monitoring and mitigation programs, and soliciting feedback.
- Providing information and soliciting community feedback on mine reclamation and closure plans and activities.

Sabina will continue to actively engage communities during the operations phase of the Project. While the mine and its facilities will be very active locations, the operations phase of the Project will be highly routinized and employment numbers will stabilize. However, operational plans may evolve over the course of the Project; for example, project expansions may be proposed that require new regulatory approvals and community consultation. Community meetings, ongoing communication with community stakeholders, use of social media, and other forms of engagement will be utilized during this period.

Community engagement activities during the reclamation and closure, and post-closure phases of the Project will focus on:

- Providing communities with Project and reclamation and closure-related updates.
- Informing communities of training and hiring opportunities during reclamation and closure, and post-closure.
- Identifying community issues and concerns regarding reclamation and closure-related activities.
- Updating communities on the results of reclamation and closure-focused monitoring and mitigation programs, and soliciting feedback.

Community engagement activities will be less intensive during the reclamation and closure, and post-closure phases of the Project. Prior to final closure, ore production will permanently stop, much of the infrastructure will be removed from the site, and necessary Project land will be remediated. While effects monitoring will continue, only a small staff of closure professionals will remain at the Project site. Community meetings, ongoing communication with community stakeholders, use of social media, and other forms of engagement will be utilized during this period.

7.2 PROJECT UPDATES

Successful engagement will be based on timely and transparent communication regarding the status of the Project and related topics including training and employment opportunities. Project updates on

matters including progress, current initiatives, and future work have already been initiated and will continue throughout the life of the Project. Community newsletters are distributed by Sabina's CLO and are readily available to the public and the communities. Sabina will provide Project updates to all employees, the communities, and the public regarding any notable changes to Project activities, including changes to production and operations (such as temporary closure or care and maintenance periods) and shipping schedules. Communication will mainly take place through the following means:

- In-person to employees via managers during staff meetings, which will be followed by informational posts on bulletin boards at several location in the camps as well as the Sabina office in Cambridge Bay (postings will be provided in English, Inuinnaqtun, and Inuktitut).
- Community radio broadcasts that inform listeners of Project updates and other Project related information.
- Online, through the use of company provided updates to the Back River Project website (www.backriverproject.com), and other social media including email distribution lists, Twitter, and RSS feeds.
- Public meetings that are open to all community members.
- Stakeholder meetings with HTOs, Hamlets, Aboriginal and other community organizations, and governments held periodically at major Project milestones through the life of the Project.
- Distribution of Project bulletins or newsletters (provided in English, Inuinnaqtun, and Inuktitut) online and in print within Kitikmeot Region communities (printed copies provided in government offices and public buildings, and directed to individuals who have requested to be kept up-to-date on the Project).
- Distribution of other Project materials including handouts, posters, popular summaries, and company reports.
- Meetings with CAGs in Cambridge Bay and Kugluktuk to further facilitate the provision of Project updates, and other Project related information.

7.3 INCORPORATION OF PUBLIC FEEDBACK AND COMMUNITY INPUT

The Plan was developed based on the requirements for the EIS with consideration for issues discussed during socio-economic and land use community research and the annual Kitikmeot Region Socio-economic Monitoring Committee meetings and reports. The results of Sabina's existing community engagement program have also informed the development of the Plan.

Addressing and incorporating public suggestions and concerns related to the Project is a goal Sabina will meet through the use of public and stakeholder meetings, the Back River Project website, and community research. This work began early in the environmental assessment process and will continue through the life of the Project. Sabina will continue to provide information and request feedback at all public and stakeholder meetings. Community suggestions and concerns are also elicited during community research and through the use of the Project website which provides a forum for the public to provide feedback. Public engagement efforts will be evaluated through the record of public meetings, and meetings with HTOs, Hamlets, CAGs, governments, and other organizations, and will include any feedback provided by community members regarding the engagement process. Sabina will respond to community suggestions and concerns in-person when possible, for example at community meetings, through the CAGs, through the CLO, by providing updates in Project newsletters and bulletins, and/or on the Back River Project website, as applicable. Overall, the Plan is designed to help ensure the timely consideration and resolution of all substantive issues, concerns, and comments raised by stakeholders.

Public feedback will be solicited through public and stakeholder meetings, through the Sabina office in Cambridge Bay, meetings with the CAGs, call-in radio shows, and by encouraging local employees and contractors to share their thoughts and suggestions with community relations and management staff. These methods of engagement also provide an effective form of two-way communication and an opportunity for Sabina to provide responses to inquiries, for example, comments, suggestions, and/or concerns about the Project. Sabina will also solicit feedback about the Project through the provision of comment forms available at various locations in the Kitikmeot Region and will establish a procedure to address public feedback in a timely, effective, and transparent manner. Sabina will track and monitor community views on the issues and concerns that arise through public meetings, stakeholder meetings, public comment forms, and/or CAG meetings through a community engagement database. Local employees and contractors will also be encouraged to provide direct feedback on workplace and Project-related issues that arise.

As mentioned previously, Sabina employs a CLO in Cambridge Bay that facilitates the distribution of Project information, maintenance of relationships, and receipt of community feedback about the Project. Many community involvement methods will continue throughout the life of the Project. The adaptive management approach enables the continual integration of community input into design and implementation of the Plan.

7.4 PROMOTION OF INUIT PARTICIPATION IN EMPLOYMENT AND CONTRACTING OPPORTUNITIES

Sabina will communicate upcoming employment and contracting opportunities through the use of a public online database housed within the Back River Project website. Additionally, formal targeted communications strategies will include providing information and materials to community Economic Development Officers (EDOs), the Sabina CLO, and education institutions (i.e., the Nunavut Arctic College), while more informal means of communication will include posting information in strategic community locations and at the mine site. Sabina will host public meetings to provide communities with information regarding employment and training opportunities throughout the life of the Project. Employment opportunities will also be communicated via the Back River Project newsletter which will be available in English, Inuktitut, and Inuinnaqtun.

Contractors listed on the Nunavut Tunngavik Inc. (NTI) Inuit Firms Registry Database, on the Kitikmeot Inuit Business Listing, and as identified through other means will be invited via email to provide information about their firms and area of expertise and to bid on Project work. For further information related to Inuit contracting opportunities and local sourcing refer to the Business Development Plan (Volume 10, Chapter 24). The use of a variety of methods of communication will ensure that information is publically accessible and readily available.

Sabina will develop a number of measures to promote Inuit participation in employment such as preferential hiring and contracting, a viable work rotation schedule, the fly-in/fly-out operation of the Project (which enables workers to return to their home communities regularly during time off), as well as training opportunities and career counselling to advance the careers of Inuit employees. Sabina's approach to promoting Inuit participation in Project employment is detailed in the Human Resources Plan (Volume 10, Chapter 28). Similarly, several measures to promote the participation of local Inuit businesses in contract work with the Project will be established. These will include, for example, first opportunities for contracts to Inuit-owned businesses, encouragement of contractors to breakdown larger contracts into parcelled components readily subsumed by equipped Inuit firms, and demand-driven workshops to build business capacity. Further details are provided in the Business Development Plan (Volume 10, Chapter 24).

Other programs to promote Inuit participation in employment and contracting opportunities include the Employee and Family Assistance Program (EFAP) which provides counselling related to financial management and budgeting, addictions counselling, stress management, as well as individual and family counselling, among others. The EFAP is detailed in the Human Resources Plan (Volume 10, Chapter 28).

7.5 COMMUNICATION OF RESEARCH RESULTS

Results of community research of social, cultural, and ecological conditions will be publicly available on the NIRB website, on the Back River Project website, and at the Sabina office in Cambridge Bay. The information available will include all submissions included as part of the EIS, as well as on-going annual environmental and socio-economic monitoring reports. Where appropriate, the interim results of research can be provided to community or government organizations upon request. If additional research or studies are conducted over the course of construction or operations on topics other than those defined by the monitoring programs, these results may also be similarly shared with communities. However, Sabina acknowledges the requirements of the *Scientists Act* (Nunavut) and commits to ensuring that legislated reporting requirements under the *Scientists A*ct are followed when communicating (and reporting) research results.

8. Reporting and Plan Effectiveness

Reports on Plan outcomes and performance, as well as any recommended additional adaptive management actions, will be prepared at a minimum annually for internal company distribution and use. The Plan will be evaluated against the defined scope and objectives (Section 2).

As part of the Back River Socio-Economic Monitoring Program (Volume 10, Chapter 23), the relevant findings will be reviewed in collaboration with other members of the Back River Project Socio-economic Monitoring Committee (SEMC) and the NIRB. Key findings and recommendations will be incorporated into an annual report to the NIRB. Reporting of monitoring results will also be provided to the Back River Project SEMC and the Kitikmeot Region SEMC.

9. Summary

The Plan aims to help minimize the negative effects and to maximize or enhance the potential benefits of the Project within the communities of the Kitikmeot Region. The objective of the Plan is to fulfil Project external public engagement commitments and maintain meaningful relationships with communities and the public. The Plan is meant to outline the efforts Sabina will make to communicate and engage with residents, communities, and stakeholders throughout the life of the Project. Specifically, the Plan describes Sabina's commitment to provide Project updates, to incorporate public feedback, to promote Inuit participation in employment and contracting opportunities, to receive community input, and to communicate research results.

The Socio-economic Monitoring Program will provide information to assist in the management of the outcomes of the Plan and will collect and analyze information on conditions and trends. The monitoring program will inform the ongoing management and mitigation of the potential social and economic effects identified in the EIS and will facilitate best practices in social responsibility as it relates to community engagement, capacity building, and realization of benefits from the Project. The

monitoring program will be established to enable Project managers and community leaders to respond proactively and in a timely manner to any undesirable changes to socio-economic conditions.

Sabina recognizes that the Project will present Inuit communities with both substantial opportunities as well as changes to current social and economic conditions. Sabina is committed to implementing measures to enhance the benefits of the Project for individuals residing in the Kitikmeot Region communities. Mitigating existing and potential impacts, and promoting individual, family, and community well-being is a shared responsibility of Sabina, the KIA, the hamlets, and the Government of Nunavut. Commitments to enhance regional employment and training and the provision of community programs and services to enhance community well-being do not impose responsibility on Sabina to assume the role of government. Sabina will cooperate in these efforts. For the benefits of the Project to be fully realized at the local level the communities must be engaged in the implementation of strategies to build capacity to enhance well-being, which contributes to the ability of communities to deal with current and future challenges and to retain the benefits beyond the life of the Project.

There is inherently some uncertainty associated with predicting social impacts prior to the implementation of Project activities. Sabina will work to address impacts and enhance benefits as they are identified over time. Adaptive management was a method used for the creation and implementation of the Plan, and the monitoring program enables the engaged parties to instigate change where required and to employ the use of new data and best practices as they become available. Further, the adoption of adaptive management practices enables the engaged parties to adjust plans based on the findings of the monitoring program and community feedback throughout the life of the Project.

References

NIRB. 2013. *Guidelines for the Preparation of an Environmental Impact Statement For Sabina Gold & Silver Corp.'s Back River Project*. (NIRB File No. 12MN036). Cambridge Bay, Nunavut.

NTI. 1997. *Mining Policy – Oyagakheoktin.*

27. Cultural and Heritage Resources Protection Plan

Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Cultural and Heritage Resources Protection Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions)
Chapter 27	All Sections	George and TCWR connector	Removal of reference to the George Property and the TCWR Connector
	All Sections	DEIS	Changed DEIS to FEIS
	8.1	Mitigation and Adaptive Measures	Removed archaeological sites related to the George Property
	8.2	Mitigation and Adaptive Measures	Removed archaeological sites related to the TCWR
	8.2	Mitigation and Adaptive Measures	Made changes based on the revisions to the proposed Winter Road

BACK RIVER PROJECT
CULTURAL AND HERITAGE RESOURCES PROTECTION PLAN

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Appendix B. Archaeological Chance Find Procedure

Glossary and Abbreviations

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

Borden number	An alphanumeric designation used as a unique identifier for archaeological sites recorded in Canada (i.e., MbNj-52). The system consists of a grid based on the National Topographic Series of maps published by Natural Resources Canada. Two upper case letters which run from south to north and from east to west, identify each grid block. Each upper case letter is followed by a close case letter which designates a subdivision of the grid block based on latitude and longitude. Site within each lower case block are assigned sequential numbers by a responsible institution (the Canadian Museum of Civilization assigns these numbers for sites recorded in Nunavut).
FEIS	Final Environmental Impact Statement
GN-DCH	Government of Nunavut Department of Culture and Heritage
GPS	Global Positioning System
IHT	Inuit Heritage Trust
LSA	Local Study Area
NIRB	Nunavut Impact Review Board
QA/QC	Quality Assurance and Quality Control
the Plan	The Cultural and Heritage Resources Protection Plan for the Back River Project
the Project	The Back River Project
PDA	Proposed Development Area
RSA	Regional Study Area
Sabina	Sabina Gold & Silver Corp.
SOP	Standard Operating Procedure

1. Introduction

This chapter describes the Cultural and Heritage Resources Protection Plan (the Plan) that Sabina Gold & Silver Corp. (Sabina) will follow in the development and operation of the Project. This Plan, and other management plans, are intended to describe the ways in Sabina which will address or mitigate issues identified in the Final Environmental Impact Statement (EIS).

This Plan details the protection of cultural and heritage resources which have been identified within or adjacent to the Project footprint. The Plan has been prepared as part of the Project Environmental Impact Statement and follows the Guidelines issued by the Nunavut Impact Review Board (NIRB) for the Project. The Plan will be reviewed and updated on an as-needed basis as the Project proceeds into detailed design, construction, operations, and closure.

There are four key elements which have been addressed in the Plan:

1. A summary of applicable legislation and guidelines for management of potential impacts to identified cultural and heritage resources.
2. An inventory of known archaeological resources in the Project area, including the results of the archaeological investigations undertaken for the Project.
3. A summary of the archaeological resources which may be impacted by the Project, as outlined in the FEIS for the Project.
4. General and site-specific measures for the protection of archaeological sites and mitigation of potential adverse impacts.

2. Scope and Objectives

Management of cultural and heritage resources will be an important part of the on-site management program. The intent for this plan is to describe the commitments and philosophy for the management of cultural and heritage resources in relation to the Project. Management of cultural and heritage resources will be accomplished through consultation and collaboration between Sabina Gold & Silver Corp. (Sabina), the Project archaeologist, and the Government of Nunavut Department of Culture and Heritage (GN-DCH).

3. Planning and Implementation

Planning for the Cultural and Heritage Resources Management Plan started with the development of the FEIS, which identified existing (baseline) conditions, assessed potential impacts of the Project, developed conceptual mitigation strategies and developed specific mitigation measures to execute these strategies. Conceptual strategies and plans will continue to be elaborated and executed throughout the construction, operation, and closure phases of mining. Environmental management and social aspects will be tracked, reviewed, and updated through ongoing maintenance of the plan. These updates will incorporate relevant feedback from the public, obtained during public consultation.

Significance criteria have been developed that assist in identifying priority aspects, establish management criteria and activity-specific mitigation measures. For social issues and effects, a key factor for determining significance is ongoing feedback from public consultation. These efforts will be used to communicate progress, and involve the public where necessary, on environmental performance.

Monitoring will be the principal mechanism to provide feedback to continually gauge the effectiveness of environmental performance. Operational control is facilitated through the contractor job-specific standard operating procedures (SOPs) work instructions, on-the-job instruction, tailgate meetings where required, contract requirements, and service agreements. The effectiveness of physical operational control will be reviewed according to preventative maintenance and review procedures and schedules.

4. Applicable Legislation and Guidelines

All archaeological and paleontological sites in Nunavut are protected under territorial or federal legislation. Archaeological and paleontological sites are protected under Section 51 of the *Nunavut Act* (Nunavut Archaeological and Paleontological Sites Regulations, 2001*)*. In addition, archaeological sites and as yet unrecorded archaeological sites found on federal Crown Land are protected by the Territorial Land Use Regulations (2013) of the *Territorial Lands Act* and by the *Canada Oil and Gas Operations Act* (Canada Oil and Gas Geophysical Operations Regulations, 2012).

Permits to conduct archaeological and paleontological research throughout Nunavut are applied for and issued under the *Nunavut Act* (Nunavut Archaeological and Paleontological Sites Regulations, 2001). In addition, work conducted on Inuit Owned Lands or within the Nunavut Settlement Area will be conducted in accordance with Articles 21 and 33 of the *Nunavut Land Claims Agreement Act* (1993).

There are two administrative bodies that are involved in the protection and management of archaeological sites in Nunavut. The GN-DCH is the government agency responsible for the administration of all regulations concerning archaeology in Nunavut and is designated as such under the *Nunavut Land Claims Agreement Act* (1993). The Inuit Heritage Trust (IHT) was created to "support, encourage and facilitate the conservation, maintenance, restoration and display of archaeological sites and specimens in the Nunavut Settlement Area", as outlined under Article 33 of the *Nunavut Land Claims Agreement Act* (1993).

Additionally, locational information pertaining to archaeological sites is protected by a Data Licence Agreement issued by GN-DCH. A condition of the data license stipulates that archaeological sites will not be plotted on a map which could be made available to the public unless the scale of the map is less than or equal to 1:2,000,000 and the positional accuracy has been randomized. Due to these restrictions no maps depicting archaeological site locations are included in this document.

5. Roles and Responsibilities

The General Manager is ultimately responsible for the success of the plan and approves all relevant policies and documents, auditing, action planning and the verification process.

The Environmental Superintendent along with his/her direct reports are responsible for the implementation of this plan including:

- Overall management of plan.
- Monitoring.
- Operational aspects.
- Internal reporting.
- External reporting.
- Ensuring compliance and adaptive management.

6. Environmental Protection Measures

Protection of cultural and heritage resources will include monitoring of known archaeological sites within the local study area LSA (Section 7) and the institution of a chance find procedure for the protection of currently unknown sites that may be identified during Project phases (Appendix B). Avoidance is always the preferred mitigation measure for cultural and heritage site; however, if avoidance is not feasible a systematic data recovery program may be instituted that will be designed in consultation with the GN-DCH to reduce the negative effect to a not significant level (Section 8).

7. Monitoring Program

7.1 REPORTING RESPONSIBILITIES

Sabina will maintain documentation regarding archaeological site monitoring, chance finds, and will report any impacts to archaeological sites. Sabina will work in collaboration with the Project archaeologist and will coordinate site monitoring/inspection and documentation of chance archaeological finds.

Sabina will arrange for site orientation and training of all employees and on-site personnel with regards to compliance with the *Nunavut Archaeological and Paleontological Sites Regulations* (2001) and the use of the Project's Archaeological Chance Find Procedure (see Section 7.3). Training and site orientation will be provided for all new employees and refresher training will be provided to all employees and on-site personnel on an annual basis. This training will focus on not disturbing known archaeological sites, the procedures in place for responding to newly identified sites, as outlined in the Project's Archaeological Chance Find Procedure, and how to report these sites or observed site impacts.

7.2 ARCHAEOLOGICAL SITE MONITORING AND FLAGGING

Archaeological site monitoring and/or site flagging during construction, operations, and closure is identified in Section 8 as a management measure for archaeological sites which are located within 50 to 150 m of all Project infrastructure (Sections 7.2.1 and 7.2.2) and those located within 150 to 1,000 m (Section 8.2.3) from the Project footprint, with the exception of winter roads. This section describes how and when monitoring and site flagging will take place at those identified sites as well as the use of the Project's Archaeological Chance Find Procedure.

7.2.1 Archaeological Site Construction Monitoring – 50 to 150 m

Construction occurring near archaeological sites which are within 50 to 150 m of the Project footprint will have an Environmental Monitor present during construction and the sites will be flagged/fenced prior to construction. Development maps will clearly indicate the location of archaeological site boundaries in relation to Project footprint components. The Environmental Monitor will watch for archaeological site impacts or situations where construction activities are occurring less than 50 m from a site. Should impacts be anticipated to occur less than 50 m from a site, the Project archaeologist will be contacted to determine if mitigation measures, which may include systematic data recovery, are required.

Flagging/fencing of archaeological site boundaries will take place prior to construction during snow-free conditions and when the ground is not frozen. Flagging/fencing will be conducted by the Project archaeologist and an Environmental Monitor. Archaeological sites in this region typically contain surface scatters of artifacts; therefore installation of flagging/fencing is best conducted when the surface of the site is visible to prevent any unnecessary damage. Installation of flagging/fencing when the ground is not frozen is recommended for ease of installation where rebar or wooden stakes will be used (see Section 7.2.2).

The Environmental Monitor will document, by means of photographs and field notes, the type of construction and disturbance occurring near a site, weather conditions, personnel present, and other pertinent details. It is imperative that detailed field notes are recorded during monitoring. This information will be summarized in an Archaeological Site Monitoring report to be provided to the GN-DCH.

7.2.1.1 Field Notes

The following information will be recorded in the field during the archeological site monitoring program for sites within 50 to 150 m from construction activities:

- Borden number (i.e., MbNj-52) of the site being monitored.
- Photographs in cardinal directions (N, E, S, W) of the site and photographs illustrating any construction or other activity being conducted nearby.
- All photograph numbers, direction of image, and a description of each image must be recorded in the field notes.
- Date and time monitoring was undertaken and completed at the site.
- Nature of construction or other activity being undertaken.
- Distance to construction or other activity being conducted.
- GPS location.
- Personnel involved in construction activities and the name(s) of the Environmental Monitor(s).
- General observations of the condition of the site.
- Weather conditions at each site at the time of monitoring.

It is imperative that detailed photographs are taken and that detailed field notes are recorded during site monitoring.

7.2.1.2 Reporting

A data report will be completed following monitoring conducted at each site. The reports will generally include the site's Borden number, a summary of the methods and equipment used, GPS location, a photo log of the photographs taken during monitoring, and a map showing the location of the site being monitored in relation to the Project component.

7.2.2 Archaeological Site Boundary Flagging

Site boundaries for sites which fall between 50 to 150 m of proposed infrastructure will be flagged prior to construction by the Project archaeologist and an Environmental Monitor. Typically, site boundary flagging involves the use of rebar or wooden stakes with snow fencing, or other visible barrier, running around the outside of the site boundary. Similarly, brightly coloured stakes installed at intervals around the boundaries of the site can be used if snow fencing or other visible barriers are impractical or constitute a barrier for wildlife. In either case, fencing will be visible above the anticipated snowline, particularly where sites are located along winter roads.

It is best practice to have the Project archaeologist mark the boundaries and erect the flagging/fencing in order to limit impacts to the site and to avoid any sensitive areas which may be present. Once the site has been flagged, the site will be visited during and after construction activities to determine if impacts have occurred. Environmental Monitors will also check on and maintain these flagged boundaries if future construction or other development activities are planned nearby in the future.

7.2.3 Archaeological Site Monitoring – 150 to 1,000 m

Archaeological sites which are within 150 to 1,000 m of the Project footprint will have the Project archaeological and/or an Environmental Monitor check on these sites periodically to determine that they remain intact and unaffected by the Project.

Should impacts be observed at archaeological sites, the Project archaeologist and the GN-DCH will be contacted and notified of any impacts. Post-impact mitigation plans will be developed in consultation with the GN-DCH on a case-by-case basis.

The Project archaeologist and/or the Environmental Monitor will document, by means of photographs and field notes, the type of impact (if present), weather conditions, personnel present, and other pertinent details. It is imperative that detailed field notes are recorded during monitoring. This information will be summarized in an Archaeological Site Monitoring report to the GN-DCH.

7.2.3.1 Field Notes

The following information will be recorded in the field during the archeological site monitoring program for sites within 150 to 1,000 m from proposed infrastructure:

- Borden number (i.e., MbNj-52) of the site being monitored/inspected.
- Photographs in cardinal directions (N, E, S, W) of the site and photographs illustrating the current condition of the site and any impacts (if present).
- All photograph numbers, direction of image, and a description of each image must be recorded in the field notes.
- Date and time monitoring was undertaken and completed at the site.
- Nature of impact at the site (if present).
- GPS location.
- Personnel involved in monitoring/inspection activities.

- General observations of the condition of the site.
- Weather conditions at each site at the time of monitoring.

It is imperative that detailed photographs are taken and that detailed field notes are recorded during site monitoring.

7.2.3.2 Reporting

A report will be completed following monitoring conducted at each site. The reports will generally include the site's Borden number, a summary of the methods and equipment used, GPS location, a photo log of the photographs taken during monitoring, a map showing the location of the site being monitored in relation to the Project component.

7.3 ARCHAEOLOGICAL CHANCE FIND PROCEDURE

As part of the baseline studies undertaken for the Project, an Archaeological Chance Fine Procedure was developed and implemented to assist in the chance discovery of archaeological materials by Project personnel. The Archaeological Chance Find Procedure will continue to be used during construction, operations, and closure and has been appended to this plan (Appendix B).

All Project personnel will be training to use the Archaeological Chance Find Procedure and the protocols and steps which will be followed should archaeological materials be encountered during construction, operations, or closure.

8. Mitigation and Adaptive Management

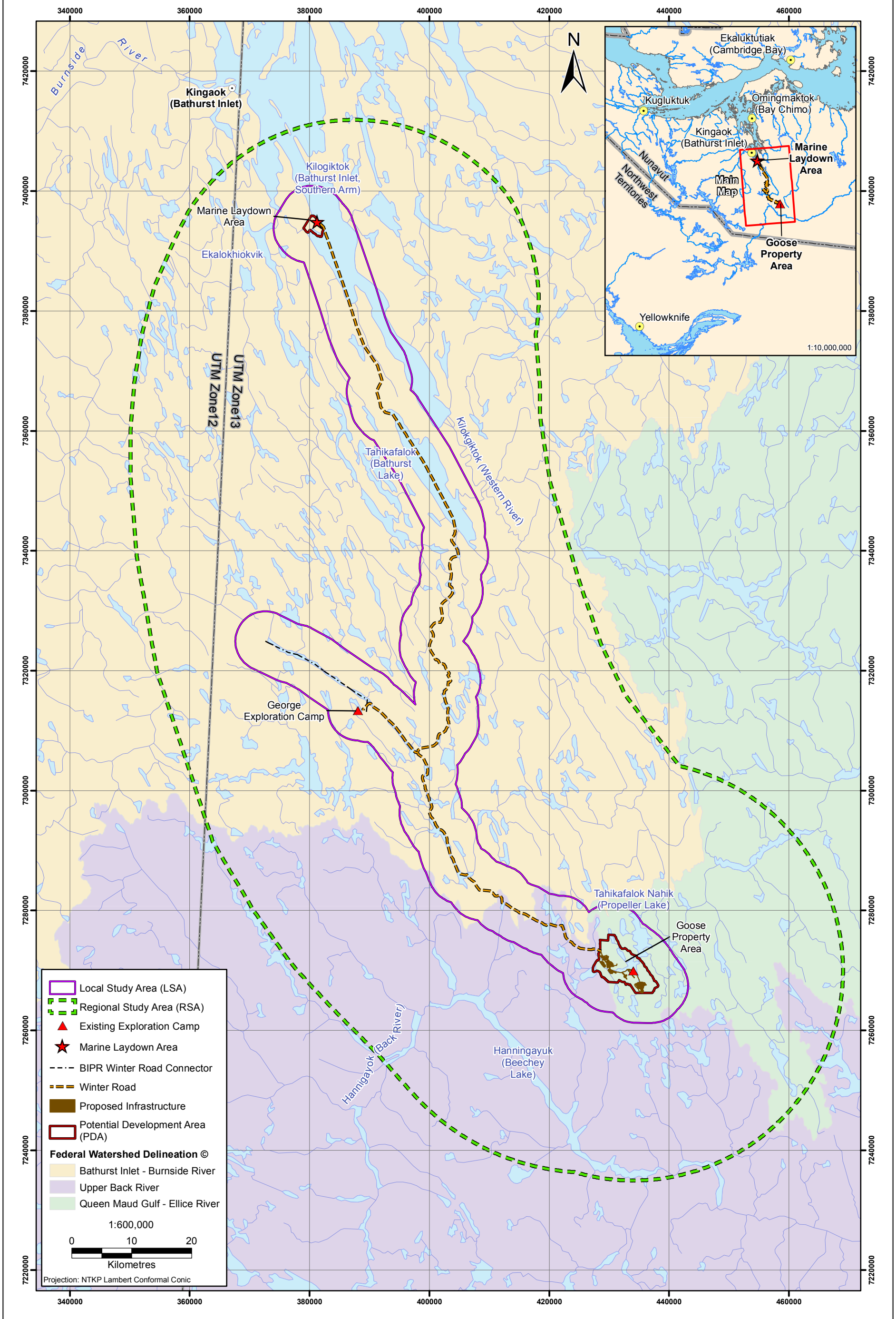
This section includes an inventory of known archaeological sites within the Project's local study area (LSA) taking in a 5 km area on either side of the Project footprint. Sites within 1,000 m of Project footprint components that will potentially be impacted by the Project are summarized in Appendix A. Due to the sensitive nature of archaeological sites, locational information is not provided in this document but will be illustrated on construction maps. Sites that are within the LSA but are more than 1,000 m away from the Project footprint are provided for reference but are not considered further in this plan as they are outside of the anticipated impact zones. The Project footprint considered in this plan, as well as the regional study area (RSA) and LSA, are illustrated in Figure 8-1. Should Project footprint components be revised during the course of construction, operations, and closure, the site inventory included in Appendix A and construction maps showing the locations of these sites will be consulted to determine if any known archaeological sites may be in conflict.

Mitigation and adaptive management measures for archaeological sites within 1,000 m of the Project footprint have been included in this plan on a site-by-site basis. Several levels of direct and indirect impacts from Project developments have been considered. Where a site is:

- **0 m** to **50 m** from the Project footprint, direct impact from construction activities is anticipated.
- **50 m** to **150 m** from the Project footprint, indirect impact from construction activities is anticipated.
- **150 m** to **1,000 m** from the Project footprint, indirect impact from increased human presence is anticipated.
- **Greater than 1,000 m** from the Project footprint, no impact is anticipated.

GIS # BAC-02-073

August 18 2015



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Local Study Area and Regional Study Area for Archaeology

Figure 8-1

Rescan an ERM company

Archaeological sites can be impacted during construction by the movement, excavation, or disturbance of soils including the clearing and grading of roads, building foundations and footings, and earthworks, excavation, and blasting related to open pits, adits, and other minesite infrastructure. In addition, archaeological sites can be impacted by increased human presence in the area as sites within the LSA often have archaeological materials present on the surface.

Where sites fall within 0 to 50 m of proposed infrastructure, the risk of direct impacts from construction activities is high. Typically, site avoidance through Project redesign is the recommended management option. However, if avoidance is not possible, mitigation of such sites will be conducted prior to construction activities. Mitigation measures are determined in consultation with the GN-DCH and carried out by a professional archaeologist. Mitigation may involve detailed mapping, photography, and systematic data recovery through surface collection, and, if subsurface deposits are present, controlled excavations of evaluative units. Upon approval by the GN-DCH development in these areas can proceed.

Where sites fall within 50 to 150 m of proposed infrastructure, the risk of indirect impacts from construction activities is moderate to high. These areas will be marked as "No Work Zones" on development maps. An Environmental Monitor will be present during construction activities near such sites and/or the site boundary will be flagged or fenced to limit any indirect impacts. Caution will be exercised during construction activities near the site. If direct impact at these sites is anticipated during construction, mitigation measures will be required (see above).

Where sites fall within 150 to 1,000 m of proposed infrastructure, the risk of increased human presence in the area is low to moderate. Efforts will be made to avoid these sites during construction, operations, and closure. These areas will be marked as "No Work Zones" on development maps. Where sites are within 150 to 1,000 m of winter roads, continued site avoidance will be practiced. Where sites are within 150 to 1,000 m of Project infrastructure, not including winter roads, continued site avoidance will be practiced and monitoring and inspection of these sites will be undertaken periodically to determine that they remain intact and unaffected by the Project. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites (see Section 8.3).

Sites beyond 1,000 m of proposed infrastructure are at low risk of direct and/or indirect impacts from construction and/or human presence, unless the Project footprint is revised during construction, operations, and/or closure. Therefore, sites beyond 1,000 m of proposed infrastructure are not discussed further in this plan.

Any archaeological sites discovered during construction, operations, and closure or sites which fall within 1,000 m of revisions to the Project footprint that are not currently discussed in this document will be subject to the same level of management and mitigation afforded to archaeological sites outlined in this plan. Archaeological sites not previously recorded will be inspected by the Project archaeologist and documented under a Class 2 Nunavut Territory Archaeologists Permit, issued by GN-DCH.

For ease of review, archaeological sites within 1,000 m of the Project footprint are discussed in this Plan in relation to proposed development components, as illustrated in Figure 8-1, followed by site-specific management and mitigation measures for the protection of archaeological sites from potential adverse impacts. Appendix A describes the distance from archaeological site boundaries to Project components and also outlines proposed mitigation and management measures for each site within 1,000 m of the Project footprint.

8.1 GOOSE PROPERTY PROPOSED DEVELOPMENT AREA

There are five archaeological sites located within 1,000 m of the PDA at the Goose Property (an area including open pits, adits, laydown areas, waste rock storage, etc.): LjNh-1, LjNh-2, LjNh-3, LjNh-4, and LjNh-5.

8.1.1 Site-specific Effects, Management, and Mitigation

8.1.1.1 Sites LjNh-1, LjNh-2, LjNh-4, and LjNh-5

These sites fall within 0 to 50 m of the PDA for the Goose Property and are at risk of direct impacts from construction activities. Site avoidance through Project redesign is the recommended management option. If avoidance is not possible, mitigation of these sites will be conducted prior to construction activities. Mitigation measures will be determined in consultation with the GN-DCH. Mitigation may involve detailed mapping and systematic data recovery though surface collection, detailed site mapping, photography and controlled subsurface excavations of evaluative units if subsurface deposits are present (see Appendix A for site-specific mitigation measures). Upon approval of the GN-DCH development in this area can proceed.

8.1.1.2 Site LjNh-3

Site LjNh-3 falls within 150 to 1,000 m of the PDA for the Goose Property and has the potential to be indirectly impacted by increased human presence in the area. This area will be marked as a "No Work Zone" on development maps and Project personnel will be educated about the Project's Chance Find Procedure and protocols around the management and protection of archaeological sites. Efforts will be made to avoid this site during construction, operations, and closure. Monitoring and inspection of this site will be undertaken periodically to determine that it remains intact and not effected by the Project.

8.2 PROPOSED WINTER ROADS

There are 44 archaeological sites located within 1,000 m of the proposed winter roads: LjNi-1, LkNj-1, LlNj-1, LlNk-7, LlNk-11, LlNk-13, LlNk-14, LlNk-15, LlNk-16, LlNk-17, LlNk-18, LlNk-19, LlNl-14, LlNl-15, MaNj-5, MaNj-6, MaNj-7, MaNl-1, MaNl-2, MaNl-3, MaNl-4, MaNl-5, MaNl-6, MaNl-7, MaNl-8, MaNl-9, MbNj-7, MbNj-8, MbNj-17, MbNj-18, MbNj-19, MbNj-21, McNk-4, McNk-5,McNk-6, McNk-7, McNk-8, McNk-9, McNk-10, McNk-11, McNk-12, McNk-13, MdNk-43, and MdNk-48.

8.2.1 Site-specific Effects, Management, and Mitigation

8.2.1.1 Sites LlNk-18 and McNk-9

Archaeological sites LlNk-18 and McNk-9 fall within 0 to 50 m of the proposed winter road centre line and are at risk of direct impacts from construction activities. Site avoidance through Project redesign is the recommended management option. If avoidance is not feasible, mitigation of these sites will be conducted prior to construction activities. Mitigation measures will be determined in consultation with the GN-DCH. Mitigation may involve detailed mapping and systematic data recovery though surface collection, detailed site mapping, photography and controlled subsurface excavations of evaluative units if subsurface deposits are present (see Appendix A for site-specific mitigation measures). Upon approval of the GN-DCH development in these areas can proceed.

8.2.1.2 Sites MaNj-5, MaNj-6, MbNj-7, MbNj-18, and McNk-4

These sites fall within 50 to 150 m of the proposed winter road and are at risk if indirect impacts from construction activities. These areas will be marked as "No Work Zones" on development maps. An Environmental Monitor will be present during construction activities near these sites and/or the site boundaries will be flagged/fenced to limit any indirect impacts. Caution will be exercised during construction activities by construction crews during work near the site.

8.2.1.3 Sites LjNi-1, LkNj-1, LlNj-1, LlNk-7, LlNk-11, LlNk-13, LlNk-14, LlNk-15, LlNk-16, LlNk-17, LlNk-19, LlNl-14, LlNl-15, MaNl-1, MaNl-2, MaNl-3, MaNl-4, MaNl-5, MaNl-6, MaNl-7, MaNl-8, MaNl-9, MaNj-7, MbNj-8, MbNj-17, MbNj-19, MbNj-21, McNl-5, McNk-6, McNk-8, McNk-10, McNk-11, McNk-12, McNk-13, MdNk-43, and MdNk-48

These sites fall within 150 to 1,000 m of the proposed winter road centerline and maybe indirectly impacted by increased human presence in the area. These areas will be marked as "No Work Zones" on development maps. Efforts will be made to avoid these sites during construction, operations, and closure. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.

While sites MaNl-1 and MaNl-4 are within 150 to 1,000 m no further work is required at these sites as all artifacts have been collected and features have been documented by photography and mapping.

8.3 MARINE LAYDOWN AREA PROPOSED DEVELOPMENT AREA

There are 15 archaeological sites which are located within 1,000 m of the proposed Marine Laydown Area on Bathurst Inlet: MdNl-5, MdNl-6, MdNl-7, MdNl-8, MdNl-9, MdNl-10, MdNl-11, MdNl-12, MdNl-13, MdNl-14, MdNl-16, MdNl-17, MdNl-18, MdNl-19, and MdNl-20.

8.3.1 Site-specific Effects, Adaptive Management, and Mitigation

8.3.1.1 Sites MdNl-5, MdNl-6, MdNl-7, MdNl-8, MdNl-9, MdNl-10, MdNl-11, MdNl-12, MdNl-13, MdNl-14, MdNl-16, MdNl-17, MdNl-18, MdNl-19, and MdNl-20

These sites fall within 0 to 50 m of the proposed Marine Laydown Area and are at risk of direct impacts from construction activities. Site avoidance through Project redesign is the preferred management option. If avoidance is not possible, mitigation of these sites will be conducted prior to construction activities. Mitigation measures will be determined in consultation with GN-DCH. Mitigation may involve detailed mapping and systematic data recovery though surface collection, detailed site mapping, photography and controlled subsurface excavations of evaluative units if subsurface deposits are present. Upon approval of the GN-DCH development in this area can proceed.

8.4 REVISIONS TO PROJECT FOOTPRINT DURING CONSTRUCTION, OPERATIONS, AND CLOSURE

Any archaeological sites discovered, as a result of revisions to the Project footprint during construction, operations, and closure within 1,000 m will be subject to the same level of management and mitigation afforded archaeological sites outlined in this plan. These sites will be inspected by a professional archaeologist and documented in a Class 2 Nunavut Territory Archaeologists Permit, issued by GN-DCH.

9. Checking and Corrective Action

Checking and corrective action evaluates the predicted effects of the Project on the Heritage VSECs, and evaluates the compliance of the Project and its sub-contractors. Evaluation of predicted effects will be conducted through monitoring of archaeological sites within 1,000 m of Project developments (Section 7.2).

10. Record Keeping

Record keeping will be conducted by Sabina and its subcontractors. Data will be entered into suitable electronic databases (e.g., MS Access), checked for quality control and stored with subcontractor responsible for monitoring and with Sabina. Data will be entered in a format and program that allow for comparison between years and storage in a single file format for each type of survey or monitoring activity. QA/QCed data will be appended to the annual Archaeologist's report and the compilation of all years data will be transferred for storage with the GN-DCH.

11. Environmental Reporting

Environmental reporting for monitoring and, if necessary, systematic data recovery for archaeological sites within the LSA will be carried out under Nunavut Archaeologist Permits and the final reports will be submitted to the GN-DCH and all other communities and organizations specified under the terms of the permit. By March 31st of each year that footprint changes are occurring or that an archaeological permit is obtained Sabina will provide the GN-DCH summaries of the current status of all known archeology sites within 80 meters of the Project and a set of maps illustrating changes in the Project footprint. If systematic data recovery is recommended due to concerns raised during site monitoring a data recovery program will be developed in consultation with the GN-DCH.

12. Plan Effectiveness

The Cultural and Heritage Resources Management Plan will be effective as the mitigation and management and monitoring activities will be carried out under Nunavut Archaeologist permits. The Nunavut Archaeological permitting system allows the GN-DCH to comment on the proposed methodology prior to approving the work and to assess its efficacy upon receiving the final permit report.

13. Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) measures will be undertaken at three key stages in monitoring activities: 1) during field data gathering, 2) during data entry and analysis, and 3) through reporting and reassessment of methods as part of the evaluation of Plan Effectiveness.

The process of data gathering in the field will be quality controlled through the use of qualified archaeologists and a system of pre- and post-field checks to ensure that consistent, repeatable data is being gathered. Data in the field will be collected using an electronic data collector (currently using an Esri platform) or through field notes collected in a field notebook. Data will either be entered directly into the database from the data collector or transcribed into a database from field notes. QA/QC of data entry will be conducted through an assessment of the completeness and accuracy of the field data. QA/QC of data analysis will be conducted through a process of clear, written instructions for data analysis and pre-and post-analysis checks by a second qualified archaeologist. Finally, the efficacy of the methods as a whole will be evaluated through repeated scrutiny of the data and through review by stakeholders.

References

1985. *Canada Oil and Gas Operations Act*, RSC. c. O-7. Last amended 19 June 2015.

1985. *Territorial Lands Act*, RSC. c. T-7. Last amended 1 April 2014.

1993. *Nunavut Act*, SC. c. 28. Last amended 26 February 2015.

1993. *Nunavut Land Claims Agreement Act*, SC 1993, c29. Last amended 21 May 2004.

2012. *Canadian Environmental Assessment Act*, S.C. 2012, c. 19, s. 66. Last amended 6 July 2012.

2001. Nunavut Archaeological and Paleontological Sites Regulations, SOR/2001-220. 14 June 2001.

2012. Canada Oil and Gas Geophysical Operations Regulations, SOR/96-117. 10 December 2012.

2013. Territorial Land Use Regulations, C.R.C., c. 1524. 10 June 2013.

Appendix A

Archaeological Sites within 1,000 m of the Project Footprint

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Appendix A. Archaeological Sites within 1,000 m of the Project Footprint

Borden Number	Distance to Nearest Project Component	Nearest Project Component(s)	Distance to Second Nearest Project Component	Second Nearest Project Component	Proposed Mitigation, Monitoring, and Management Measures	Permit Number
LjNh-1	0	Goose Property PDA	239	Proposed Winter Road	It is recommended that the site be revisited, if additional artifacts are located, systematic data recovery through surface collection, detailed site mapping, and photography will be undertaken. If subsurface deposits are present, controlled subsurface excavations of evaluative units will be conducted.	2010-024A
LjNh-2	0	Goose Property PDA	218	Proposed Winter Road	It is recommended that the site be revisited, if additional artifacts are located, systematic data recovery through surface collection, detailed site mapping, and photography will be undertaken. If subsurface deposits are present, controlled subsurface excavations of evaluative units will be conducted.	2010-024A
LjNh-3	802	Goose Property PDA	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2010-024A
LjNh-4	2	Goose Property PDA	n/a	n/a	Systematic data recovery through surface collection, detailed site mapping, and photography will be undertaken. If subsurface deposits are present, controlled subsurface excavations of evaluative units will be conducted.	2011-022A
LjNh-5	0	Goose Property PDA	n/a	n/a	Systematic data recovery through surface collection, detailed site mapping, and photography will be undertaken. If subsurface deposits are present, controlled subsurface excavations of evaluative units will be conducted.	2011-022A
LjNi-1	839	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2010-024A
LkNj-1	800	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2010-024A
LlNj-1	746	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2010-024A
LlNk-7	760	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A
LlNk-11	244	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A
LlNk-13	160	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A
LlNk-14	232	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A
LlNk-15	470	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A
LlNk-16	178	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A
LlNk-17	180	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and protocols around the management and protection of archaeological sites. Monitoring and inspection at this site will be undertaken on an annual basis to determine that it remains intact and unaffected by the Project.	2012-012A
LlNk-18	3	Proposed BIPR Winter Road Connector	n/a	n/a	Systematic data recovery through surface collection, detailed site mapping, and photography will be undertaken. If subsurface deposits are present, controlled subsurface excavations of evaluative units will be conducted.	2012-012A

Appendix A. Archaeological Sites within 1,000 m of the Project Footprint

Borden Number	Distance to Nearest Project Component	Nearest Project Component(s)	Distance to Second Nearest Project Component	Second Nearest Project Component	Proposed Mitigation, Monitoring, and Management Measures	Permit Number
LlNk-19	300	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A
LlNl-14	858	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A
LlNl-15	838	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A
MaNj-5	78	Proposed Winter Road	n/a	n/a	Site boundaries will be flagged/fenced and the site will be marked as a 'No Work Zone' on construction maps. Monitoring will be conducted when construction occurs within 150 m of the site.	2013-020A
MaNj-6	84	Proposed Winter Road	n/a	n/a	Site boundaries will be flagged/fenced and the site will be marked as a 'No Work Zone' on construction maps. Monitoring will be conducted when construction occurs within 150 m of the site.	2013-020A
MaNj-7	227	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2013-020A
MaNl-1	821	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2001-019A
MaNl-2	532	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2001-019A
MaNl-3	809	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2001-019A
MaNl-4	565	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2001-019A
MaNl-5	193	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A
MaNl-6	190	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A
MaNl-7	178	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A
MaNl-8	435	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A
MaNl-9	638	Proposed BIPR Winter Road Connector	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A
MbNj-7	136	Proposed Winter Road	n/a	n/a	Site boundaries will be flagged/fenced and the site will be marked as a 'No Work Zone' on construction maps. Monitoring will be conducted when construction occurs within 150 m of the site.	2010-024A

Appendix A. Archaeological Sites within 1,000 m of the Project Footprint

Borden Number	Distance to Nearest Project Component	Nearest Project Component(s)	Distance to Second Nearest Project Component	Second Nearest Project Component	Proposed Mitigation, Monitoring, and Management Measures	Permit Number
MbNj-8	257	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2010-024A
MbNj-17	328	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A
MbNj-18	99	Proposed Winter Road	n/a	n/a	Site boundaries will be flagged/fenced and the site will be marked as a 'No Work Zone' on construction maps. Monitoring will be conducted when construction occurs within 150 m of the site.	2012-024A
MbNj-19	749	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A
MbNj-21	293	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2013-020A
McNk-4	111	Proposed Winter Road	n/a	n/a	Site boundaries will be flagged/fenced and the site will be marked as a 'No Work Zone' on construction maps. Monitoring will be conducted when construction occurs within 150 m of the site.	2010-024A
McNk-5	160	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2010-024A
McNk-6	173	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2010-024A
McNk-7	230	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2010-024A
McNk-8	370	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2010-024A
McNk-9	23	Proposed Winter Road	n/a	n/a	Systematic data recovery through surface collection, detailed site mapping, and photography will be undertaken. If subsurface deposits are present, controlled subsurface excavations of evaluative units will be conducted.	2010-024A
McNk-10	269	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2010-024A
McNk-11	207	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2010-024A
McNk-12	212	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2010-024A
McNk-13	198	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2010-024A
MdNk-43	935	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A

Appendix A. Archaeological Sites within 1,000 m of the Project Footprint

Borden Number	Distance to Nearest Project Component	Nearest Project Component(s)	Distance to Second Nearest Project Component	Second Nearest Project Component	Proposed Mitigation, Monitoring, and Management Measures	Permit Number
MdNk-48	692	Proposed Winter Road	n/a	n/a	The site will be marked as a 'No Work Zone' on construction maps and the site will be avoided. Project personnel will be educated about the Project's Chance Find Procedure and training provided pertaining to the protocols around the management and protection of archaeological sites.	2012-012A
MdNl-5	0	Marine Laydown Area PDA	829	Proposed Winter Road	Systematic data recovery through surface collection, detailed site mapping, and photography will be undertaken. Controlled subsurface excavations of evaluative units will be conducted.	78-432, 2012-012A
MdNl-6	0	Marine Laydown Area PDA	898	Proposed Winter Road	It is recommended that the site be revisited, if additional artifacts are located, systematic data recovery through surface collection, detailed site mapping, and photography will be undertaken. If subsurface deposits are present, controlled subsurface excavations of evaluative units will be conducted.	2012-012A
MdNl-7	0	Marine Laydown Area PDA	n/a	n/a	Some artifact collection has been conducted at this site. Additional artifacts are located at the site; therefore systematic data recovery through surface collection, detailed site mapping, and photography will be undertaken. Controlled subsurface excavations of evaluative units will be conducted.	2012-012A
MdNl-8	0	Marine Laydown Area PDA	963	Proposed Winter Road	Some artifact collection has been conducted at this site. Additional artifacts are located at the site; therefore systematic data recovery through surface collection, detailed site mapping, and photography will be undertaken. Controlled subsurface excavations of evaluative units will be conducted.	2012-012A
MdNl-9	0	Marine Laydown Area PDA	n/a	n/a	Systematic data recovery through detailed site mapping and photography will be undertaken. Controlled subsurface excavations of evaluative units will be conducted.	2012-012A
MdNl-10	0	Marine Laydown Area PDA	n/a	n/a	Systematic data recovery through surface collection, detailed site mapping, and photography will be undertaken. Controlled subsurface excavations of evaluative units will be conducted.	2012-012A
MdNl-11	0	Marine Laydown Area PDA	983	Proposed Winter Road	Systematic data recovery through surface collection, detailed site mapping, and photography will be undertaken. If subsurface deposits are present, controlled subsurface excavations of evaluative units will be conducted.	2012-012A
MdNl-12	0	Marine Laydown Area PDA	868	Proposed Winter Road	Systematic data recovery through detailed site mapping and photography will be undertaken. Controlled subsurface excavations of evaluative units will be conducted.	2012-012A
MdNl-13	0	Marine Laydown Area PDA	994	Proposed Winter Road	Systematic data recovery through surface collection, detailed site mapping, and photography will be undertaken. If subsurface deposits are present, controlled subsurface excavations of evaluative units will be conducted.	2012-012A
MdNl-14	0	Marine Laydown Area PDA	n/a	n/a	Systematic data recovery through detailed site mapping and photography will be undertaken. Controlled subsurface excavations of evaluative units will be conducted.	2012-012A
MdNl-16	0	Marine Laydown Area PDA	n/a	n/a	Systematic data recovery through surface collection, detailed site mapping, and photography will be undertaken. Controlled subsurface excavations of evaluative units will be conducted.	2012-012A
MdNl-17	0	Marine Laydown Area PDA	448	Proposed Winter Road	Systematic data recovery through detailed site mapping and photography will be undertaken. Controlled subsurface excavations of evaluative units will be conducted.	2012-012A
MdNl-18	0	Marine Laydown Area PDA	252	Proposed Winter Road	Systematic data recovery through surface collection, detailed site mapping, and photography will be undertaken. Controlled subsurface excavations of evaluative units will be conducted.	2012-012A
MdNl-19	0	Marine Laydown Area PDA	n/a	n/a	Systematic data recovery through surface collection, detailed site mapping, and photography will be undertaken. If subsurface deposits are present, controlled subsurface excavations of evaluative units will be conducted.	2012-012A
MdNl-20	0	Marine Laydown Area PDA	528	Proposed Winter Road	Systematic data recovery through surface collection, detailed site mapping, and photography will be undertaken. If subsurface deposits are present, controlled subsurface excavations of evaluative units will be conducted.	2012-012A

Appendix B

Archaeological Chance Find Procedure

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Archaeological Chance Find Procedure

In Nunavut archaeological and paleontological sites are protected under Section 51 of the *Nunavut Act* (*Nunavut Archaeological and Palaeontological Sites Regulations)*. In addition, archaeological sites and as yet unrecorded archaeological sites found on federal Crown Land are protected by the *Territorial Land Use Regulations* of the *Territorial Lands Act* and by the *Canada Oil and Gas Operations Act* (*Canada Oil and Gas Geophysical Operations Regulations*). There are more than 5,000 archaeological sites currently recorded in the Northwest Territories and Nunavut with many more being added to the territorial inventory every year. However, this represents only a small portion of the total number of sites that exist and have yet to be recorded. This protocol has been established to increase awareness of this important resource and to assist in planning future developments.

Permits to conduct archaeological and paleontological research throughout Nunavut are applied for and issued under the *Nunavut Act* (*Nunavut Archaeological and Paleontological Sites Regulations*). In addition, work conducted on Inuit Owned Lands or within the Nunavut Settlement Area should be conducted in accordance with Articles 21 and 33 of the *Nunavut Land Claims Agreement*. Locational information pertaining to archaeological sites is protected by a Data License Agreement issued by the Government of Nunavut. The location of archaeological sites should not be depicted on publically available maps. No ground disturbance or alteration should occur within 30 metres of a known archaeological site. The *Regulations* stipulate that only individuals who have obtained a permit can investigate archaeological or palaeontological sites. Under the *Nunavut Act*, individuals who contravene these *Regulations* are guilty of an offense punishable on summary conviction.

The remnants of Nunavut's earliest cultures are represented in today's landscape by a wide variety of site types, most of which are related to art, habitations, resource gathering and production, tool making, and traditional ceremonial or ritual activities. Some sites that may be immediately visible include:

- Rock cairns (inukshuks) and rock piles.
- Surface features such as camp sites, fish traps, stone circles, caches and burned rock.
- Artifacts that have become visible on the land surface owing to erosion or recent land altering activity. These may be produced in a variety of materials such as stone, bone, antler, wood, or shell. Buried cultural remains that may be sighted in a cut-bank, excavation, eroded shoreline, or other exposed deposit.

If you discover a site in the course of your work that you suspect may be a possible archaeological site:

- Stop all work in the area to avoid damaging the site.
- **Do not disturb any archaeological remains that you may encounter.**
- Report your discovery to your supervisor.
- Isolate and protect the area.

- Note the location and leave all discoveries in place.
- Prepare an initial Chance Find Form.
- Sabina Gold & Silver Corp. will contact the Project Archaeologist.
- The Project Archaeologist will assess the potential significance of the find. If it is determined to be archaeological in nature they will contact the Nunavut Department of Culture and Heritage.
- The archaeologist, in consultation with the Nunavut Department of Culture and Heritage, will conduct an investigation consistent with the Archeology Permit.
- The archaeologist will work with Sabina Gold & Silver Corp. to prepare a Site Instruction to recommence work in the area.
- A site report will be submitted to Sabina Gold & Silver Corp., the Inuit Heritage Trust, and the Nunavut Department of Culture and Heritage.

If you discover what you suspect may be a possible human remains in the course of your work:

- Stop all work in the area to avoid damaging the site.
- Report your discovery to your supervisor or if they are unavailable, the site supervisor, who will provide further instructions.
- **Do not disturb any possible human remains that you may encounter.**

The following steps will generally be followed:

- The Coroner's Office and local policing authority are notified and the Coroner's Office determines whether the matter is of contemporary forensic concern.
- If the remains are not of forensic concern, the Nunavut Department of Culture and Heritage will attempt to facilitate disposition of the remains.
- If a cultural affiliation for the remains can be determined, the Department of Culture and Heritage will contact an organization representing that cultural group. If the remains are of aboriginal ancestry, attempts to contact the relevant organization(s) will be made.
- Generally, if remains are still buried and are under no immediate threat of further disturbance, they will not be excavated or removed.

Summary of Legislation Protecting Heritage Resources in Nunavut

The *Nunavut Archaeological and Palaeontological Sites Regulations*, pursuant to the *Nunavut Act*, apply throughout Nunavut and state:

Archaeology:

> 4. No person shall search for archaeological sites or archaeological artifacts, or survey an archaeological site, without a Class 1 or Class 2 permit.
>
> 5(1). No person shall excavate, alter or otherwise disturb an archaeological site, or remove an archaeological artifact from an archaeological site, without a Class 2 permit.

On federal Crown Land, the **Territorial Land Use Regulations**, pursuant to the *Territorial Lands Act*, also apply. Two sections are relevant to archaeological sites:

> 10(a). No permittee shall, unless expressly authorized in his permit or expressly authorized in writing by an inspector conduct a land use operation within 30 metres of a known monument or a known or suspected archaeological site or burial ground; and
>
> 16. Where, in the course of a land use operation, a suspected archaeological site or burial ground is unearthed or otherwise discovered, the permittee shall immediately:
>
> - suspend the land use operation on the site; and
> - notify the engineer or an inspector of the location of the site and the nature of any unearthed materials, structures or artifacts.

Archaeological Chance Find Report Form

Recorder's Name/Affiliation: _____

Date: _____

Location of chance find (Location description, UTM coordinates, depth below surface): _____

_____

_____

Description of find: _____

_____

_____

Method used to mark and protect find: _____

_____

_____

Distribution:

☐	☐	☐	☐
Site Manager	Sabina Gold & Silver Corp.	Site Archaeologist	Nunavut Department of Culture and Heritage

Sketch Map	Photo

28. Human Resources Plan

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BACK RIVER PROJECT
Human Resources Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 28	3.1	Sabina Operating Rules and Practices	Statement added on provisions of EFAP, which may include access to counselling services.
	3.1.4	Anti-harassment and Discrimination	Statement added to develop anti-harassment/abuse policies prior to start of construction.
	3.1.7	Layoff	New subsection added on lay-off notice periods to be in-line with relevant legislation.
	7.1.1	Skills and Entrance Requirements	Statement added regarding service fees to be paid to Community Health Services if pre-employment medical screening program required.
	7.1.5.2	Environmental Protection and Health and Safety Orientation	Statement added regarding providing access to information on sexual health and well-being.
	7.3	Workforce Training Strategy	Statement regarding ongoing commitment to community engagement and awareness of career opportunities.
	7.3.1	Workforce Training Strategy (Targeted Outcomes)	Statement on commitment to report on results of employee support and training programs.
	7.3.2.1	Strategic Partnerships	Statement on commitment to work with stakeholders to identify skills gaps and worker readiness training.
	7.3.2.1	Strategic Partnerships	Statement on commitment to work with stakeholders to ensure alignment of appropriate training and apprentice programs.
	7.3.2.1	Strategic Partnerships	Statement on commitment to provide workforce schedule information to the GN, and on trades working on the Project.
	7.3.2.1	Strategic Partnerships	Statement on commitment to consult with GN Family Services to identify apprentice students for training and employment.
	7.3.2.2	Program and Training Contributions	Removal of reference to the Nunavut Mine Training Society (MTS).
	7.3.2.4	Inuit Employment and Training Coordinator	Statement on commitment to report on results of Coordinator program results.
	7.3.2.5	Youth Employment	Statement on commitment to implement a Summer Student Employment Program.
	7.3.2.6	Women in the Workplace	Statement on commitment to govern gender equality.
	7.3.2.6	Women in the Workplace	Statement on commitment to work with educational facilities and groups to provide information on the employment of women.

BACK RIVER PROJECT
HUMAN RESOURCES PLAN

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1. Introduction

This chapter describes the Human Resources Plan (the Plan) that Sabina Gold & Silver Corp. (Sabina) will follow in the development and operation of the Project. This Plan, and other management plans, are intended to describe the ways in which Sabina will address or mitigate issues identified in the Final Environmental Impact Statement (EIS).

The Plan has been developed in accordance with internal company and regulatory requirements. The Plan has been further informed by community-based research and a review of literature discussing the lessons learned of other northern mine projects. The measures set out in the Plan correlate directly to potential socio-economic effects of the Project which were identified during the environmental assessment process (See Volume 8, Chapters 3 and 4 of the Back River Project Final EIS).

The Human Resources Plan is a living document and will be regularly updated based on management reviews, community feedback, incident investigations, regulatory changes, or other Project-related changes. The Plan will be revisited and updated or adapted on an annual basis. As Sabina works to address impacts and enhance benefits identified over time, changes may be made to this plan to better achieve desired outcomes. The adaptive management strategy enables engaged parties to instigate change where required and to employ the use of new data and best practices as they become available, for example, data and analysis generated by the Socio-economic Monitoring Program. Sabina's Senior Management and Human Resources staff will work to implement and update this plan throughout the life of the Project.

2. Scope and Objectives

The Project has the potential to enhance the work experience, education, and skill levels of the regional workforce. These capabilities also help maximize the retention of workers and contribute to the overall development of human capital (and employability) of workers. Workforce training to achieve these ends will also support the development of a workforce capable of meeting Project needs.

The Project has the potential to positively and adversely impact the regional workforce. The following potential Project effects and topics of concern to communities that are addressed by this Human Resources Plan include:

- Changes to employment levels and income.
- Changes to work experience, education, and skill levels.
- Changes to family and community dynamics that result from the fly-in/fly-out worker rotation schedule.
- Changes to individual and community participation in traditional land based activities.
- Unemployment associated with job loss at Project closure.

The objective of the Human Resources Plan is to maximize the employment, income, and education and training benefits available to local and regional communities, while mitigating any related

potential negative impacts associated with these benefits. These Project effects are addressed through the following four elements:

- Labour Relations Strategy.
- Preferential Recruitment Strategy.
- Workforce Training Strategy.
- Workforce Transition Strategy.

Sabina aims to maximize employee retention and minimize worker turnover and will provide employment financial management and life skills training for all workers (based on demand). Hiring and training will be conducted with consideration for Inuit people and gender equity. Equal opportunities and career advancement will be provided to all individuals employed with the Project.

The Human Resources Plan would apply from the time a construction decision is made. The temporal extent of the Plan will be the life of the Project itself, including construction, operation, reclamation and closure, post-closure, and temporary closure/ care and maintenance phases.

3. Applicable Legislation and Guidelines

3.1 SABINA OPERATING RULES AND PRACTICES

Sabina will establish a number of operating rules and practices that respond to the needs of the company and those of Kitikmeot residents. These rules and practices will apply to all Project employees, contractors, and subcontractors both at the Project site and while in transit to the Project site. Company rules and practices will govern activities and behaviour at the Project site including the use of drugs and alcohol, harvesting activities, external communications, use of languages, availability of country foods, discrimination and harassment, firearms, smoking and gambling. The company will also provide and appropriate Employee and Family Assistance Program (EFAP) which may include access to counselors onsite or referrals to additional facilities should the need arise.

Sabina will develop rules and practices consistent with the requirements of the forthcoming Inuit Impact and Benefit Agreement (IIBA) between Sabina and the Kitikmeot Inuit Association (KIA) as stated in Article 26 of the Nunavut Land Claims Agreement (NCLA).

3.1.1 Alcohol and Drugs

Sabina will establish a No Alcohol and Drug Rule in compliance with Nunavut's *Mine Health and Safety Act (1994)*. Under this rule, alcohol, non-prescription drugs, and other intoxicants are prohibited substances. Community-based research has indicated that local communities place high value on measures related to ensuring all Project sites in the region provide a drug and alcohol free environment. This requirement is not only linked to the safety of workers at the Project site, but also to common understanding that some individuals struggle with substance abuse issues. The call for random drug and alcohol testing on behalf of local communities is a result of experience with past mine projects. However, in light of the recent Supreme Court of Canada ruling (Supreme Court of Canada 2013), which indicates random alcohol testing is a violation of individual privacy rights, Sabina will commit to the use of security personnel to enforce the zero tolerance policy by screening and controlling access to the worksite. Pre-hiring and scheduled drug and alcohol testing may be implemented. Employees' belongings and luggage may be examined for the presence of alcohol and/or

drugs during transport to and from the mine site. Peer monitoring and reporting at the worksite will also be encouraged. All employees will be made aware of that alcohol, non-prescription drugs, and other intoxicants are not permitted at the Project site, the adherence to, zero tolerance, and the consequences for those who do not comply. In addition to the defined enforcement and compliance measures, Sabina will provide access to addictions counselling through the EFAP.

In summary, employee drug and alcohol use will be minimized through the following actions:

- Pre-screening of workers (e.g., examination of belongings) prior to accessing the mine site.
- Establishing and instituting a zero tolerance policy for onsite drug and alcohol use, including pre-employment/site access testing, scheduled and post-incident testing, and clear communication of these rules and consequences of non-compliance to all workers.
- Providing access to addictions counselors and Inuit Employment and Training Coordinators who communicate with community alcohol and drug workers as well as community mental health professionals as necessary.

3.1.2 Harvesting

Sabina may develop rules regarding harvesting (hunting, fishing, trapping, and gathering) by Inuit and non-Inuit employees alike. Sabina will avoid having unnecessary firearms and firearms activity to facilitate the safety of all Project employees and any others present at the Project Site. Sabina will establish a No Harvesting Rule for all mine employees during the course of their employment and time at the mine site and related camps. Inuit mine employees will be engaged in a variety of work schedules, the majority based on 12-hour work days, and are expected to return to their home community when not on shift. With the anticipated two-week on/two-week off shift schedule, Inuit workers will have considerable time off shift to be able to continue to participate in traditional land-use and harvesting activities.

Sabina will adopt the No Harvesting Rule to avoid any unnecessary impacts on wildlife and fish populations and vegetation at the Project site. Mine employees will also be prohibited from engaging in harvesting activities during the course of their employment and time in the Project area. To facilitate this, recreation and other activities will be provided at the camps, which will be well-appointed facilities. This regulation will provide assistance in the management of access to land areas currently in use by local Inuit. This preserves areas near the Project site and camps for the current users while enabling Inuit employees to continue to engage in traditional harvesting activities while not at work.

Sabina recognizes the rights and needs of individuals who are not employed by the Project but are travelling through the area as part of regular subsistence land use activities. Individuals who are travelling through the area will be supported in their activities (e.g., potentially provided with short-term room and board on request). During any stay, individuals will also be provided with a camp safety induction describing relevant safety information regarding the Project. This safety information is provided so local hunters are aware of Project activities and can adjust their land use activities accordingly. Section 5.7.1.7 of the NLCA limits the right of Inuit to hunt within one mile of buildings, structures, or facilities on lands under surface lease, an agreement for sale, or owned in fee simple. In accordance with the Section 5.7.1.7, hunting will not be permitted within a one mile radius of the surface lease associated with the Project.

All employees will be asked to report sightings of non-Project individuals in the vicinity of the Project. These individuals will be contacted to make them aware of the risks associated with the use of firearms

near the Project, and will be asked to refrain from such use. Use of firearms will be strictly prohibited within the active Project Development Areas.

Sabina will make reasonable efforts to ensure country foods are available to mine employees and that all catering and food provision contracts include country food provisions. This will serve the dual purpose of providing country foods to Inuit employees and enabling non-Inuit employees to experience Inuit culture. The contract for catering at the mine camps will be awarded to a facility approved by the Canadian Food Inspection Agency (CFIA), as is required for kitchen operations. It is recognized that currently the availability of country foods from a CFIA-approved food processing facility is limited (i.e., Kitikmeot Foods in Cambridge Bay being the only regional supplier). Given this limitation, it may be that the ability to provide country foods on a regular basis to mine employees will be limited. Sabina will explore with Inuit employees other options to facilitate the consumption of country foods while at site (e.g., an employee country food storage and cooking facility).

3.1.3 External Communications

Communication between mine employees and their family members will be facilitated by access to phone and internet connections. Appropriate use of technologies, such as internet-based voice or video calls, will be encouraged. This will enable workers to maintain contact with family members on a daily or semi-daily basis while working away from home for extended periods. This measure may address certain aspects of community well-being in that, for Inuit, prolonged separation from family directly affects identity, belonging, and other aspects of self and family relations. Essentially, maintaining communication within the family unit will enable Inuit mine employees to retain their employment without significantly compromising their cultural values of family and social ties to community. The communications policy will apply for all mine employees.

3.1.4 Anti-harassment and Discrimination

Sabina is committed to providing a workplace free of all types of harassment or abuse, and will develop appropriate policies prior to construction. Such policies will be based on the premise that one or a series of incidents involving unwelcome comments or actions concerning the person's race, colour, ancestry, place of origin, political belief, religion, marital status, physical or mental disability, age, sex, or sexual orientation:

- when such conduct might reasonably be expected to cause emotional or physical insecurity, discomfort, offence or humiliation to another person or group;
- when submission to such conduct is made either implicitly or explicitly a condition of employment;
- when submission to or rejection of such conduct is used as a basis for any employment decision including, but not limited to, matters of promotion, raise in salary, job security or benefits affecting the employee; or
- when such conduct has the purpose or the effect of interfering with a person's work performance or creating an intimidating or hostile or offensive work environment.

Sexual harassment is defined as one or a series of incidents involving unwelcome sexual advances, requests for sexual favours or other verbal or physical conduct of a sexual nature:

- when such conduct might reasonably be expected to cause embarrassment, emotional or physical insecurity, discomfort, offence or humiliation to another person or group;

- when submission to such conduct is made either implicitly or explicitly a condition of employment;
- when submission to or rejection of such conduct is used as a basis for any employment decision including, but not limited to, matters of promotion, raise in salary, job security or benefits affecting the employee; or
- when such conduct has the purpose or the effect of interfering with a person's work performance or creating an intimidating, hostile or offensive work environment.

Types of behaviour which constitute sexual harassment include, but are not limited to:

- sexist jokes causing embarrassment or offence, told or carried out after the joker has been advised that they are embarrassing or offensive, or that are by their nature clearly embarrassing or offensive;
- leering;
- the display of offensive material of a sexual nature;
- sexually degrading words used to describe a person;
- derogatory or degrading remarks directed towards members of one sex or one sexual orientation;
- sexually suggestive or obscene comments or gestures;
- unwelcome sexual flirtations, advances or propositions;
- unwelcome enquiries or comments about a person's sex life;
- requests for sexual favours;
- unwanted touching;
- verbal or written abuse or threats; and
- sexual assault.

All types of harassment are illegal and are strictly prohibited. Any individuals who feel they have been harassed or who witness harassment are obligated to report the harassment to the Sabina human resources representative at the mine site. All mine employees will receive cross-cultural and gender sensitivity training and are expected to understand what behaviours are and are not acceptable including the changes to employment status that may occur if they are found to be non-complaint. All alleged cases of harassment and discrimination will be investigated and key findings reported to Sabina management and other individuals appointed to deal with violations.

3.1.5 Language

Nunavut's *Official Languages Act* (GN 2006) recognizes three official languages: Inuit language, English, and French. The Act guarantees the use any official language in legislative, judicial, and government communications. The *Inuit Language Protection Act* (2008) is federal legislation that aims to protect and revitalize a first peoples' language.

Although the working language in the mine will be English, Sabina is committed to providing culturally appropriate conditions in the workplace and will establish rules and practices that promote the use of Inuit languages to the extent possible. All primary signs at the mine site and camps will be provided in

English, Inuktitut, and Inuinnaqtun. Sabina will provide support for employees interested in improving their English, Inuinnaqtun, or Inuktitut skills.

Sabina will explore the possibility of establishing Inuit language speaking work groups within sub-activities of the Project, with the provision that members of each work group can communicate competently in English with other personnel on the Project. This would be contingent upon the number of Inuit language speakers employed within each Project activity group. There is a risk that the use of other languages by Project employees could pose a safety risk on the worksite. A paramount consideration is the optimal functioning of the workplace and safety of all employees – with this in mind, all employees will be required to be functionally proficient in English.

3.1.6 Firearms, Smoking, and Gambling

Safety at the Project site will be promoted by a no firearms rule. Although firearms will be kept on site and adequate secure storage will be provided for this purpose, mine employees flown into the mine site will be prohibited from transporting firearms or weapons for any purpose.

Sabina will discourage employees from smoking in mine camps and will prohibit smoking at specific locations. In camps, smoking will be permitted at designated locations only. Gambling between workers will be prohibited on site and in camps during the course of their employment. Well-appointed recreation facilities and other activities will be provided in camps to provide alternatives and help encourage compliance.

3.1.7 Layoff

Should it become necessary to conduct employee layoffs during the Project life, Sabina commits to ensure appropriate lay-off notice periods are in line with relevant legislation including the *Labour Standards Act (1988a)*.

3.2 GOVERNMENT LEGISLATION AND POLICY

The *Labour Standards Act (1988a)* regulates employment in Nunavut. Other supporting legislation includes:

- *Mine Health and Safety Act* and Regulations, S.N.W.T. (Nu.; 1994; 2008), c. 25.
- *Safety Act*, R.S.N.W.T. (Nu.; 1988c), C. S-1.
- *Workers' Compensation Act,* R.S.N.W.T. (Nu.; 1988d) c. W-6.
- *Workers' Compensation Act* (Consolidation) SNu. (2007), C. 15.
- *Labour Standards Act* R.S.N.W.T (Nu.; 1988a) c.L-1.
- *Nunavut Employees Union* R.S.N.W.T. (Nu.; 1988b), c.U-1.
- *Consolidation of Official Languages Act* R.S.N.W.T. (Nu.; 2006), c.O-1.
- *Consolidation of Official Languages Act* SNu. (2006), c.17.

Sabina will develop rules and practices that comply with the requirements of these acts and the forthcoming IIBA between Sabina and the KIA as stated in Article 26 of the NCLA.

4. Roles and Responsibilities

Implementation of the Human Resources Plan, as well as on-going performance evaluations, updates or revisions to the Plan, will be the responsibility of the Manager for Human Resources or similar position, or another designated management personnel with requisite skill set and experience. The Manager of Human Resources may also delegate responsibility for specific components of the Plan to other personnel. Specifically, the Inuit Training and Employment Coordinator will have direct responsibility for provisions of the Plan associated with recruitment or workforce training, reporting to the Manager for Human Resources. Other supporting roles and responsibilities of staff will be identified during implementation based on needs.

Sabina is committed to regular engagement of the NIRB, the KIA, and Kitikmeot communities and seeking feedback on potential areas for improvement in the Human Resources Plan over the life of the Project. In this regard, the role of these organizations, community stakeholders, and the public is important to support continual improvement and adaptive management.

5. Management Measures

A Socio-economic Monitoring Program (Volume 10, Chapter 23) has been developed to help ensure that the Project fulfills best practices in social responsibility as it relates to community engagement, capacity building, and realization of benefits from the Project, especially for Inuit. Equally, monitoring will provide relevant and timely information to enable Project managers and community leaders to respond proactively to potential risks and adverse socio-economic effects.

In order to support management measures associated with the Human Resources Plan, a number of Project-specific indicators have been defined to monitor Plan performance and achievement of management objectives with respect to employment, education and training (Table 5-1). Thresholds for each indicator will be determined in consultation with the NIRB, Community Advisory Groups, and the Back River Project Socio-economic Monitoring Committee (see Socio-economic Monitoring Program, Volume 10, Chapter 23). Where Project performance is addressed by the IIBA, it is anticipated that applicable thresholds will be defined in reference to the provisions of the IIBA. For all indicators, management action will be triggered when annual performance is below threshold. Specific actions will be determined in consultation with the NIRB and the KIA (when applicable to the IIBA). This will involve an evaluation of the existing mitigation and management measures, and identification of appropriate adjustments to the Human Resources Plan.

Table 5-1. Indicators, Thresholds, and Triggers to Support Management Measures

Valued Socio-economic Component (VSEC)	Indicator	Threshold	Trigger	Suggested Action
Socio-Economics: Employment	Number of persons directly employed with the Project	Determined in consultation with the NIRB, Community Advisory Groups, and the Back River Project Socio-economic Monitoring Committee	Annual performance below threshold	Determined in consultation with the NIRB. Evaluate mitigation and apply additional/adjust mitigation as appropriate.

(continued)

Table 5-1. Indicators, Thresholds, and Triggers to Support Management Measures (continued)

Valued Socio-economic Component (VSEC)	Indicator	Threshold	Trigger	Suggested Action
Socio-Economics: Employment *(cont'd)*	Number of person-days worked by all employees	Determined in consultation with the NIRB, Community Advisory Groups, and the Back River Project Socio-economic Monitoring Committee	Annual performance below threshold	Determined in consultation with the NIRB. Evaluate mitigation and apply additional/adjust mitigation as appropriate.
	Number of person-days worked by Inuit employees	Determined in reference to the IIBA provisions.	Annual performance below threshold	Determined in consultation with the NIRB and the KIA. Evaluate mitigation and apply additional/adjust mitigation as appropriate.
	Percentage of direct employees by gender	Determined in consultation with the NIRB, Community Advisory Groups, and the Back River Project Socio-economic Monitoring Committee	Annual performance (number of female workers) below threshold	Determined in consultation with the NIRB. Evaluate mitigation and apply additional/adjust mitigation as appropriate.
	Number of Inuit employees from the Kitikmeot Region and the number of Inuit employees from elsewhere in Nunavut	Determined in reference to the IIBA provisions.	Annual performance below threshold	Determined in consultation with the NIRB and the KIA. Evaluate mitigation and apply additional/adjust mitigation as appropriate.
	Percentage of Inuit in each job category	Determined in reference to the IIBA provisions.	Annual performance below threshold	Determined in consultation with the NIRB and the KIA. Evaluate mitigation and apply additional/adjust mitigation as appropriate.
Socio-Economics: Education and Training	Number of Inuit filled apprenticeships supported by the Project	Determined in reference to the IIBA provisions.	Annual performance below threshold	Determined in consultation with the NIRB and the KIA. Evaluate mitigation and apply additional/adjust mitigation as appropriate.
	Number of employees that complete on-the-job training courses	Determined in consultation with the NIRB, Community Advisory Groups, and the Back River Project Socio-economic Monitoring Committee	Annual performance below threshold	Determined in consultation with the NIRB. Evaluate mitigation and apply additional/adjust mitigation as appropriate.
	Number of Inuit employees that complete on-the-job training courses	Determined in reference to the IIBA provisions.	Annual performance below threshold	Determined in consultation with the NIRB and the KIA. Evaluate mitigation and apply additional/adjust mitigation as appropriate.

(continued)

Table 5-1. Indicators, Thresholds, and Triggers to Support Management Measures (completed)

Valued Socio-economic Component (VSEC)	Indicator	Threshold	Trigger	Suggested Action
Socio-Economics: Education and Training *(cont'd)*	Number of person-courses completed by employees by type of course	Determined in consultation with the NIRB, Community Advisory Groups, and the Back River Project Socio-economic Monitoring Committee	Annual performance below threshold	Determined in consultation with the NIRB. Evaluate mitigation and apply additional/adjust mitigation as appropriate.
	Number of person-courses completed by Inuit employees by type of course	Determined in reference to the IIBA provisions.	Annual performance below threshold	Determined in consultation with the NIRB and the KIA. Evaluate mitigation and apply additional/adjust mitigation as appropriate.
	Average number of years of mining experience as a result of the Project	Determined in consultation with the NIRB, Community Advisory Groups, and the Back River Project Socio-economic Monitoring Committee	Annual performance below threshold	Determined in consultation with the NIRB. Evaluate mitigation and apply additional/adjust mitigation as appropriate.

6. Monitoring Program

Sabina will track and manage outcomes of this Human Resources Plan as described by the Back River Socio-economic Monitoring Program (Volume 10, Chapter 23).

7. Mitigation and Adaptive Management

7.1 LABOUR RELATIONS STRATEGY

The Labour Relations Strategy aims to reduce labour force entry barriers and improve employee retention. To this end, the strategy details skills and entrance requirements, employee benefits, employee communication, work rotation schedules, and employee orientation programs.

7.1.1 Skills and Entrance Requirements

Sabina will work with Inuit associations and communities, governments, women's groups, as well as other groups as appropriate, to assist individuals in decisions about career opportunities with the Project. Sabina is involved in ongoing discussions with communities regarding prerequisite skills and entry requirements for Project employment. Employment opportunities and conditions include anticipated minimum qualifications for entry level (unskilled jobs). These include completion of grade twelve (or equivalent), ability to pass a criminal records check (leniency for pardons for minor crimes will be considered), and the ability to pass a health screening, including the possibility of a drug and alcohol check. In the event that pre-employment medicals are required, Sabina will commit to a service fee

payable to the Community Health Services based on a negotiated fee schedule. Sabina will develop any pre-employment medical screening program in discussion with Nunavut Health Services.

Barriers to employment for Inuit can include a lack of education and skills, a criminal record, and personal and family issues (including time away from family). To help address these issues, the following will be undertaken:

- Sabina will work with regional education providers (e.g., Nunavut Arctic College) to support the provision in Kitikmeot communities of education and training programs that prepare workers for employment. This includes programs ranging from, for example, Adult Basic Education (ABE) to pre-trades and trades. In addition, on-the-job training will be made available as it relates to an individual's job requirements and desired career development path, as applicable.
- Sabina may, on a case-by-case basis, establish a process of review for employees that meet all other employment requirements but have a criminal record to assess whether leniency can be granted. Sabina will also encourage applicants to access the pardon process where relevant.
- Sabina's external communications practices (see Section 3.1.3) aim to provide the opportunity for employees to remain in contact with their family members on a regular basis, in turn providing support to employees and increasing employee retention. Sabina is committed to providing assistance in overcoming obstacles to employment.

7.1.2 Employee Benefits

Individuals who obtain full time employment with the Project will be compensated in terms of employment income and benefits. Sabina will offer a complete range of benefits consistent with mine industry standards now in place in Nunavut. All mine employees will receive these benefits, which include for example:

- **Health Care Plan:** provides coverage for a range of health care services and medications potentially required by the employee and immediate family. Options for extended health care, including vision and dental care, will also be provided.
- **Employee and Family Assistance Program (EFAP):** provides counseling related to financial management, drug and alcohol dependency issues, work related stress, and many other employee concerns.
- **Vacation:** granted in accordance with Nunavut legislation. All employees are required to take vacation annually.
- **Pension Plan:** will be provided to reflect industry standards.

Through the EFAP, all employees will have direct access to counselling and other forms of personal assistance. Inuit employees will also have access to the Inuit Employment and Training Coordinator who will facilitate access to counselling and information resources, such as for substance abuse, financial management, work related stress, employee and family well-being, or employment and career counselling. These services are aimed at maximizing employee retention and providing a positive work experience for all employees.

7.1.3 Employee Communication

Sabina's Human Resources Department will be responsible to receive and address employee concerns, complaints, grievances, or suggestions. Conflicts and concerns will be treated confidentially and will be addressed promptly and effectively. Employees will be made aware of this mechanism during employee

orientation. For Inuit employees, the communication processes will be complemented by the services of the Inuit Employment and Training Coordinator who will work with the Human Resource Department as necessary.

The relevant terms and conditions of the IIBA, where applicable to Inuit employment and where agreed to with the KIA, will be directly communicated to employees.

7.1.4 Work Rotation Schedules

Sabina has structured work rotation schedules to enable employees to continue to participate in traditional activities from their home communities. This will generally be facilitated by the two weeks in/two weeks out shift schedule which provides employees with an extended period of time off to participate in land use and community activities. Cambridge Bay and Kugluktuk are expected to be major points of hire and as such there will be direct flights from both communities to and from the Project site for shift changes. The provision of direct charter flights from other Kitikmeot communities, including Gjoa Haven, Taloyoak, and Kugaaruk, will be determined based on need. Sabina will provide direct airfare from points of hire at no-cost for all Kitikmeot-based Inuit employees allowing workers to continue to live in their home communities.

Additionally, Sabina may consider granting leave without pay on a case-by-case basis for Inuit employees requesting additional time off for cultural reasons, for example, to participate in major community harvesting activities or important community and cultural events.

7.1.5 Orientation Programs

Sabina will provide orientation programs (in the form of either training or material) to employees that will develop understanding of what is expected in terms of work responsibilities, environmental protection, and health and safety management. All orientation programs will be provided to employees as part of their employment training and aim to public safety and well-being at the Project site. Orientation programs will include:

- Workplace preparedness orientation.
- Environmental protection and health and safety orientation.
- Financial management orientation.
- Cross-cultural and gender-sensitivity orientation.

7.1.5.1 Workplace Preparedness Orientation

The Workplace Preparedness Orientation Program will describe employment details such as:

- An overview of day-to-day mine operations and work schedules, layout of the mine site and camps, brief descriptions of what activities are taking place in different areas, locations of all employee resources.
- Means through which employees can remain in contact with their family members, location of these facilities, and appropriate use (including number of contacts made per day and length of time per contact) to facilitate communication with family and community while at camp.
- A review of acceptable and unacceptable conduct at the mine site and camps including a review of company rules and practices (e.g., drug and alcohol, harassment, no hunting/ no fishing) and changes to employment status that may occur if employees are found to be non-compliant with company policies.

- A review of attendance and truancy guidelines, including a discussion of actions that are potential cause for termination of employment.

Sabina may also offer a Workplace Preparedness Orientation Program for new workers and their families that want to learn more about the mine employment lifestyle, the various challenges that may need to be overcome, and support options available to employees and their families.

7.1.5.2 Environmental Protection and Health and Safety Orientation

The Environmental Protection and Health and Safety Orientation Program will include details regarding:

- Acceptable means of work conduct as related to environmental protection including environment and wildlife awareness training. Workers and visitors will be provided with information about the Arctic environmental and informed as to the appropriate conduct when in the presence of wildlife in the Project area, including encounter and conflict avoidance techniques.
- An overview of policies related to the use of resources such as recycling and waste management, water management, and use and access of surrounding lands.
- Review of health services and how to access on-site health services generally and in the case of an emergency, as well as protocols to follow.
- How, where, and under what circumstances to access relevant personnel such as the Manager of Health and Safety, Manager of Environment, Manager of Community, and the Manager of Human Resources.
- Sexual health and well-being and how to access further information (including access to condoms). This information will be developed with the support of a qualified health practitioner.

Health and safety orientation will vary as to each employees job description; however, a general safety orientation will be provided to all mine employees describing appropriate conduct including mine site and camp safety policies. Sabina will provide suitable work facilities and conditions with the objective of safeguarding the health, safety, and general well-being of employees. Sabina will require all employees and contractors to maintain safe work practices, including adherence to all legislated and company health and safety requirements.

7.1.5.3 Cross-cultural and Gender Sensitivity Orientation

Sabina will provide a Cross-cultural and Gender Sensitivity Orientation Program for all mine employees and contractors (Inuit and non-Inuit employees and managers) aimed at enhancing positive interaction between Inuit and non-Inuit in the workplace. This workshop will be designed in consultation with local Inuit and will provide information about culture and gender differences among the workers. Examples of what constitutes appropriate and inappropriate workplace conduct will be reviewed. The program will also provide guidance as to how individuals experiencing or witnessing inappropriate behaviour can address the issue and will outline the consequences of inappropriate behaviour. Overall, the Cross-cultural and Gender Sensitivity Orientation Program is designed to facilitate effective working relationships between employees and to establish and maintain a positive work environment.

Cross-cultural aspects of the program will be primarily focused to provide non-Inuit employees with opportunities to better understand Inuit culture and communities. Sabina will work to provide workplace conditions that are respectful of all cultures in order to provide a suitable work environment and help attract and retain Inuit employees.

Further, gender sensitivity training will occur to educate mine workers as to what actions are considered sexual harassment and will outline the consequences. Gender sensitivity training will also inform individuals of the steps to take to address this situation if one arises, including reporting procedures and resources. This training aims to promote gender equality in the workplace.

Sabina will employ an Inuit Employment and Training Coordinator to assist Inuit employees in accessing this program, the EFAP, health care, and other programs as needed. These individuals will provide an important means through which Inuit employees can obtain employment support, and Project management can obtain valuable information on the efficacy of this Human Resources Plan.

7.1.5.4 Financial Management Orientation

Sabina will arrange for Financial Management Orientation for employees. Employee financial management and life skills development will be provided through the following actions:

- Financial management and life skills training for all workers, which will include various aspects of household budgeting.
- Banking and financial services information provided in collaboration with regional financial service providers, which will include an overview of available services in the region, the benefits of services, and what is needed to access these services.
- Additional advice and/or financial management counseling for employees upon request, to be accessed through the Inuit Employment and Training Coordinator.

Financial management training will include information about the function of banks and other financial services, how to become a client and obtain an account, as well as appropriate and inappropriate use of bank accounts, bank cards, and cheques. This information will incorporate information on family and individual budgeting. Employees who do not have bank accounts will be encouraged (and may be required) to obtain one. Sabina will work with the Nunavut Housing Corporation (NHC) to integrate information describing changes to rent levels (as this is indexed to household income level) and how to budget for same each month or how to set up monthly direct payment to the NHC.

The Inuit Training and Employment Coordinator will work in cooperation with Kitikmeot Region counsellors to assist mine employees and their families, as requested, to adjust to lifestyle changes associated with full time employment and financial management/budgeting.

7.2 PREFERENTIAL RECRUITMENT STRATEGY

The intent of the Preferential Recruitment Strategy is to maximize the engagement of the Kitikmeot Inuit in the Project workforce though regular information updates regarding employment and training opportunities, hiring plans, and Project schedules. This process will utilize both formal targeted as well as informal means to communicate employment information.

7.2.1 Mitigation and Targeted Outcomes

The Preferential Recruitment Strategy focuses on areas to enhance local Inuit employment in the Project. Defined targets include:

- Inuit residing in the Kitikmeot region, specifically in Cambridge Bay and Kugluktuk, are aware of employment and training opportunities with the Project, and understand what steps to take to obtain Project employment.

- A maximum and sustainable number of Kitikmeot Inuit become employed and are retained with the Project.

A number of methods will be employed in this management plan that aim to promote the participation and retention of Nunavummiut in Project employment, including:

- Cultural awareness policies.
- Financial management and substance abuse counseling.
- Means to communicate with family while away at work.
- Work rotation schedules that give consideration to cultural activities.
- Providing and promoting training activities, mentorship programs, and engaging youth through information sessions.
- Communicating early and clearly the employment and training opportunities available.
- Providing assistance to individuals that meet all employment requirements who are barred from employment as a result of their criminal record.
- Provision of culturally appropriate food options, where feasible.

Further details of the strategies that will be used to promote Inuit participation in employment and contracting opportunities are provided in the Community Involvement Plan (Suppl. Vol. 10).

7.2.2 Adaptive Management

Sabina is committed to providing continuing employment opportunities for Kitikmeot Region residents. First opportunity for hire will be provided to residents of Cambridge Bay and Kugluktuk and former residents of Bathurst Inlet and Omingmaktok who now reside in these communities as a result of their traditional and contemporary ties to the Project area. However, residents from the eastern Kitikmeot communities (i.e., Gjoa Haven, Kugaaruk, and Taloyoak) will also be provided with hiring opportunities wherever possible. Specific objectives for employment will be subject to the results of IIBA negotiations between Sabina and the KIA.

Given the Project workforce requirements, workers will be hired from various areas of Canada with specific focus on communities throughout the Kitikmeot Region. Cambridge Bay and Kugluktuk will serve as major points of hire with direct flights to and from the Project. If employment numbers are sufficient in other Kitikmeot communities, direct flights to and from the Project may also be organized. Northern workers will generally work two week in/two week out shift although this may vary by role. The southern workforce will be directed though Edmonton, Yellowknife or a similar location with direct flights possible from one or more of those locations.

Awareness of Project opportunities will be enhanced by providing public presentations within local communities, such as hosting local job fairs and community feasts to further establish positive relationships with communities and to provide advanced notification of employment opportunities and expectations. Through these events and coordination with local education and training facilities, Sabina will provide early and clear public communications of hiring schedules and skill/certification requirements for positions.

Sabina will also develop and maintain employment opportunity information online. The Back River Project website (www.backriverproject.com) provides public access to information about Project-related employment, including the type of jobs that will be available, a description of responsibilities, and the

requirements for that type of employment, such as education and experience. Additionally, employment opportunity postings including the same information will be provided in Project camp sites, hamlet offices (or other appropriate community organization), and at the Sabina office in Cambridge Bay. Further to this notification of recruitments, Sabina will collaborate with local training facilities (i.e., the Nunavut Arctic College [NAC]) to provide them with the Project information necessary in advance to help the educational institutions offer programs that help prepare workers for Project employment.

7.3 WORKFORCE TRAINING STRATEGY

The Workforce Training Strategy was designed to assist the local labour force with potential employment with the Project. To achieve this, Sabina seeks to establish strategic partnerships with local post-secondary education institutions, to provide program and training contributions, to provide in-house training and career development, to employ an Inuit Employment and Training Coordinator, and to promote youth employment. Sabina is committed to ongoing community engagement, including youth and education service providers, to ensure they are aware of the career opportunities with the Project and can make informed decisions regarding education and skills development.

7.3.1 Mitigation and Targeted Outcomes

The Project has the potential to enhance the work experience, education and skill levels of the local workforce, and human capital in the region. The Workforce Training Strategy seeks to maximize these benefits. In order to maximize Inuit employment, experience, education, and skill levels, Sabina intends to support worker training programs through external education and training institutions. In-house training and career development opportunities will also be provided to local Inuit in order to meet the employment demands of the Project.

In sum, through education and training initiatives, Sabina aims to:

- Maximize prospects for Inuit employment and retention in the Project workforce.
- Assist Inuit in developing the practical skills and education qualifications that enable them to work effectively and advance in their employment.
- Contribute to the human capital and well-being of the Kitikmeot Region.
- Reduce barriers to employment throughout the life of the Project.

Sabina will identify existing barriers to employment for Inuit and will work with the Inuit Education and Training Coordinator, and others to implement measures that reduce these barriers.

Sabina will providing a description of all employee support programs and training undertaken including: a qualitative description of the structure and goals of each program; the number of times it was provided to employees and; the percentage of employees (by level) who have successfully completed the program. This report will be provided annually to the relevant department within the Government of Nunavut.

7.3.2 Actions and Adaptive Management

To enhance benefits of the Project related to employment Sabina will take measures to enhance the experience, education, and skill levels of the local workforce by:

- Developing strategic partnerships.
- Contributing to local programs and training initiatives.
- Providing in-house training and career development.

- Employment of an Inuit Employment and Training Coordinator.
- Engaging youth through mentorship programs.

7.3.2.1 Strategic Partnerships

Sabina will develop strategic partnerships with local post-secondary education institutions in the region (i.e., the NAC) to support those institutions in establishing worker training programs that would help meet the requirements of the Project. Sabina will work in partnership with the KIA and other stakeholders, such as the Mining Industry Human Resources Council and the NAC, to identify skills gaps for work readiness training. Sabina will work with representatives, including the Government of Nunavut Family Services, to ensure alignment of appropriate training and apprentice programs. This will include providing, prior to the commencement of construction, National Occupational Coding for the Project's workforce schedule, and to identify and register with the appropriate Government of Nunavut department, all trades persons and apprentices working within the Project operations. Sabina will consult with the Government of Nunavut's Department of Family Services Career Development Division to identify current apprentice students for training and employment. Sabina will also work with post-secondary institutions to help ensure the availability of space in education and training programs does not become a significant barrier to mine employment for Inuit in the Kitikmeot Region. Sabina will provide early and clear communication related to employment requirements and hiring schedules to education and training facilities.

Throughout the life of the Project, Sabina will continue to work with education and training providers by providing information related to ongoing employment requirements to coordinate with the provision of additional (more advanced) programs, based on demand, that would enable individuals to increase their skills training, certification, supervisory, and management skills with the intention of qualifying Inuit employees for future skilled and supervisory positions with the Project. Through their work with local training and education providers, Sabina will contribute to and support a system through which successfully completed training leads to employment.

Sabina will seek to maintain ongoing working relationships with the NAC, Kitikmeot Region high schools, Kitikmeot School Operations, Government of Nunavut Department of Family Services (Career Development Division), Government of Nunavut Department of Education, Government of Nunavut Municipal Training Organization, and other relevant organizations.

7.3.2.2 Program and Training Contributions

Sabina will work with and contribute to the exiting pre-trades programs offered by the NAC and high schools in the Kitikmeot Region by providing experienced individuals to speak with students and offer presentations about work in the mining industry. Sabina will also consider contributions to other education and training activities and will work with the KIA to identify additional resources for Inuit training, potentially including joint applications to Human Resources and Skills Development Canada (HRSDC), the Mining Industry Human Resources Council, and Aboriginal Affairs and Northern Development Canada.

Along with the federal government, other mine and mineral corporations, the three territorial governments and other Aboriginal governments, Sabina also intends to support relevant mine training initiatives.

7.3.2.3 In-house Training and Career Development

In-housing training and career development opportunities will be maximized by: developing worker training programs as part of worker recruitment (e.g., needs based training); developing on-the-job training programs to enhance worker job experience and to promote worker advancement; and by

providing information and counselling as to individual career development plans for Project workers. Career development opportunities will be available in all departments and career counselling sessions will be made available periodically to review employee progress and define next steps and experience needed to achieve specific employment milestones.

Sabina will also consider supporting requests for external training, to advance Project related careers. Sabina will develop continuing education practices consistent with the requirements of the IIBA negotiated between Sabina and the KIA. Additionally, Sabina will facilitate apprenticeship opportunities where possible and will work to increase the availability of these types of opportunities throughout the life of the Project. In-housing training and career development opportunities seek to encourage Inuit to remain in the Kitikmeot Region and to increase the retention of Project benefits.

7.3.2.4 Inuit Employment and Training Coordinator

Sabina will hire an Inuit Employment and Training Coordinator that will facilitate all aspects of mine employment for Inuit workers. Responsibilities will include, for example, arranging access to training programs, orientation, and counselling, and providing advice, solutions, or alternatives to Inuit employees as needed. The person in this position is also expected to act as a career counsellor and will provide information and direction for those workers who wish to increase their skill level for the purpose of career advancement.

Sabina will provide a description of the Coordinator's duties in relation to employee support, their on-site availability, and a general assessment of whether the position is achieving the desired goals. This report will be provided annually to the relevant department within the Government of Nunavut.

7.3.2.5 Youth Employment

In partnership with local educational facilities (Kitikmeot Region high schools and the NAC), Sabina will host periodic educational sessions with youth (target ages 15 to 29) in Kugluktuk, Cambridge Bay, Gjoa Haven, Taloyoak, and Kugaaruk aimed to provide background and context about the mining industry, the types of employment available in the mining industry, and what it is like to be at a mine site. Information about training opportunities will also be provided as well as the importance of education. For high school students, this will include an overview of what high school courses would provide a foundation for the type of mine employment of interest to them. It is anticipated that this will be coordinated with any relevant mining sector or pre-trades Multiple Options program streams offered in the high schools. For youth who have completed high school or equivalent, a similar overview of available training opportunities and related requirements may be provided. Sabina will also develop and implement a Summer Student Employment Program that will provide direct opportunities for youth employment.

Sessions will also include information for those interested in employment that allows individuals to understand how they would continue to connect with their friends and family while working at the mine site. An overview of employee support programs, such as financial planning, addictions counselling, wellness counselling and others, will also be provided. If possible, Sabina will work to have a currently employed local Inuk speak to youth about their experience at the mine.

7.3.2.6 Women in the Workplace

Sabina will govern gender equality through the Canadian Human Rights Commission, Human Rights Maturity Model where current and future policies and practices follow: 1) leadership and accountability; 2) capacity building and resources; 3) alignment of policies and processes; 4) communication and consultation; and 5) evaluation for continuous improvement.

In line with other educational facilities and groups (Kitikmeot Region high schools, NAC and community women's groups), Sabina will ensure educational sessions and communications includes information focused on the employment of women. This information will background and context about the mining industry, the types of employment available in the mining industry, and what it is like to be at a mine site. Information about training opportunities will also be provided.

Workforce Transition Strategy

The Workforce Transition Strategy details the actions Sabina will take to enhance the ability of Project employees to transition to other employment following the completion of Project activities.

7.3.3 Mitigation and Targeted Outcomes

Upon Project decommissioning, loss of employment with the Project may create negative impacts for workers and communities, such as increased levels of unemployment. The intent of the Workforce Transition Program is to minimize these adverse effects by easing the transition of workers to other employment opportunities in the region.

The objective of this strategy is to enhance employees' ability to secure suitable employment elsewhere during the closure phase of the Project. This strategy focuses on areas likely to enhance employees' ability to secure suitable employment and aims to achieve the following:

- Maximize the transferability of workers skills and experience.
- Provide job search assistance to all workers seeking the service.
- Maximize the number of workers that find alternative suitable employment.

7.3.4 Actions and Adaptive Management

In order to maximize the transferability of workers skills and experience Sabina will develop materials and tools that will enable workers to: 1) identify the skills they acquired and used throughout their employment on the Project by providing relevant listings and descriptions of training and other employment achievements to workers from their personnel records; 2) match skills to alternative industries and positions; and 3) articulate and present skills and experience effectively in personal resumes and other job search materials to target those alternative industries and positions.

To provide assistance with job search capabilities and to maximize the number Project workers that find alternative suitable employment, Sabina will: 1) direct individuals to local listings and regional job opportunities potentially suitable for workers; 2) create an inventory, with the agreement of workers, of available workers and their skills/experience and make this available to external human resources officials; 3) support employees' job searching skills by facilitating connection with external job search facilities and assistance; 4) offer resume-writing and interviewing skills-building services, as requested; and 5) coordinate with appropriate regional training institutions to provide industry-specific retraining information sessions in response to the level of interest by Project workers.

8. Reporting and Plan Effectiveness

Reports on Plan outcomes and performance, as well as any recommended additional adaptive management actions, will be prepared at a minimum annually for internal company distribution and use. The Plan will be evaluated against the defined scope and objectives (Section 2).

As part of the Back River Socio-economic Monitoring Program (Volume 10, Chapter 23), the relevant findings will be reviewed in collaboration with other members of the Back River Project Socio-economic Monitoring Committee (SEMC) and the NIRB. Key findings and recommendations will be incorporated into an annual report to the NIRB. Reporting of monitoring results will also be provided to the Back River Project SEMC and the Kitikmeot Region SEMC.

9. Summary

The Project aims to provide employment that will attract, develop, and retain qualified personnel, and business opportunities that support the development of suppliers in the region's communities. The objective of the Human Resources Plan is to maximize the employment, income, and education and training benefits available to local and regional communities, while mitigating any related potential adverse effects associated with these benefits. To meet this objective, the Human Resources Plan includes: 1) Labour Relations Strategy; 2) Preferential Recruitment Strategy; 3) Workforce Training Strategy; and 4) Workforce Transition Strategy.

The monitoring of Plan outcomes will inform the ongoing management and mitigation of the potential social and economic effects identified in the EIS and will facilitate best practices in social responsibility as it relates to worker engagement, capacity building, and the realization of benefits from the Project. The monitoring program will be established to enable Project managers and community leaders to respond proactively and in a timely manner to any undesirable changes to socio-economic conditions.

Sabina recognizes that the Project will present Inuit communities with both substantial opportunities as well as changes to current social and economic conditions. Sabina is committed to implementing reasonable measures to enhance the benefits of the Project for individuals residing in the Kitikmeot Region communities. Mitigating existing and potential impacts, and promoting individual, family, and community well-being is a shared responsibility of Sabina, the KIA, the hamlets, and the Government of Nunavut. Commitments to enhance regional employment and training and the provision of community programs and services to enhance community well-being do not impose responsibility on Sabina to assume the role of government. Sabina will cooperate in these efforts. For the benefits of the Project to be fully realized at the local level the communities must be engaged in the implementation of strategies to build capacity to enhance well-being, which contributes to the ability of communities to deal with current and future challenges and to retain the benefits beyond the life of the Project.

There is inherently some uncertainty associated with predicting the social impacts prior to the implementation of Project activities. Sabina will work to address impacts and enhance benefits as they are identified over time. Adaptive management as a method used for the creation and implementation of the Human Resources Plan and the monitoring program enables the engaged parties to instigate change where required and to employ the use of new data and best practices as they become available. Further, the adoption of adaptive management practices enables the engaged parties to adjust plans based on the findings of the monitoring program throughout the life of the Project.

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29. Mine Closure and Reclamation Plan

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BACK RIVER PROJECT
Mine Closure and Reclamation Plan

November 2015

REVISION G.1

Volume 10: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 29	2.1, 5.2	Project schedule	Update for the phases and estimated development schedule for the Project
	2.1	Mine plan	Revised mine schedule including sequence, durations, and quantities of ore and waste
	2.2	Geochemical characterization	Update quantities of NPAG and PAG and together with new thermal modeling, inform waste rock closure concepts
	2.3	Tailings deposition	Provide details on deposition plan incl. use of mined out open pits (Umwelt and Goose Main) vs all tailings on surface.
	2.4	Waste rock management	Update for four WRSAs and the general disposal plan; WRSA on TSF to close and reduce overall waste rock footprint. Also, all WRSAs progressively reclaimed during operations.
	2.5	Goose Property is not zero discharge	Contact, non-contact, and groundwater will be managed separately; not all will report to the TSF per DEIS
	2.5	Water management	Revise water use, sourcing, and treatment statistics
	4.2, 5.6	Tailings facilities	Revise approach to close TSF and add for mine-out open pits, i.e. TFs
	5.4	UG mine portals	No concrete plugs are required; all UG mines now accessed from surface, not from base of open pits.
	5.10	Waste management	Non-hazardous waste may also be deposited within the open pits that will be covered with at least 5 m of water.
	5.11	Water management	Update for details of water management for closure incl. treatment and monitoring. Saline water now pumped into underground mines and into open pits for long-term.
	7	Cost estimate	Estimate cost for closure and reclamation updated to reflect current Project.

BACK RIVER PROJECT
MINE CLOSURE AND RECLAMATION PLAN

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1. Introduction

This chapter describes the Mine Closure and Reclamation Plan (MCRP or Plan) that Sabina Gold & Silver Corp. (Sabina) will follow in the development, operation, and closure of the Back River Project (the Project). This plan and other management plans are intended to describe the ways in which Sabina will address or mitigate issues identified in the Final Environmental Impact Statement (EIS). The Plan outlines the approach to closure for the Marine Laydown Area (MLA) in southern Bathurst Inlet and the Goose Property.

The MCRP has been prepared in accordance with Section 9.6 of the EIS guidelines issued by the Nunavut Impact Review Board (NIRB) to Sabina (NIRB 2013). This Plan was prepared in conformance with current Federal and Territorial statutory requirements.

The information presented herein is current as of August 2015. This is a living document and will be updated based on engineering design, management reviews, incident investigations, regulatory changes, or other Project-specific protocols. The Plan will be included in Sabina's future Type A Water Licence Application and may be updated prior to submitting the application pending comments from review of the FEIS. The Plan may be updated again prior to construction if instructed to do so by the NWB during the licensing process. This plan will be reviewed on a regular basis to incorporate any lessons learned, major changes to facility operation or maintenance, and environmental monitoring results.

1.1 OVERVIEW

The Back River Project (the Project) involves the construction, operation, and closure of one mine site at the Goose Property. A marine receiving and staging area, Marine Laydown Area (MLA), will be established at Bathurst Inlet to deliver supplies, via a 160 km winter ice road connecting the MLA to the Goose Property.

1.2 PROPONENT INFORMATION

Sabina's corporate office is located at the following:

Sabina Gold & Silver Corp.
#202 - 930 West 1st Street
North Vancouver, BC Canada V7P 3N4
Tel: (604) 998-4175
Fax: (604) 998-1051
Toll Free: (888) 648-4218

1.3 PROPONENT COMMITMENTS

Sabina operates pursuant to its Sustainable Development Policy, presented in the Overall Environmental Management Plan.

Sabina also subscribes to the Towards Sustainable Mining (TSM) Initiative, including the implementation of the Mine Closure Framework (MAC 2008).

1.4 HISTORY OF THE PROPERTY

The Property comprises 45 federal mineral leases and 19 federal mining claims covering approximately 55,000 ha (Figure 1.4-1). The Property is divided into one main project: Goose, and four exploration prospects: George, Boot, Boulder, Del, and Bath.

1.5 CURRENT ENVIRONMENTAL CONDITIONS

The Property is located in a remote area within the Kitikmeot Region of Nunavut and at least 160 km from any community. Virtually no development and little human disturbance have occurred in the area, aside from various mineral exploration campaigns conducted since 1982 (Section 1.4).

The Property is located in an area of continuous permafrost that extends to a depth of between 490 and 570 m below ground surface (mbgs) (Rescan, 2014). Beneath the permafrost, and where open taliks exist, the regional groundwater is saline. As such three underground mines, Umwelt mine (Umwelt U/G), Llama mine (Llama U/G), and Goose Main mine (Goose Main U/G), are likely to penetrate through the permafrost and into the saline groundwater. Llama open pit intersects Llama Lake and is anticipated to be an open talik; saline groundwater is also anticipated from this mine. This is further discussed in Section 4.

This iteration of the Mine Closure and Reclamation Plan (MCRP) forms part of a Final Environmental Impact Statement (FEIS) that Sabina is submitting to the Nunavut Impact Review Board so that the company may obtain a Project Certificate in order to proceed with the Project. The FEIS covers the current environmental conditions; future versions of this plan may include additional detail regarding environmental conditions as relevant to support the MCRP.

1.6 REGULATORY CONTEXT

1.6.1 Legislation Applicable to Mine Closure

The following legislation is applicable to mine closure planning in Nunavut. A complete list of legislation can be found in the overall Environmental Management Plan (Volume 10, Chapter 1).

Federal Legislation

- *Nunavut Land Claims Agreement* (NLCA; Canada, 1993).
- *Territorial Lands Act* (Canada, 1985c) and *Regulations* (Canada, n.d.).
- *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (Canada, 2002) and *Regulations* (Canada, 2013).
- *Fisheries Act* (Canada, 1985b) and applicable regulations.
- *Arctic Waters Pollution Prevention Act* (Canada, 1985a) and *Regulations* (Canada, n.d.).
- *Transportation of Dangerous Goods Act* (Canada, 1992) and *Regulations* (Canada, 2001).

Territorial (Nunavut) Legislation

- *Environmental Protection Act* (Nunavut, 1988a) and *Regulations*.
- *Environmental Rights Act* (Nunavut, 1988b) and *Regulations*.
- *Mine Health and Safety Act* (Nunavut, 1994) and *Regulations* (Nunavut, 1995).

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October 31 2015

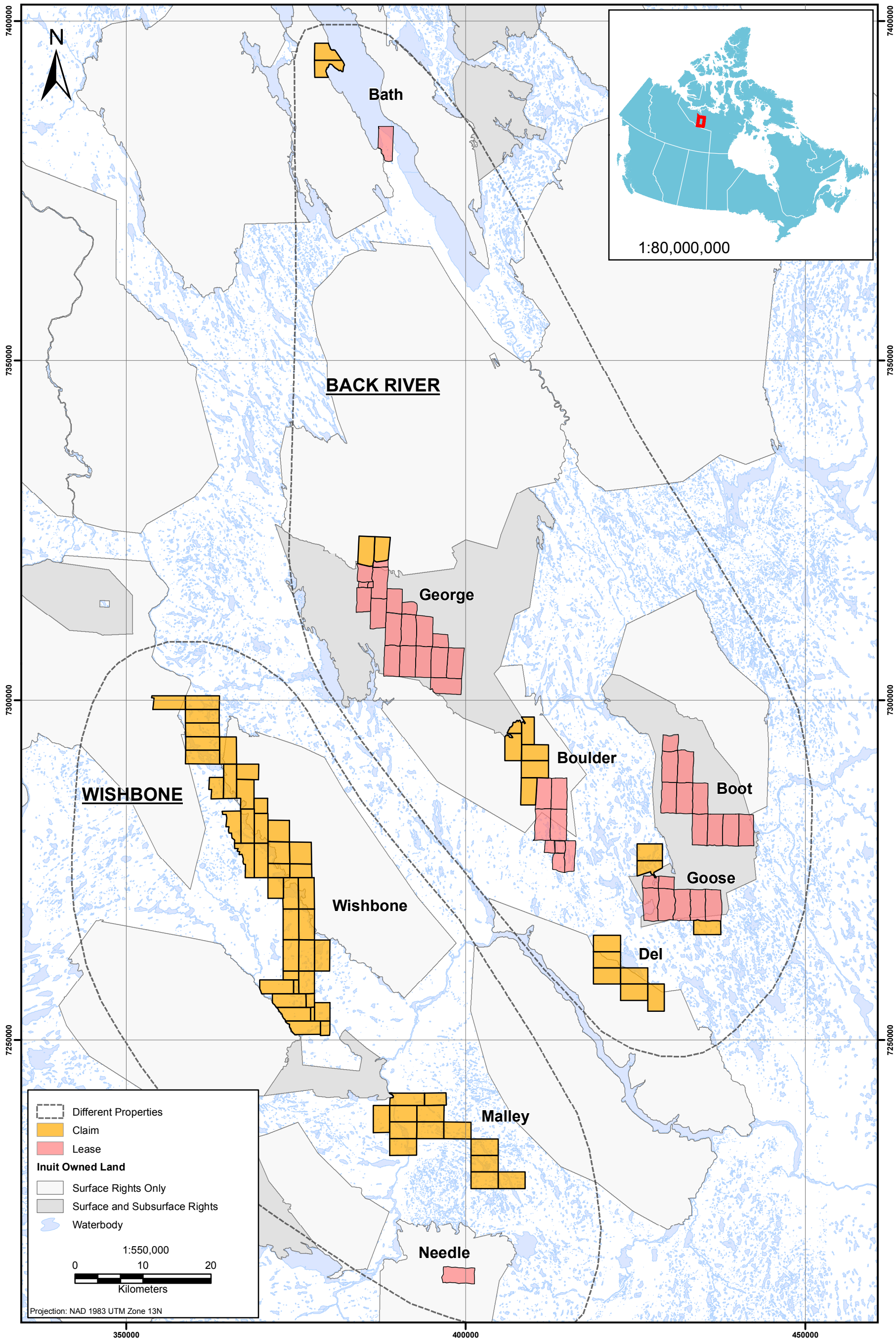

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Figure 1.4-1

Back River Mineral Claim and Lease Map

It should be noted that the primary regulatory instruments applicable to mine closure include land use authorizations and water licences.

Surface rights for Inuit Owned Land (IOL) are vested in the Kitikmeot Inuit Association (KIA), which administers the access and management of the IOL for the benefit of the Inuit in that region. Access to and use of surface lands requires an Inuit land use permit, licence or commercial lease issued by the KIA. The majority of the Project, including the Goose Property and the MLA, is located on either surface rights, or surface and subsurface rights on IOL administered by the KIA. Land ownership in relation to the Project is shown on Figure 1.4-1. Sabina anticipates that the majority of financial security posted for mine closure will likely be held by the KIA.

Surface rights on Crown Land are vested in the federal government and in the Aboriginal Affairs and Northern Development Canada (AANDC). Access to and use of these surface lands requires a land use permit, licence or commercial lease issued by the AANDC. A northern portion of the winter ice road connecting the MLA and the Goose Property is located on Crown Land.

Use of water resources as well as waste disposal in Nunavut is regulated by the Nunavut Water Board (NWB). The Project will require a Type A Water Licence for mine development, pursuant to the *Nunavut Waters Act*, and Sabina's MCRP will require approval under the water licence.

An important element of mine closure planning in Nunavut is the establishment of mine closure costs and the posting of financial security. This will be a stated condition of the Type A Water Licence. Financial security is typically posted to the AANDC for water-related closure costs and to the landowner(s) for land-based reclamation activities.

1.6.2 Current Permits and Approvals

Table 1.6-1 lists the current permits and approvals that govern exploration activities at the Back River Project.

Table 1.6-1. Summary of Land and Water Access Permits (as of June 2, 2015)

Permit	Expiry (mm/dd/yyyy)	Agency	Description
KTL204C012 - Amended	12/13/2015	KIA	Boulder: Staking/prospecting, exploration (ground/air geophysics), geophysical survey, gridding and drilling
KTL204C020 - Amended	12/13/2015	KIA	Boot: Exploration (air/ground geophysics), staking, prospecting, fly/survival camp and drilling
KTL304C017 - Amended	12/13/2015	KIA	Goose: Staking/prospecting, exploration (ground/air geophysics), drilling, bulk sampling, bulk fuel storage, camp, winter road
KTL304C018 - Amended	12/13/2015	KIA	George: Staking/prospecting, exploration (ground/air geophysics), drilling, bulk sampling, bulk fuel storage, camp, winter road
KTL304F049 - Amended	12/13/2015	KIA	Winter road Bathurst Inlet to Goose and George
KTP11Q001	12/13/2015	KIA	Goose rock quarry
KTP12Q001	12/13/2015	KIA	Goose airstrip borrow area
KTP12Q002	12/13/2015	KIA	George borrow quarry
N2011F0029	12/13/2015	AANDC	Winter road connecting George-Goose
N2010F0017[1]	9/16/2015	AANDC	Winter road connecting Bathurst Inlet - Back River Project

(continued)

Table 1.6-1. Summary of Land and Water Access Permits (as of June 2, 2015; completed)

Permit	Expiry (mm/dd/yyyy)	Agency	Description
N2010C0016[1]	10/31/2015	AANDC	Exploration activities
2BEGOO1520	02/18/2020	NWB	Goose water licence
2BEGEO1520	05/29/2020	NWB	George water licence

1: waiting for the NPC to provide guidance on their NUPPA renewal process

1.6.3 Applicable Guidelines related to Mine Closure

Planning for mine closure in Nunavut is guided by the following:

- Mine Site Reclamation Policy for Nunavut (AANDC, 2002).
- Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories (MVLWB/AANDC 2013).

Mine closure planning is an iterative process that starts during the permitting process and continues until mine closure is implemented at the end of mine life. In Nunavut, a preliminary MCRP is produced during the planning and permitting stage of a project (MVLWB/AANDC 2013). At start-up and through the Operations phase, various iterations of an Interim MCRP are produced with a Final MCRP being produced before permanent closure. According to MVLWB/AANDC (2013), a conceptual MCRP is prepared during the initial mine planning prior to construction and is expected to emphasize the following:

- *"Identification of closure objectives for individual project components;*
- *Realistic descriptions and assessments of closure options related to temporary, unpredicted, or indefinite closure;*
- *Identification of uncertainties related to closure objectives, options, or criteria, and potential reclamation research or engineering studies to address uncertainties;*
- *A review of similar case studies and a description of applicable lessons learned from other sites;*
- *Credible evidence that the selected closure activities can achieve the stated closure objectives;*
- *Photographs depicting what the site looks like before operations begin, conceptions of the maximum extent of disturbance during mining operations, and the post-closure landscape;*
- *Identification of any likely post-closure monitoring requirements and responsibilities for the selected closure activities;*
- *Conceptual projections of the likely post-reclamation risks to environmental, human, and wildlife health (risk assessment); and*
- *Closure and reclamation liability costs and a financial security estimate to a level of detail reflective of the available information."*

1.6.4 Environmental Assessment Requirements

This MCRP is expected to accompany an FEIS prepared for the Project, which is subject to a Part 5 environmental review by the Nunavut Impact Review Board (NIRB). NIRB (2013) issued EIS Guidelines to Sabina in April 2013.

Review of the FEIS through the NIRB review process will evaluate how well the MCRP has incorporated closure into the mine design and if the effects of the Project during mine Closure and Post-Closure have been adequately minimized.

1.7 CLOSURE OBJECTIVES AND CRITERIA

Closure Objectives

This MCRP has been developed to conform to all applicable legislation and guideline documents as listed in the preceding sections. In addition, all of the closure and reclamation activities are proven technology, having been applied at other Canadian Arctic mine sites, including Nunavut mines.

This MCRP is based on the following objectives.

Objective 1: Design the Mine for Closure

This involves identifying the processes and forces that may act upon the mine components after mine closure and reclamation so that they can be factored into the design and operation of the mine. This includes adoption of the objectives outlined by MVLWB/AANDC (2013) as follows:

- Design and construct mine components in such a way that they achieve, or can readily be modified to achieve, the reclamation objectives and closure criteria.
- Determine mine reclamation costs as part of the closure planning and provide adequate security to cover the cost of reclamation over the life of the mine to ensure the closure criteria can be met.
- Include reclamation planning in the development and operation of the mine. This planning will ensure that mine operating activities do not unnecessarily increase the amount of reclamation work or effectively compromise what might otherwise be promising reclamation activities.
- Incorporate progressive reclamation activities into operation of the mine.
- Coordinate among Aboriginal, Federal and Territorial governments; land owners; local communities; regulatory authorities; the mining company; and other impacted parties to ensure that appropriate objectives, closure criteria, and activities are developed.

Objective 2: Achieve Physical Stability

Mine components that will remain after mine closure will be constructed or modified at closure to be physically stable so as to not erode, subside, or move from its intended location under natural extreme events or disruptive forces to which it may be subjected after closure. The objective of physical stability is to not pose a hazard to humans, wildlife, or environment health and safety.

Achieving physical stability includes establishing the conditions post-closure that allow for natural revegetation so that the land returns to productive use by wildlife. As part of this MCRP, potential revegetation of disturbed sites, including active revegetation, seeding, and soil amendment, were reviewed. At this time, active revegetation of the Property as part of closure is not planned given the

cold climate setting of the Project as well as the precedent established for mine closure in Nunavut. Additional research in this field may be considered in future iterations of the MCRP.

Objective 3: Achieve Chemical Stability

Mine components including wastes remaining after mine closure will be chemically stable. Chemical constituents released from the mine components should not endanger public, wildlife, or impact environmental health and safety. These constituents should not result in the inability to achieve the water quality objectives in the receiving environment and should not adversely affect long-term soil or air quality. If necessary, appropriate long-term management of potentially acid generating/metal leaching materials and any affected waters will be considered.

Objective 4: No Long-Term Active Care

All practical efforts to ensure that Project components that remain after closure will not require long-term active care will be made. Any post-closure monitoring will only continue for a defined period of time. Objective 1, which proposes designing the mine for closure, and Objectives 2 and 3 for physical and chemical stability, will help ensure the achievement of this principle.

Objective 5: Consider Future Use and Aesthetics

The site will be compatible with the surrounding lands once reclamation activities have been completed. Consideration of future use and aesthetics involves the following elements:

- Naturally occurring biophysical conditions, including any physical hazards of the area (pre- and post-development);
- Characteristics of the surrounding landscape pre- and post-development;
- Level of ecological productivity and diversity prior to mine development and intended level of ecological productivity and diversity for post-mine closure;
- Local community values and culturally significant or unique attributes of the land; and
- Level and scale of environmental impact.

Approach to Inclusion of Community Values

An important aspect of northern mine closure is the incorporation of community perspectives on closure. This is a stated requirement of the NWT Mine Closure Guideline (MVLWB/AANDC 2013). It is also a key element of the NIRB environmental review and the NWB water licencing processes.

In the short term, community perspectives are expected to be gathered during the permitting phase through the public environmental review and water licencing processes. Beyond the permitting phase, communities and workers will become more familiar with the Project through the Construction and Operations phases and will be able to provide input into mine closure through both Sabina's worker and community engagement programs, as well as during formal reviews of future interim MCRPs (part of water licence implementation and renewal).

Mine Effluent Discharge Limits and Receiving Water Quality Objectives

Thresholds identified in the FEIS will be adopted and applied to this and future iterations of the MCRP. This includes application of the mine effluent limits from Schedule 4 of the Metal Mining Effluent Regulations (MMER) pursuant to the *Fisheries Act*, for end of pipe discharges. This includes discharges from open pits, TSF, TFs, and waste rock storage areas (WRSAs).

In addition, receiving water quality guidelines have been adopted, including site-specific water quality objectives (SSWQOs) for select parameters, or the generic criteria presented in the Canadian Environmental Quality Guidelines for the Protection of Freshwater Aquatic Life (CWQG-PAL), developed by the Canadian Council of Ministers of the Environment (CCME, 2015). Monitoring during Operations and Closure will confirm whether criteria are being met (Section 6).

1.8 FUTURE ITERATIONS OF THIS MCRP

The MCRP is a working document that reflects both the level of current detail available for the Project and the current closure standards and techniques. Future updates to the MCRP will reflect Project modifications, provide additional details and closure costs, and will account for potential changes in technology, standards, guidelines, or legislation.

AANDC (2013) outlines the phases of closure planning through the life stages of a mine. This includes:

- Conceptual MCRP - Prepared during the planning and permitting stages of the Project before construction.
- Interim MCRP – Produced for the application for a Type A water licence and must be issued within 12 months of the Water Licence issuance or as directed by the licensing agency. The interim MCRP shall be updated before construction as necessary with changes to the mine plan.
- Final MCRP – Produced two years prior to the end of operations and the start of the mine closure and reclamation phase, or as required by a condition of a Water Licence for an abandoned mine.

The current plan is a conceptual MCRP and further iterations of this MCRP may be an outcome of the NIRB review and water licencing processes. It is expected that formal approval of the first Interim MCRP will be granted to Sabina by the Nunavut Water Board under a future Type A Water Licence.

2. Project Overview

2.1 MINE PLAN

The Project involves the construction, operation, and closure of open pit and underground mines at the Goose Property. A Marine Laydown Area (MLA) will be established at Bathurst Inlet to deliver supplies, via a 160 km winter ice road connecting the MLA to the Goose Property.

The Project life is described in Phases as follows:

- Phase 1 – Mobilization and Construction (4 years; Years -4 to -1);
- Phase 2 – Operations (10 years; Years 1 to 10);
- Phase 3 – Closure (8 years; Years 11 to 18); and
- Phase 4 – Post-Closure (5 years; Years 19 to 23).

The mine plan consists of open pit mining plus underground mining at four (4) deposits, supporting a 6,000 t/d milling operation over an estimated 10 year mine life. The four deposits are as follows:

- Umwelt (Umwelt Pit and Umwelt U/G);

- Llama (Llama Pit and Llama U/G);
- Goose Main (Goose Main Pit and Goose Main U/G); and
- Echo (Echo Pit and Echo U/G).

The complete mine production schedule is presented on Figure 2.1-1.

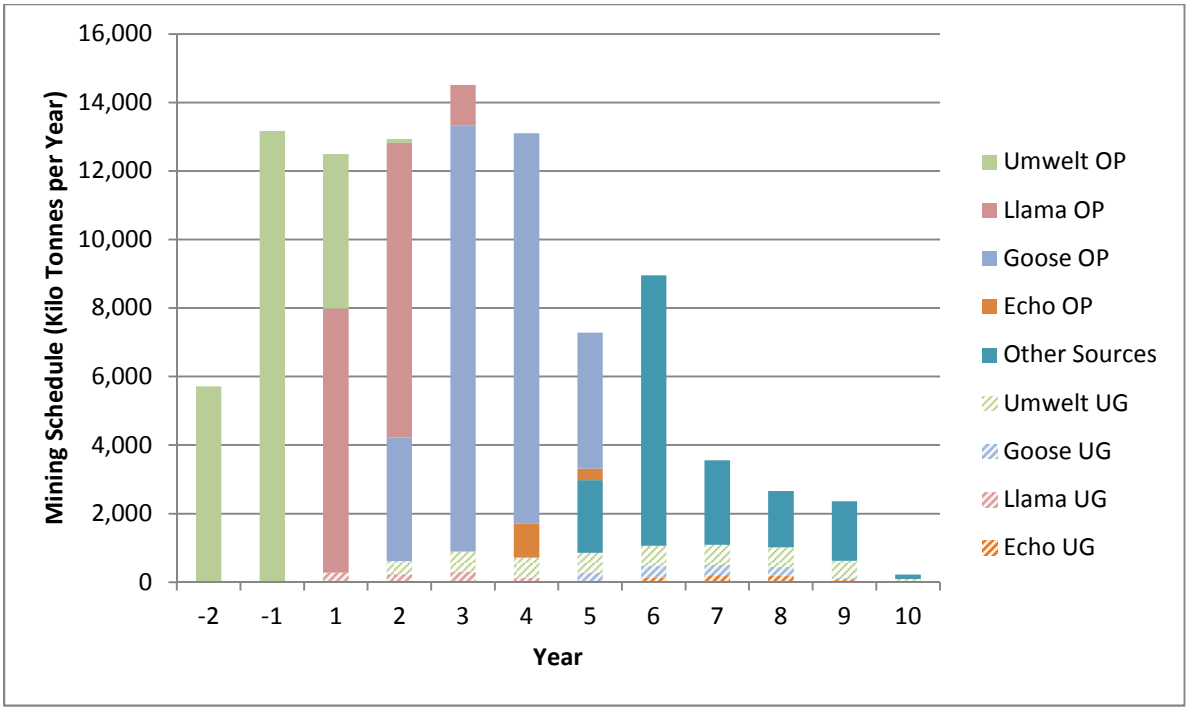


Figure 2.1-1. Mine Production Schedule by Deposit

Mining will begin with pre-stripping at the Umwelt Pit in Year -2 (i.e., during Construction). Open pit mining will then transition sequentially to the Llama, Goose Main, and Echo pits. All open pit mining at Goose Property concludes in Year 6 when mining in the Goose Main Pit is complete. Underground ore production will begin at Llama in Year 1 and then transition to Umwelt, Goose Main, and Echo mines. When Llama U/G production ceases at the end of Year 4, Goose Main U/G starts producing, followed by Echo U/G in Year 6. Umwelt U/G, beginning in Year 2, will continue until Year 10. Between Years 6 and 10, it is assumed that, in addition to the underground production, the Goose Process Plant will be fed ore from other deposits, including possibly from the George Property.

Low, medium, and high grade ore stockpiles will be established at the Goose Plant Site.

2.2 GEOCHEMICAL CHARACTERIZATION

Geochemical characterization of the waste rock, ore, quarry rock, overburden, tailings, and mine workings has been completed on the Property (Rescan, 2013; SRK, 2015a).

Results from these characterizations indicated that, after a 75% segregation efficiency is taken into account, approximately 58% of the mine workings and waste rock is potentially acid generating (PAG) and may lead to acidic drainage after a lag time of 14 to 20 years. This lag time is expected to be longer than the amount of time needed for the PAG rock, which will be covered with at least 5 m of non-potentially acid generating (NPAG) rock, will take to freeze. Acidic conditions are expected to

occur more rapidly in some of the waste rock, but average pH conditions in seepage and runoff would be expected to remain buffered until WRSA freeze back conditions develop. As such, long-term acid rock drainage and metal leaching are not anticipated.

Samples from the Umwelt Quarry and the Airstrip Quarry have indicated the rock there is NPAG. However, some rocks in the iron formation from the Airstrip Quarry have been characterized as PAG. Elevated concentrations of arsenic have been observed in samples from both quarries. Overburden across the Goose Property has been characterized as NPAG. Further details on waste segregation and management can be found in the Mine Waste Rock Management Plan (Volume 10, Chapter 9), and the Borrow Pits and Quarry Management Plan (Volume 10, Chapter 16).

The majority of the tailings samples from the Goose Property have been characterized as PAG (Rescan, 2013; SRK, 2015a).

Water quality predictions were evaluated in all open pits, tailings facilities, and in predefined locations downstream of the Goose Property. Results were compared to Metal Mining Effluent Regulations (MMER) and Canadian Council of Ministers for the Environment (CCME) water quality guidelines. Water quality predictions indicate that water treatment will be required within the Goose Main Pit, once it becomes the Goose Main TF. With this proposed water treatment strategy, the predicted water quality of open pit and tailings facility overflows at Closure meets MMER limits, and long-term water quality (Post-Closure) is expected to meet CCME guidelines in Goose Lake (SRK, 2015b).

2.3 TAILINGS MANAGEMENT

Gold ore will be milled at the Goose Process Plant with tailings discharged to multiple facilities, and tailings storage management dictates how water is managed on the Project. As such, the Operations phase (Phase 2) is further described in stages according to the tailings storage and water management plans, as follows:

- Stage 1 – Tailings Storage Facility – For the first two years of Operations (Years 1 and 2), a purpose-built Tailings Storage Facility (TSF) will be utilized;
- Stage 2 – Umwelt Tailings Facility (Umwelt TF) – From Years 2 to 6, the mined-out Umwelt Pit will used for the tailings deposition; and
- Stage 3 – Goose Main Tailings Facility (Goose Main TF) – From Year 6 onward, tailings will be disposed of in the mined-out Goose Main Pit.

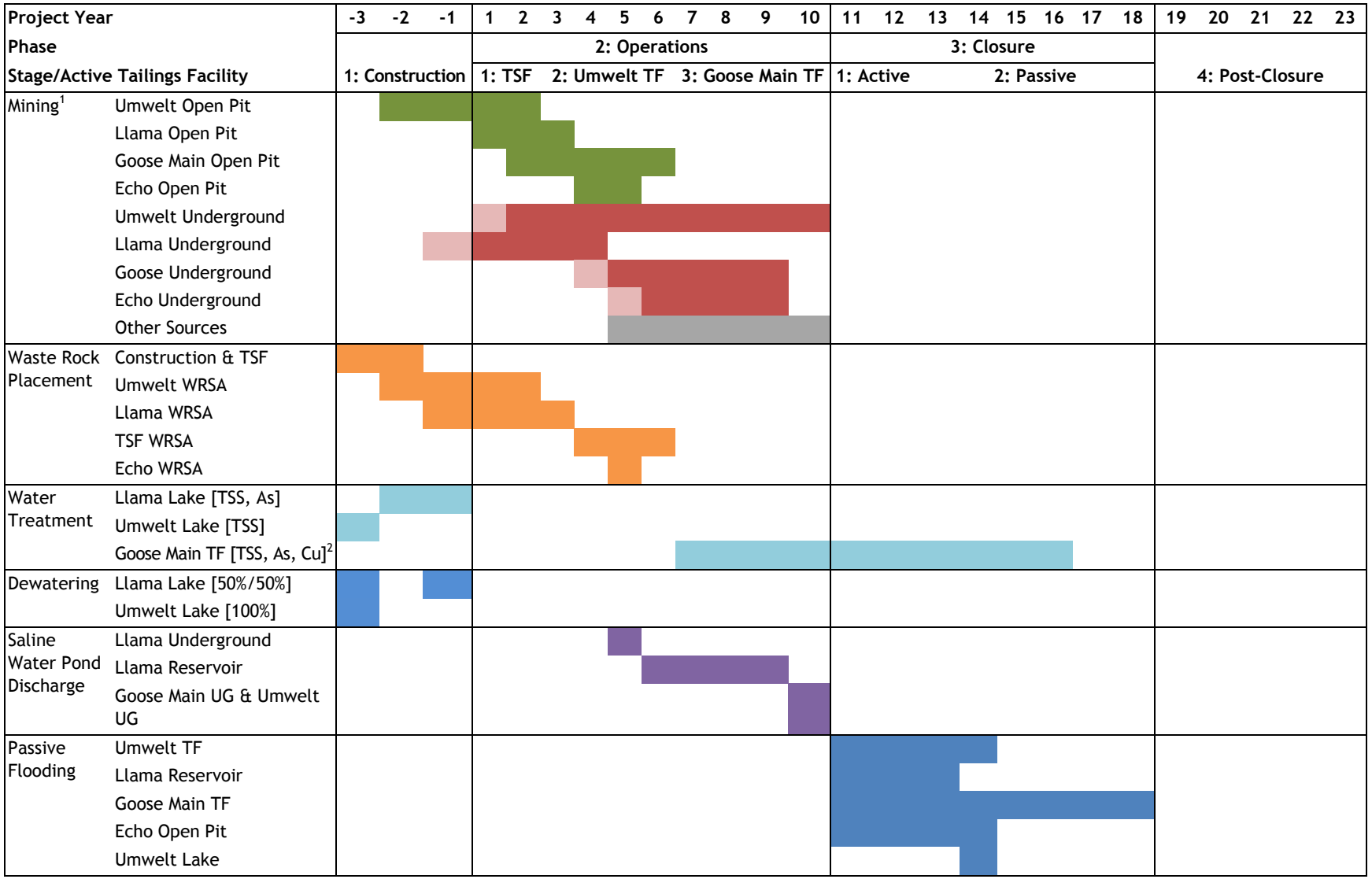
Figure 2.3-1 presents the Project phases and stages, along with waste rock disposal scheduling and key water management activities.

2.4 WASTE ROCK STORAGE

Waste rock will be stored in waste rock storage areas (WRSAs) established close to each pit. Four WRSAs are proposed:

- Umwelt WRSA;
- Llama WRSA;
- TSF WRSA (servicing the Goose Main Pit); and
- Echo WRSA.

Figure 2.3-1. Project Phases and Stages



1: Lighter red on undergrounds denotes Development in advance of Production.
2: TSS = total suspended solids, As = arsenic, Cu = copper.

Waste rock generated from the Umwelt Pit during pre-stripping that is demonstrated to be non acid-generating or metal leaching will also be used in construction of various mine site development areas and the TSF embankments.

The Umwelt, Llama, and TSF WRSAs will be conventional stockpiles constructed with final side slopes at 3H:1V, and Echo WRSA will have final side slopes of 2.4H:1V. The WRSAs are expected to be stable over the long term. The TSF WRSA is a waste rock storage area created on and around the TSF to support mining of the Goose Main Pit after Year 2, once use of the Umwelt TF for tailings disposal has been initiated and the supernatant has been drained from the TSF.

PAG and NPAG waste rock will be placed concurrently at each WRSA location during Operations such that there is a 5 m cover of NPAG waste rock over PAG waste rock. A disposal plan has been developed that maximizes the placement of NPAG waste rock over final PAG lifts during mine operations by using NPAG waste rock sourced directly from the pits. This approach will minimize the amount of dedicated capping that will be required to close out the WRSAs. Overburden will be co-disposed in the WRSAs and a portion may also be used for capping material. All WRSAs will be fully constructed and covered with NPAG material by the end of Year 6 such that final reclamation can be undertaken progressively before the end of the Operations Phase.

Geochemical evaluations suggest that runoff from WRSAs during Operations will likely exceed MMER Schedule 4 limits for arsenic and copper (SRK, 2015b). During Operations, runoff from the WRSAs at the Goose Property will be directed to contact water storage ponds or the active TF, and eventually pumped to the water treatment plant (WTP) for treatment prior to discharge. It is expected that the final WRSAs will be frozen except for an active layer within the NPAG cap. Once the WRSAs are capped and permafrost has aggraded into the PAG rock, water quality is expected to improve to acceptable limits for discharge.

2.5 WATER MANAGEMENT

Water on the Project is categorized into three types:

- Contact water – Water which is impacted by mine workings (waste rock, ore stockpile, pits, tailings, etc.). Contact water is contained in event ponds and tailings management facilities, and is transferred via diversions and pumped pipelines.
- Non-contact water - Water which is runoff from undisturbed areas. Non-contact water is diverted off-site through event ponds, pumped pipelines, berms, and culverts.
- Saline water – Saline groundwater will inflow into the Llama Pit and most of the U/G mines. Saline water is pumped from the underground facilities and stored in the Saline Water Pond.

Each type of water is managed separately throughout each Project phase.

A water treatment plant (WTP) will be operational in the open water season at the Goose Property in the Construction phase to initially dewater Llama and Umwelt lakes in order to create storage for contact water and saline water, respectively. Treatment is inactive between Years 1 and 5, but begins again year-round from the Goose Main TF in Year 6 to reduce metal and total suspended solids (TSS) loading in the facility. Once mining is complete in Year 10, water treatment continues during the open water season from the Goose Main TF until the Property is finally closed in Year 18.

The MLA does not require any pond or diversion infrastructure for water management purposes, and remains in the same condition for both the Construction and Operations phase. A desalination plant will produce domestic and industrial water, and greywater will be discharged to the tundra.

2.6 ANCILLARY FACILITIES

Site layouts are included in Appendix A. Ancillary facilities at the Goose Property will include a process plant, power generation, worker accommodations, administration offices, etc.

The MLA will consist of a lightering barge for unloading sealift vessels, fuel storage, laydown storage areas, and camp facilities.

3. Care and Maintenance Plan for Temporary Mine Closure

3.1 DEFINITION OF TEMPORARY CLOSURE

Temporary closure (also termed Care and Maintenance) is defined as the cessation of mining and processing operations for a finite period of time with the intention of resuming operations upon resolution of the cause of the cessation (MVLWB/AADNC 2013). Possible reasons for implementing temporary closure measures include economic factors (severely depressed gold price, major mechanical failure, late delivery of critical supplies), environmental factors (investigation following unintentional discharge to the environment), or social factors (labour conflict). Temporary closure could last for several weeks or as long as several years depending on the nature of the contributing factor(s).

It is also possible that temporary closure could lead to permanent closure without resumption of mining. This unlikely event would be triggered by a commercial decision by Sabina not to continue operating. This decision would require the Final MCRP to be filed with the NWB, or a notification to the NWB that the company intends to execute the latest Interim MCRP as its Final MCRP. Following any required NWB approval, the final closure and reclamation measures described in Section 4 would be executed.

3.2 TEMPORARY CLOSURE PRINCIPLES AND GOALS

Temporary closure is focused on the care and maintenance activities that are required during the cessation of a mining operation. Temporary closure could occur during the Construction or Operations phases for the Project and, as such, temporary closure activities are phase-dependent.

The overall objective of temporary closure is to ensure that the Project facilities are kept in a manner that is safe for humans, wildlife and the environment, and will include physically and chemically stabilizing mine components. The success of the temporary closure provisions will be monitored by conducting routine physical and chemical inspections. Additional details are provided in the following sections.

3.3 TEMPORARY CLOSURE MANAGEMENT AND ACCOUNTABILITY STRUCTURE

Temporary closure activities will be managed by a core team of Sabina site personnel. The level of site presence will be established based on the anticipated temporary closure duration. Site caretakers will

also be responsible for maintaining site security throughout the period of temporary closure. The site caretakers will report to Sabina management.

It is expected that the only site access during temporary closure will be by air and that no winter ice roads will be constructed.

3.4 TEMPORARY CLOSURE ACTIVITIES

The following temporary closure activities will be implemented as needed depending on the phase at which the cessation of operations takes place.

- **Access and Security:** Access to all buildings and facilities will be secured and restricted to authorized personnel only. Mechanical, hydraulic, and electrical systems will be locked out and maintained in a secure state (i.e., in a no-load condition) if they are not required to operate through the temporary closure period. Mobile heavy equipment that is not required during temporary closure will be stored in appropriate areas in a no-load condition.
- **Mine Openings:** Warning signs will be posted around open pits and other mine openings. Mine openings will be barricaded.
- **Monitoring Programs:** All physical, chemical, and biological treatment and monitoring programs according to applicable management plans, water licences, land use permits, and land lease conditions will be continued, if appropriate, in order to maintain compliance. The details of any such monitoring will be communicated to the affected parties.
- **Hazardous Materials:** An inventory of hazardous materials will be completed, including process chemicals, reagents, and petroleum products. Hazardous materials and other chemicals will be properly stored or removed from site.
- **Bulk Fuel Storage:** Fluid levels in all fuel tanks will be recorded and routinely inspected for leaks or potential hazards.
- **Explosives:** Explosives will be relocated to the main magazine and secured, disposed of, or removed from site.
- **WRSAs and Stockpiles:** WRSAs and ore stockpiles will be maintained such that they are physically stable. The WRSAs and stockpiles will be routinely inspected to ensure their stability or to implement any required mitigation measures.
- **Water Management:** Surface water management measures will continue through temporary closure, and will be monitored to ensure proper operation. Surface water quality will be monitored to ensure that regulatory requirements are being met. Depending on the stage at which temporary closure occurs, the water level in the active tailings facility at the time will need to be monitored as there will be a net buildup of water due to the fact that no water is being removed for processing. Should temporary closure occur for a long period of time (i.e. one or more years), it may be necessary to begin pumping from the active tailings facility and treating the excess water for discharge.
- **Infrastructure:** Access roads will be maintained, including plowing snow from roads and the airstrip, repairing culverts, employing erosion and sediment control measures, etc. Infrastructure, including ditches and spillways, will be routinely inspected to ensure proper operation or to implement contingency measures. Camp facilities will be operated and maintained.

The level of effort involved in maintaining the site in a state of temporary closure will depend upon the Project phase.

3.5 MONITORING AND REPORTING DURING TEMPORARY CLOSURE

Programs will be conducted to monitor the physical and chemical stability of mine components, maintain security of the site, continue reclamation studies, and compliance and aquatic effects monitoring. Physical inspections will be conducted to ensure that infrastructure, including embankments, berms, dykes, access roads, surface water management measures, etc., are all performing as designed.

Monitoring, maintenance, and reporting records that will be kept include the following:

- Recordings of pond water levels and pumping volumes;
- Recordings of meteorological and hydrological data;
- Physical inspections of TSF embankments, pipelines, intake structures, and progressively reclaimed areas;
- Ongoing water quality monitoring (as prescribed in the Type A Water Licence and other applicable approvals);
- Monthly site inspections by the Environmental Superintendent or designate for potential issues;
- Annual dam safety inspections of the TSF and physical inspections of the WRSAs by a qualified Geotechnical Engineer to observe that the embankments and stockpiles are performing as designed and that the TSF is being operated in accordance with the design intent;
- Ongoing maintenance of access roads as well as enforcement of security and access protocols;
- Site inspections by the Environmental, Health and Safety (EHS) Coordinator to assess any less obvious signs of potential problems; and
- Detailed site inspections by the Environmental Superintendent or designate following any extreme events, including freshet. These inspections are needed to identify and assess any damage caused by erosion or settlement that requires attention.

The inspections will be formally recorded and will include details on the inspection results. A brief summary following each inspection will be provided to Sabina management in order to identify any urgent concerns or maintenance measures. Monitoring reports will be prepared to present the findings of the inspections in accordance with licence requirements. Recommendations for maintenance and any suggested modifications to the monitoring program will be included in the reports.

Physical and chemical monitoring and the associated maintenance activities will be conducted until such time as the Project changes status by either resuming operation or advancing to final closure.

3.6 TEMPORARY CLOSURE SCHEDULE

The initial temporary closure activities in Section 3.4 will be carried out immediately following the stoppage of operations. It is expected that approximately four weeks will be required to complete the temporary closure activities following a decision to shut down operations and prepare the site for an indefinite period of care and maintenance.

4. Progressive Reclamation

4.1 DEFINITION OF PROGRESSIVE RECLAMATION

Progressive reclamation is defined as the opportunistic reclamation activities completed during the operational phase of a project before permanent closure (MVLWB/AANDC, 2013). Progressive reclamation can increase efficiencies by utilizing available mining resources to conduct reclamation activities during the revenue-generating phase of the Project. Progressive reclamation typically reduces risks, final closure costs, and the timeframe for achieving closure objectives.

4.2 CANDIDATE FACILITIES/AREAS AND RECLAMATION ACTIVITIES

Progressive reclamation activities can take place during either the Construction or the Operations phases. At the Goose Property, reclamation efforts will be focused on any final earthworks opportunities that present themselves, including:

Open Pits

- Establishing partial or full boulder fences around open pits, TFs, and TSF, where physical barriers are required to reduce the likelihood of entry by people or animals;
- Installing proper signage around mine openings and TSF; and
- Constructing open pit outflow structures.

Boulder fencing and signage are not necessary in areas that do not represent a physical hazard.

WRSAs

PAG waste rock within the WRSAs will be progressively capped using NPAG waste rock sourced from adjacent or nearby active open pit operations. All WRSAs will be fully developed by the end of Year 6, such that the final cover of NPAG over PAG waste rock can be completed during the Operations Phase. Application of a final cover over PAG waste rock using NPAG waste rock from active pit operations represents the most substantial progressive reclamation effort proposed. Final closure measures for the WRSAs are described further in Section 5.5.

Tailings Storage Facility (TSF)

Tailings in the TSF will be progressively capped using PAG rock during waste rock deposition in the converted TSF WRSA. Ultimately, a 5 m NPAG cover originating from active open pit activities will be placed on the tailings and PAG rock. This ensures that the TSF is completely rehabilitated prior to cessation of the Operations Phase.

Tailings Facilities (TFs)

The final closure strategy for the TFs is a permanent water cover. Tailings deposited in the TFs will be covered with water throughout Operations and as a result the reclamation of these facilities is ongoing and progressive.

Buildings and Infrastructure

- As buildings and infrastructure become unnecessary during the life of the mine, they will be removed and the sites will be reclaimed as much as practicable.

Contaminated Materials and Waste Disposal

- Materials (e.g. soil, snow, ice) that may become contaminated during Construction and Operations due to fuel or other spills will be cleaned up immediately following the spill. Soil will be remediated on site in lined landfarms. Final disposal will be in a WRSA or reused on site, if appropriate, once the soil meets Nunavut Site Remediation criteria for industrial land use.
- Water, snow, or ice will be collected in a lined containment area and treated using an oil-water separator during the summer months. Discharge to land (not directly to surface waters) is possible provided that the treated water meets Water Licence discharge limits for oily waste water.
- Hazardous wastes will be shipped off site periodically to minimize the amount of waste requiring removal at closure.

Reclamation Studies

Several areas of study were identified in the preliminary MCRP submitted as part of the DEIS. Several of these were addressed during the Feasibility Study (FS) and development of the FEIS. Table 4.2-1 summarizes the reclamation studies suggested in the preliminary MCRP and provides notes on the status of each study.

Table 4.2-1. Previously Proposed Reclamation Studies

Study No.	Description	Status
1	Confirm the available water for pit filling at the Goose Property from Goose, Propeller, and other lakes.	Completed during FS. Sufficient water is available for pit filling.
2	Evaluate the potential to backfill any of the pits with waste rock, and the additional option to backfill one of the Goose Property open pits with tailings (particularly Llama and Umwelt, located close to and down gradient from the Goose Process Plant and TSF).	Completed during FS. Umwelt and Goose Main pits to be TFs, saline mine water to be stored in Llama Pit.
3	Additional geochemical characterization and integration of geological block model to characterize the ARD/ML potential of the pit walls that will be above the final pit lake elevations.	Ongoing. Additional characterization and management plans completed during FS, block model no longer applicable.
4	Community perspectives on closure – to be obtained during the NIRB environmental review and the NWB Type A Water Licence Application processes.	Permitting through life of Project.
5	Evaluate the potential for thicker lifts of PAG waste rock, allowing for higher WRSAs with less surface area. If the WRSA footprints can be reduced, the costs to cover the piles may be reduced.	Completed during FS. WRSA footprints reduced.
6	Confirm cover designs are appropriate through further modelling and monitoring of temperatures, permafrost aggregation, active layer thaw in waste rock storage areas, etc.	Ongoing. Thermal modelling being updated as new information becomes available.

Studies 1, 2, and 5 addressing pit filling, pit backfill, and thicker lifts of PAG rock in WRSAs were addressed in the Feasibility Study. The waste management strategy was updated during the FS such that both Umwelt and Goose Main pits are now planned to hold tailings. A smaller tailings storage facility (TSF) will be constructed to hold tailings from mining in Umwelt Pit. Once mining in Umwelt Pit

is complete, Umwelt Pit will operate as a tailings facility (Umwelt TF). Tailings will be stored in Goose Main Pit (Goose Main TF) once mining in Goose Main Pit has been completed and the Umwelt TF is at capacity. Llama Reservoir (mined-out Llama Pit) will hold discharge from the Saline Water Pond and contact water from the Umwelt TF, which will temporarily store contact water from the Goose Main and Echo pits and the TSF. Contact water from the WRSAs will also be diverted into Umwelt TF or Llama Reservoir. Any additional water needed for dilution or water covers for the Goose Main or Umwelt TFs will be available from Goose Lake or potentially Big Lake (SRK 2015b).

As part of the Feasibility Study work, recommendations were made regarding future studies that will impact reclamation activities. Table 4.2-2 presents an update to the proposed reclamation studies going forward.

Table 4.2-2. Updated Proposed Reclamation Studies

Study No.	Description	Status and Schedule for Completion
1	Additional geochemical characterization to characterize the ARD/ML potential of the pit walls that will be above the final pit lake elevations.	Modified – From Table 3.2-1 Water Licence Application
2	Community perspectives on closure – to be obtained during the NIRB environmental review and the NWB Type A Water Licence Application processes.	Ongoing – From Table 3.2-1 Permitting through life of Project
3	Confirm cover designs are appropriate through further modelling and monitoring of temperatures, completion of energy balance on model inputs during freeze-back period, permafrost aggregation, active layer thaw in waste rock storage areas, etc.	Modified – From Table 3.2-1 Water Licence Application
4	Acquire an estimate of creep parameters for WRSA foundations and perform long-term deformation modelling for physical stability closure objective.	Water Licence Application Interim MCRP
5	Develop an improved estimate of the runoff coefficient from the WRSAs. This will have an impact operationally on pump and pond sizing, and during closure on treatment volume and environmental loading estimates.	Water Licence Application
6	Collect additional baseline water quality data during the winter to permit less conservative water quality modelling assumptions during the under-ice period.	Ongoing. Future updates to water and load balance models for permitting through life of Project.
7	Identify opportunities to locate the saline reservoir outside of Umwelt Lake in order to avoid an MMER Schedule II application for Umwelt Lake. Possible opportunities include building a ring dyke containment structure or transporting the connate water to Bathurst Inlet and discharging via a diffuser.	Water Licence Application
8	Revegetation research focused on large footprint areas which will significantly improve long-term stability and usability of the site follow Closure.	Ongoing.

4.3 PROGRESSIVE RECLAMATION SCHEDULE

Progressive reclamation activities at the open pits can be completed as material becomes available to construct boulder fences and spillways.

The use of NPAG waste rock as a final cover over PAG rock in the WRSAs and tailings in the TSF closely follows the mine plan and waste rock production schedules. The TSF will be converted to a WRSA and

closed by Year 3, and all of the WRSAs will be fully developed by the end of Year 6. A small volume of waste rock will be required as backfill for underground operations in Years 6 to 10, but otherwise final NPAG waste rock capping can be carried out during the Operations Phase as a progressive reclamation measure.

Progressive reclamation measures will be considered successful if they are completed as described in this section and monitoring confirms that the completed work is consistent with the stated closure objectives.

5. Permanent Closure and Reclamation

5.1 DECISION TO CLOSE

Permanent mine closure will occur when either all mineable and economic mineral reserves have been exhausted or if other external forces over a sustained period of time result in the Project no longer being a viable economic proposition.

An important consideration of permanent closure is the effect of mine closure on employees, contractors, suppliers, and the public. It is Sabina's aim to plan for closure so that adequate notice (if possible, on the order of a year or more) can be given to employees and the public.

Some infrastructure may stay in place should local communities, KIA, GN, federal government bodies, or other appropriate parties choose to take ownership of it. The schedule outlined below assumes that all infrastructure associated with the Project will be removed.

5.2 OVERVIEW AND SCHEDULE

Mine closure is anticipated to be 13 years and consist of three periods:

- Active Closure [Phase 3, Stage 1] – Project Year 11 – 12, i.e. two (2) years after mining operations cease. During this time, active closure activities such as earth-moving, waste disposal, and rerouting of pipelines will occur. Water treatment will also occur during this time.
- Passive Closure [Phase 3, Stage 2] – Project Year 13 – 18, i.e. six (6) years following the Active Closure stage during which seasonal water treatment and monitoring are the primary activities. A final demobilization and demolition of mine facilities will occur at the end of this stage in Year 18.
- Post-Closure [Phase 4] – Project Year 18+, i.e. a period of time during which confirmatory water quality, stability, aquatic effects, and ecosystem monitoring is conducted in order to ensure closure objectives have been met. This period is expected to be a minimum of five (5) years.

In Project Year 13, once Active Closure has been completed at the Goose Property, a "CAT train" may be operated during the winter to remove any materials and equipment (including hazardous wastes) to the MLA. If necessary, the winter ice road could be utilized should the volume of materials be deemed sufficient for its construction. A sealift from the MLA would occur the following summer to remove any hazardous materials and other wastes that have been transported to the MLA.

From this point, for the Passive Closure stage (i.e., Project Year 13 to Year 18), a smaller crew will occupy a small camp at the Goose Property to oversee seasonal water treatment operations. This camp will be supported entirely by aircraft instead of the MLA; this includes the delivery of fuel. After Year 18, when water treatment has achieved the closure objectives, it will be necessary to dispose of the pumping equipment, pipelines, the small fleet of mobile equipment, and the small camp. Any contractor equipment requiring removal from site will be backhauled by air or CAT-trained to the MLA for subsequent sealift off site.

Figures showing the Closure and Post-Closure phases of Goose Property and the MLA can be found in Appendix B.

5.3 OPEN PITS

Closure of the open pits will consist of:

- Placement of boulder fencing around the pit perimeters (mostly completed during Operations as progressive reclamation) to reduce the likelihood of people, vehicles or animals falling into an open pit;
- Removal of select equipment and materials from within the open pits; and
- Passive filling of the open pits.

The open pits will be passively filled with natural runoff and precipitation such that they can become natural outflow systems. Filling these pits will ensure an adequate water cover over tailings deposited in Umwelt and Goose Main TFs, ensure adequate meromictic conditions in Llama Pit, and in all cases minimize exposure of high walls that might pose an acid generating and metal leaching risk.

In addition, water within the Goose Main TF will be treated to reduce metal and suspended solids loading in the facility starting in Year 6 and ending at the end of the Passive Closure stage when the Project is fully closed out (Year 18). Water treatment will be undertaken year-round during the Operations Phase and seasonally during the Active and Passive Closure Phases.

Passive pit filling times were estimated by SRK (2015b). Based on average hydrological conditions, Umwelt TF will fill by Year 14, Llama Reservoir will fill by Year 13, Goose Main TF will fill by Year 18, and Echo Open Pit will fill by Year 14.

The assumptions made in preparing the plan for pit closure include:

- Average hydrologic conditions (based on baseline hydrology and meteorology data) persist into the mining and closure periods;
- About 7.2 Mm^3 of tailings will be stored in Umwelt TF;
- About 6.2 Mm^3 of tailings will be stored in Goose Main TF; and
- Overburden slopes around pit perimeters will be managed for long-term stability during pit development so that additional reclamation work will not be required at Closure. This includes possible cladding of these slopes to ensure long-term thermal stability, if necessary.

Non-contact water diversion berms around Llama and Echo pits will be breached during Active Closure. The non-contact water diversion berm around Goose Main TF will be breached at the end of Passive Closure once water treatment has achieved the closure objectives. Each flooded pit and TF, once

filled, will discharge to the environment on a seasonal basis. Discharge locations for the Goose Property are shown as breach locations on Figure 8 in Appendix B.

Predictions of open pit and TF overflow water quality were developed by SRK (2015b). It is expected that the overflow water discharged from the flooded pits and TFs will meet MMER Schedule 4 limits at the time of flooding. The overflow water from each of the pits and TFs is expected to exceed receiving water quality objectives (CWQG-PAL or SSWQOs) at the point of release. However, these objectives are expected to be met at the point of entry into receiving waters under steady state conditions.

Results of the water balance indicate that portions of the Umwelt TF, and the Llama and Echo pits will be flooded within 12 to 15 years of closure. Based on lag time calculations completed for the waste rock, it is likely that acidic conditions will develop in some of the PAG rock that is exposed in the pit walls. This was taken into account in developing water quality predictions for the pit walls (SRK, 2015a). Nonetheless, results from the water and load balance indicate that water from these pits will meet applicable discharge criteria which will enable passive discharge into nearby watercourses.

Portions of the Goose Main pit may be exposed long enough that some ML/ARD may develop. Runoff from the TSF WRSA pond will also be directed into Goose Main TF. Water from Goose Main TF will be treated throughout the Closure phase until closure objectives have been met, which is expected to be in Year 18. Additional details on geochemical pit wall characterization can be found in the SRK Water and Load Balance Report (SRK, 2015b).

In summary, the closure measures for each pit or TF are as follows:

- **Llama Reservoir** – In Year 6, the exhausted Llama Pit will be converted to a water reservoir during the Operations Phase. The Llama Reservoir will continue to passively fill reaching capacity in about Year 13. Overflow from the Llama Reservoir is expected to meet discharge requirements without water treatment.
- **Umwelt TF** – After open pit mining of the Umwelt Pit concludes, it will be used to store tailings in Years 3 to 6. The pit will passively fill and is expected to reach capacity in Year 14. The pit lake is expected to meet discharge requirements without water treatment.
- **Goose Main TF** – Mining of the Goose Pit will conclude in Year 5 and will be used for tailings disposal from Year 6 until the end of mining (Year 10). The Goose Main TF will passively fill reaching capacity in about Year 18 (the end of the Passive Closure phase). Water in the TF will be continuously treated and returned back to the TF starting in Year 6. The Goose Main TF is expected to meet discharge requirements in Year 18 and Post-Closure.
- **Echo Pit** – Mining of the Echo Pit will occur in Years 4 and 5 and will passively fill by Year 14. The pit lake is expected to meet discharge requirements without water treatment.

Monitoring of the water quality at control points across the site and in each pit will be important prior to the time at which each pit is expected to overtop in order establish that the water can be passively discharged. In the unlikely event that the water in Llama, Umwelt, or Echo pits is not suitable for discharge, the water could be batch treated to address any remaining water quality impairments.

5.4 UNDERGROUND MINE WORKINGS

The underground mines at the Goose Property will be closed out as follows:

- All hazardous wastes will be removed from the undergrounds along with any equipment to be used during the Active Closure stage;

- The mining methods require waste rock backfill to ensure underground stability; however, this is an ongoing component of mining and no additional closure activities are required to ensure long-term underground stability;
- Waste rock or concrete will be placed to seal the portals and vent raises of the underground mines; and
- Underground workings at Llama, Umwelt, and Goose Main will be flooded with water from the Saline Water Pond.

5.5 WASTE ROCK STORAGE AREAS

Waste rock storage areas will be constructed with side slopes ranging from 2.4H:1V at the Echo WRSA to 3H:1V at the Umwelt, Llama, and TSF WRSA. All WRSAs are expected to be stable over the long term.

PAG and NPAG waste rock will be placed concurrently during Operations such that there is a 5 m cover of NPAG waste rock over PAG waste rock. A disposal plan has been developed that maximizes the placement of NPAG waste rock over final PAG lifts during mine operations by using NPAG waste rock sourced directly from the pits. This approach will minimize the amount of dedicated capping that will be required during Operations (as progressive reclamation) and in the Closure phase. Overburden will have been co-disposed in the WRSAs and a portion may also be used for capping material.

As mentioned in Section 4.3, the WRSAs will be fully developed by Year 6. A small volume of waste rock will be required as backfill for underground operations in Years 6 to 10 but otherwise, final NPAG waste rock capping can be carried out during the Operations Phase as a progressive reclamation measure.

Geochemical evaluations suggest that runoff from WRSAs during Operations will likely exceed MMER Schedule 4 limits for arsenic and copper (SRK, 2015b). During Operations, runoff from the WRSAs at the Goose Property will be directed to contact water storage ponds or the active TF and eventually pumped to the water treatment plant (WTP) for treatment prior to discharge. It is expected that the final WRSAs will be frozen except for an active layer within the NPAG cap. Once the WRSAs are capped and permafrost has aggraded into the PAG rock, water quality is expected to improve to acceptable limits for discharge. Since the final covers will be applied during the Operations Phase, it will be possible to monitor the aggradation of permafrost and improvements in the quality of runoff through the Operations and Closure phases.

5.6 TAILINGS FACILITIES

The Tailings Storage Facility (TSF) will be closed out by removing tailings discharge infrastructure upon reaching TSF capacity and switching to tailings storage in Umwelt TF in Year 2. The TSF is then converted to a WRSA, and, once the TSF is drained, a 5 m NPAG cover will be progressively placed over the PAG rock and tailings in the facility. The TSF WRSA will be closed out by completing the NPAG cap and by pumping out the TSF WRSA collection pond into Goose Main TF for treatment. Once the water in Goose Main TF meets closure criteria, pumping infrastructure will be dismantled and landfilled, and the remaining portion of the TSF dam which has not been covered with NPAG waste rock will be breached with flow directed towards Goose Main TF. This is expected to occur in Project Year 18.

The Umwelt Tailings Facility (Umwelt TF) will be closed by actively pumping water during operations into Goose Main TF until the end of Operations. Water quality modelling completed during the FEIS confirmed that, if allowed to flood at closure, water quality in Umwelt TF will meet closure criteria without treatment (SRK, 2015c). Therefore, during Active Closure, Umwelt TF pumping infrastructure

will be dismantled and landfilled and Umwelt TF will be allowed to flood during the Passive Closure stage. Umwelt TF will be breached at its northwest side at Post-Closure.

Goose Main Tailings Facility (Goose Main TF) will be closed by removing tailings deposition infrastructure during Operations and by actively treating the water in the TF until it meets closure criteria. Goose Main TF will contain water from Umwelt TF, Goose Main TF, and the TSF WRSA pond at closure. Water will be pumped from Goose Main TF to the WTP, and treated water will be pumped back to Goose Main TF in a parallel pipeline. Once closure criteria for water quality is met in Goose Main TF, which is expected to be in Year 18, pipeline infrastructure will be dismantled and landfilled, and Goose Main TF will be breached on its northeast side.

Both Umwelt and Goose Main pits, once they have reached their outflow elevation, will have at least 5 m of water cover which is sufficient to avoid resuspension of tailings.

It is expected that approximately 21.5 Mm^3 of water will be treated from Goose Main TF in total during the Operations and Closure phases. Approximately 6.8 Mm^3 of water will be treated from Goose Main TF during the closure period.

5.7 BUILDINGS AND EQUIPMENT

The salvage value of equipment and machinery is expected to be limited due to the remoteness of the site. As such, all buildings, machinery, and equipment will be disposed of in an on-site landfill after any hazardous material has been removed. Equipment containing hydrocarbons that cannot be readily cleaned will be removed from site for recycling or disposal at a licenced facility. Above grade concrete structures will be broken up so that they are at or below grade, or will be covered with waste rock or overburden. Rebar will be cut so that it is flush with the surface of the concrete. Concrete structures will be infilled with NPAG waste rock, if needed.

Developed areas at each of the properties will be re-graded and contoured to remove uneven ground for public safety, minimize the potential for erosion, and to blend with the surrounding landscape.

5.8 ROADS AND AIRSTRIPS

Culverts will be removed from all-weather roads and the natural drainage restored. Roads will otherwise remain intact to ensure preservation of permafrost and facilitate long-term site access for monitoring and inspection.

Any airstrips will remain functional with a gravel surface for use during post-closure monitoring. Final closure of the airstrip will be similar to the all-weather roads.

5.9 PIPELINES AND POWER DISTRIBUTION LINES

Pipelines (such as tailings, freshwater, and effluent) will be purged, dismantled, and disposed of in a landfill within a WRSA. On-site power lines and associated materials will be dismantled and deposited in the closure landfill once power is no longer required for reclamation activities including pumping. Decommissioning of pipelines and distribution lines used for water treatment at the Goose Property will not be completed until the final year of Closure, Project Year 18.

Other power equipment and materials including oil-filled transformers will be drained and disposed of on-site, with the oil removed for off-site disposal with other hazardous wastes (Section 5.12).

5.10 WASTE MANAGEMENT SITES

Inert, non-hazardous landfills will be established within WRSAs at Goose Property during the Construction and Operations phases. These landfills will be used as closure landfills if they have adequate capacity. Additional closure landfills could be established within other WRSAs, if an alternative location is more suitable or if the Operations phase landfills reach capacity. The landfills will be closed by applying a 5 m cover of NPAG waste rock as a final cover. Non-hazardous waste may also be deposited within the open pits as would be covered with at least 5 m of water.

The closure schedule will allow for substantial closure of landfills and removal of most hazardous materials off site during the Active Closure stage. The Project will continue for another 6 years of Passive Closure while treatment of the water in Goose Main TF continues and monitoring occurs. After closure criteria have been met in Goose Main TF, a final decommissioning operation at the WTP and main camp will be required in Year 18. The final camp, mobile equipment, pipelines, and pumping systems will require landfilling, and any remaining fuel and hazardous wastes will require removal from site. Post-Closure monitoring will continue in Year 19, however there is not expected to be significant landfilling necessary after Passive Closure concludes.

5.11 WATER MANAGEMENT SYSTEMS

Water management will be an important element of the Active Closure stage at the Goose Property. Discharge infrastructure associated with the TSF will be decommissioned in Year 2 of mining, and capping of PAG rock with NPAG rock will be completed prior to cessation of mining as described in Section 5.6. Runoff collected in the TSF WRSA Pond will be pumped to Goose Main TF for treatment at the WTP throughout the closure period until closure criteria are met. Pumping and pipeline infrastructure will then be dismantled and landfilled and the remaining portion of the TSF dam that has not been covered with NPAG rock will be breached at the end of the Passive Closure stage.

Water from Goose Main TF will be treated at the WTP for arsenic and copper during the Active and Passive Closure stages, with treated water being routed back to Goose Main TF, until closure criteria are met, as described in Section 5.6. Effluent treatment sludge from the WTP during the Closure phase will be placed in a closure landfill; this facility will be closed as described in Section 5.10. Pumping and pipeline infrastructure from the WTP will then be dismantled and landfilled at the end of Year 18.

The Saline Water Pond (SWP) will be dewatered to multiple locations using separate pumping and pipeline infrastructure at the beginning of Active Closure; these locations include Llama Reservoir, and the underground mines of Umwelt, Llama, and Goose Main. Once it is dewatered, sediments will be tested and if the chloride content is too high, it may be removed and placed in an appropriate location. The SWP diversion berms and dams will then be breached allowing Umwelt Lake to re-establish.

Upon decommissioning pumping and pipeline infrastructure during the Active Closure stage, water management berms will also be breached in strategic locations to restore natural surface water drainages. Some berms, such as the main Llama non-contact water diversion berm, will be breached in four locations during the Operations phase; however the majority of the diversion berms will be breached during Closure. Table 5.11-1 outlines the berm breaching schedule during the closure period.

Llama, Umwelt, and Echo pits will be allowed to flood naturally in order to cover PAG rock on the pit walls. Goose Main TF will be allowed to fill naturally once water quality has been improved through water treatment.

Table 5.11-1. Water Management Structure Breach Schedule during Closure Period

Berm	Timing of Breach	Number of Breach Locations
Llama Non-Contact Water Diversion (Southwest, South)	Active Closure	1
SWP Contact Water Diversion	Active Closure	4
Ore Stockpile Pond Contact Water Diversion	Active Closure	2
Echo Non-Contact Water Diversion	Active Closure	2
Echo WRSA Contact Water Diversion	Active Closure	1
Echo WRSA Pond Contact Water Diversion	Active Closure	1
Llama Reservoir	Passive Closure	1
Llama WRSA Contact Water Diversion	Passive Closure	1
Umwelt TF	Passive Closure	1
Umwelt WRSA Contact Water Diversion	Passive Closure	1
Goose Main TF	Passive Closure	1
Goose Main TF Non-Contact Water Diversion	Passive Closure	1
TSF Contact Water Diversion	Passive Closure	3
TSF WRSA Dam	Passive Closure	1

Throughout both the Active and Passive Closure stages, water quality monitoring will occur at strategic control points to ensure closure criteria are being met. Monitoring locations will include the closed-out Llama Reservoir, Umwelt TF, Echo Pit, and Goose Main TF. Monitoring will also occur downstream of site infrastructure and in Goose Lake to ensure that discharge requirements are being met.

Diversion structures will remain in place to continue to direct runoff to the identified receiving environment during the Post-Closure phase. However, collection ponds will have been breached, liners removed and landfilled, and the areas recontoured and armoured (if necessary) to allow for passive runoff. Goose mine site conditions and final discharge locations in Post-Closure are presented in Appendix B.

5.12 CHEMICALS AND EXPLOSIVES

Hazardous materials will be collected for off-site disposal. Hazardous materials will include: unused chemical reagents, unused explosives, unused fuel, used oil, used glycol, and the hazardous components of vehicles and related equipment (i.e., fuel tanks, gear boxes, and hydraulic oil). Explosives will be used up or destroyed on site. Explosives and inert components still in their original packing may be returned to vendors for restocking.

All petroleum products and chemicals will be removed from the site and transported to a licenced facility for disposal. Fuel tanks will be steam cleaned, cut up, and landfilled. The rinse water will be treated before disposal.

5.13 CONTAMINATED SOIL

Soil found to exceed applicable Nunavut site remediation criteria will be bio-remediated on site within landfarms at Goose Property and the MLA. These landfarms will be established during the Construction and Operations phases, and possibly the Closure phase. A site investigation will be undertaken during the beginning of the Active Closure stage to locate any previously unidentified hydrocarbon contaminated materials. Soil will be bio-remediated in the landfarms and water (snow and ice) will be treated through an oil-water separator to meet oily water discharge criteria identified in the water licence. The length of time it will take to bio-remediate and treat is dependent on the final quantity of contaminated materials at closure.

5.14 PERMANENT CLOSURE AND RECLAMATION SCHEDULE

The schedule for Active Closure of the Project is driven by the time to treat the water in Goose Main TF and meet closure criteria. This is expected to take up to eight (8) years at the Goose Property, with final decommissioning of the water treatment plant and demobilization occurring early in the final year of Closure (Year 18). It is expected that capping of the WRSAs and TSF will be completed during the operational phase while decommissioning of the majority of water management structures, and demolition and disposal of buildings and infrastructure, will take place over the two years of Active Closure.

This schedule assumes that progressive capping of the PAG waste rock storage areas with NPAG derived material will take place during the Operations phase.

5.15 EXPECTED CONDITIONS POST-CLOSURE

A number of environmental effects will be reduced or eliminated as the Project completes Operations and moves into Active Closure. This includes reductions in air quality and noise emissions and disturbance effects to wildlife. Environmental effects will be further reduced in the Passive Closure and Post-Closure periods, following the completion of Active Closure measures to reduce environmental risks and ensure physical and chemical stability across the Project area.

The final landscape at the Goose and MLA properties is expected to consist of a disturbed project footprint that is physically and chemically stable in the long term. The final site configurations during Post-Closure are shown in Appendix B. WRSAs and flooded pit lakes will be the most prominent features at the Goose Property. Runoff from these areas is expected to meet effluent discharge criteria as well as receiving water quality criteria. In the unlikely event that contact water does not meet these performance criteria, Sabina will provide water treatment as required. Once water management structures are breached in the upstream Llama Reservoir, Umwelt Lake (the decommissioned Saline Water Pond) will be re-established over time.

Roads with culverts removed will remain as well as all airstrips. Development areas (i.e., plant site, laydown areas) will be contoured to blend with the surrounding landscape.

As previously stated, the Project is located in a remote area in Nunavut with no development and little human activity. An assessment of potential risks of the Project to human health and the environment was conducted, inclusive of the Operations, Closure, and Post-Closure Project phases (Volume 8, Chapter 6). None of the contaminants of potential concern (COPCs) assessed in the risk assessment are anticipated to change the quality of either drinking water or country foods relative to baseline conditions, with the exception of arsenic in Goose Lake associated with effluent releases from water management features. The potential for effects to human health associated with the Project is expected to be similar to baseline conditions and is not projected to change significantly due to Project-related activities. There is the possible exception of arsenic concentrations in Goose Lake, wherein an additional risk assessment was conducted and risks related to the consumption of Goose Lake water or fish were considered to be low.

6. Monitoring

6.1 MONITORING DURING THE CLOSURE PHASE

Onsite monitoring will be carried out during the Active Closure stage to confirm that:

- Closure activities are being undertaken as identified in the final approved MCRP.
- Temperatures within the WRSAs (as measured by thermistors) confirm that the piles are frozen throughout except for the predicted active layer.
- Embankments, WRSAs, and other structures are physically stable.
- Water quality and seepage rates being discharged from pits, TFs, and the WRSAs meet water quality objectives.

Due to the relatively long closure phase and progressive reclamation during Operations, there will be sufficient opportunities to conduct post-closure monitoring of the closed-out Project features. The TSF, WRSAs, and Umwelt, Echo, and Llama pits will all be closed out by second year of closure (Year 12), which will allow for a number of years of post-closure monitoring during the Passive Closure stage. Closure phase monitoring at receiving waters will be measured against water quality objectives.

6.2 POST-CLOSURE MONITORING

Post-Closure monitoring is expected to be required for five (5) years after completion of Active and Passive Closure activities in Year 18. Five years of post-closure monitoring has been selected at this stage of Project planning based on the following:

- The TSF will be decommissioned and converted into a WRSA after Year 2;
- All WRSAs will be fully constructed by the end of Year 6 and will be progressively reclaimed prior to the end of the Operations Phase; and
- The Closure Phase (inclusive of Active and Passive Closure) is sufficiently long as to have allowed for considerable post-closure monitoring prior to the formal 5-year Post-Closure period.

A number of project components will be closed out progressively during the Operations Phase or during the Active Closure phase. At the end of the 5-year Post-Closure monitoring period, WRSAs will have been monitored for about 13 years, and all pits/TFs will be monitored for 9 years after passively filling, with the exception of the Goose Main TF which will be treated and monitored until the end of the Passive Closure Phase.

The Mine Closure and Reclamation Plan is a “living document”. It will be updated based on management reviews, incident investigations, regulatory changes, or other Project-related changes. The proposed Post-Closure timeframe may be revisited in future versions of this plan.

Post-Closure monitoring is expected to include:

- Geotechnical inspections of the TSF embankments, WRSAs, pit walls, and other areas for physical stability and to ensure that permafrost encapsulation of PAG waste rock and tailings is occurring as expected.
- Water quality sampling at mine effluent discharge locations in accordance with MMER discharge limits and applicable receiving water quality objectives.
- Final Environmental Effects Monitoring (EEM) studies in accordance with the water quality objectives needed to obtain status as a recognized closed mine from Environment Canada.

The Post-Closure phase final discharge locations at the Goose Property are shown in Appendix B. Post-Closure monitoring of vegetation and wildlife has not been identified in this plan and will be identified in the Wildlife Monitoring and Mitigation Plan.

6.3 ADAPTIVE MANAGEMENT

Adaptive management is proposed through this MCRP. This includes:

- Carrying out Post-Closure monitoring beyond the stated 5-year post-closure monitoring period if closure objectives have not been met;
- Carrying out water treatment for longer (or shorter) time periods than initially planned should water quality not meet (or sooner) closure criteria within specific timeframes; and
- Modification to the MCRP as a result of the findings of the reclamation studies identified in Table 4.2-2.

7. Estimated Closure and Reclamation Costs

Sabina has completed an approximate closure and reclamation cost estimate based on current Project design. The Plan described above provided the basis of this estimate, along with additional engineering and assessment undertaken as part of the Final EIS. The total financial security for final reclamation is estimated at between $50 and $70 million. An updated MCRP and closure and reclamation cost estimate will be presented and further considered as part of the Type A Water License Application.

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Appendix A
General Site Layouts

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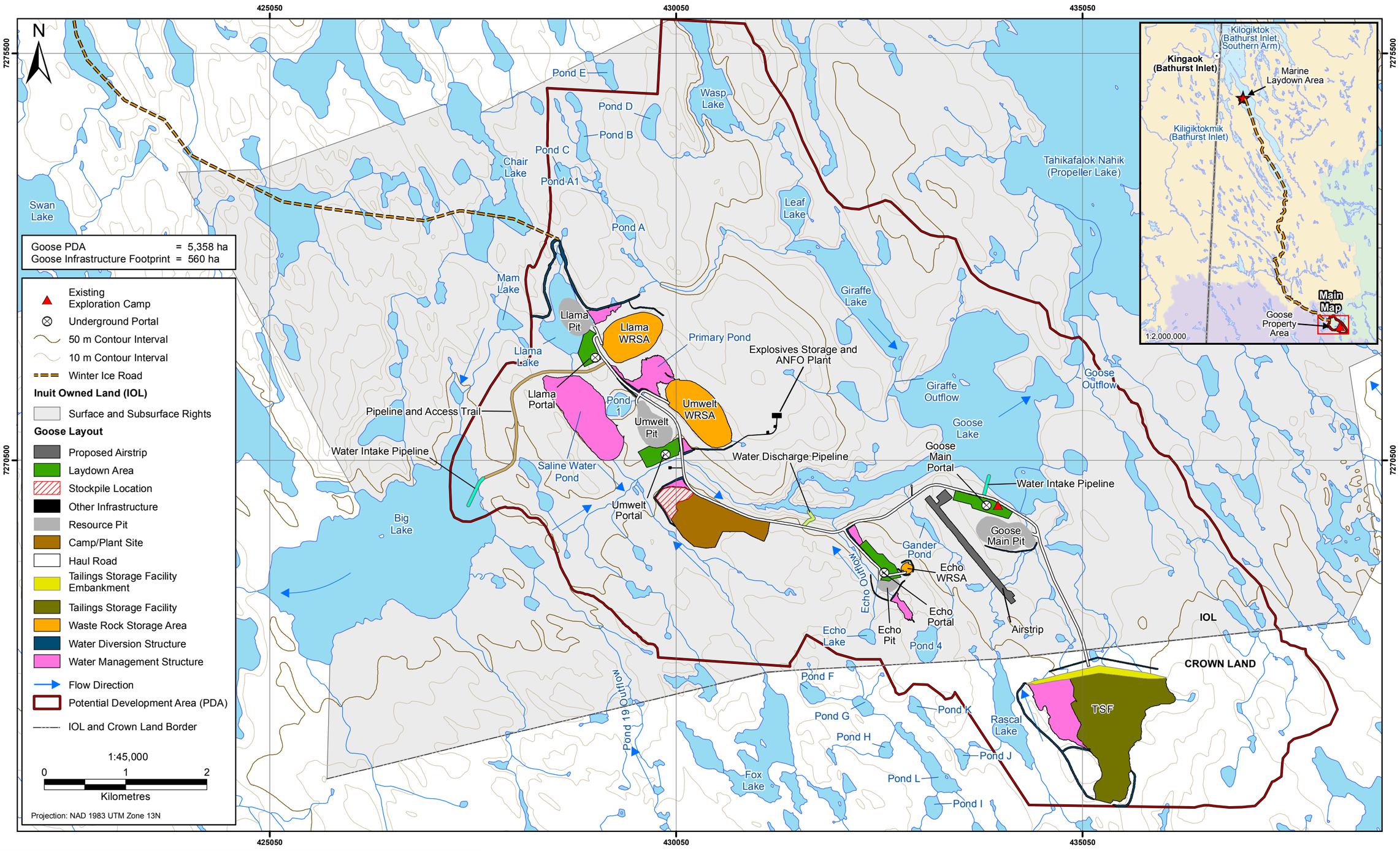

Sabina GOLD & SILVER CORP.

Figure 1

Potential Development Area and Layout
Goose Property Area

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October 21 2015

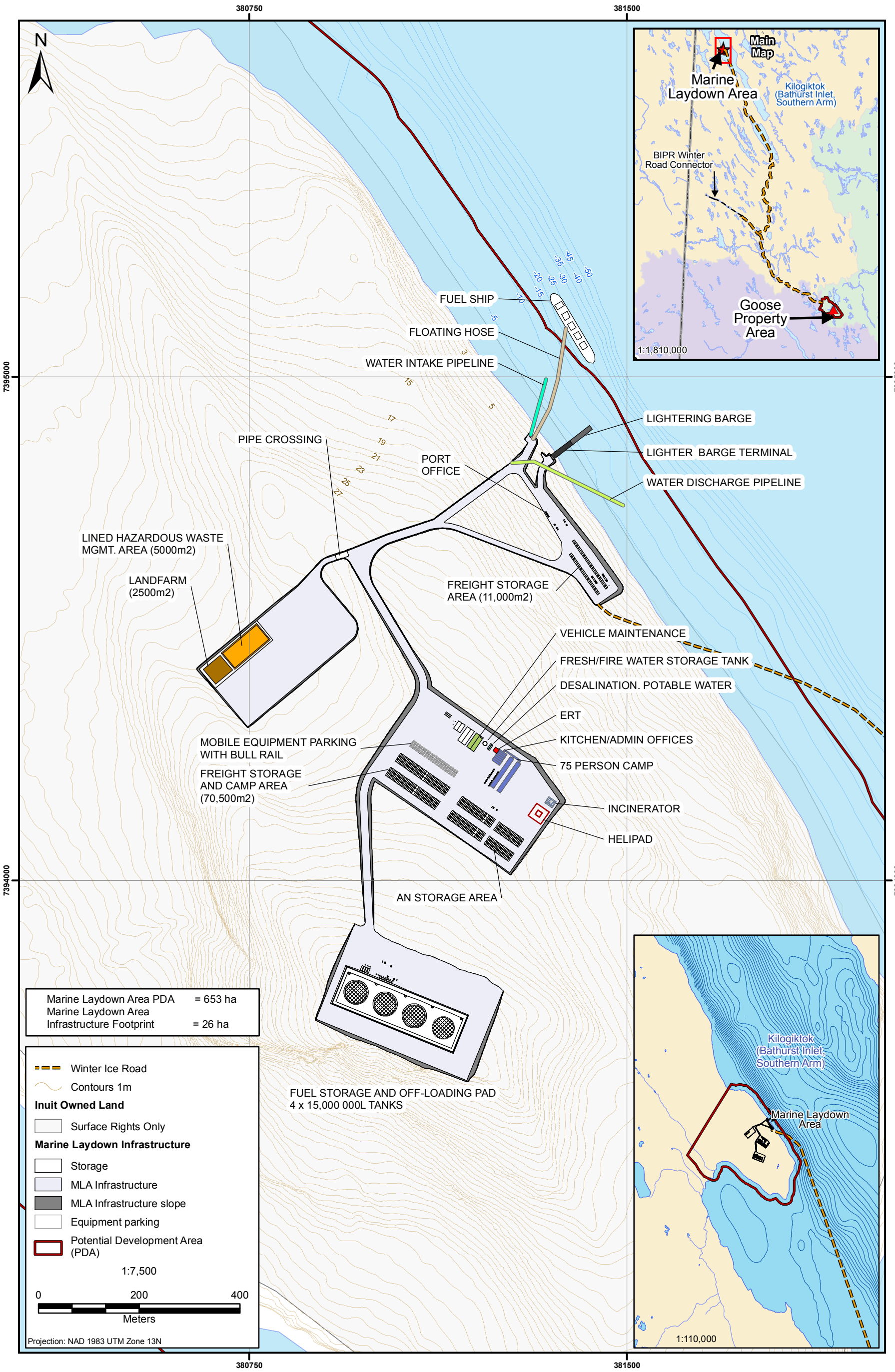

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Figure 2

Marine Laydown Area
Layout and Potential Development Area

Appendix B

Closure and Post-Closure Figures – Goose Property & MLA

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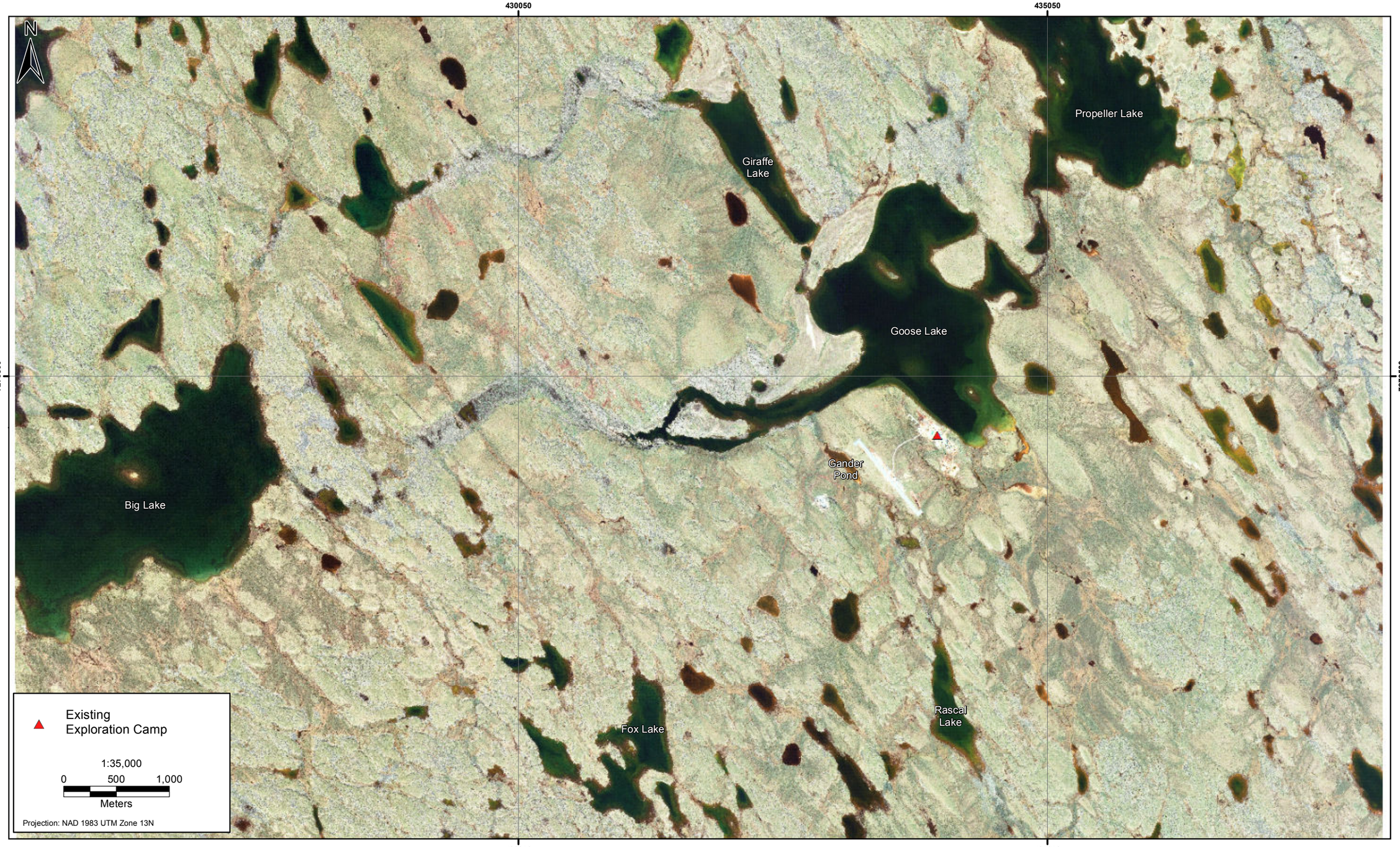

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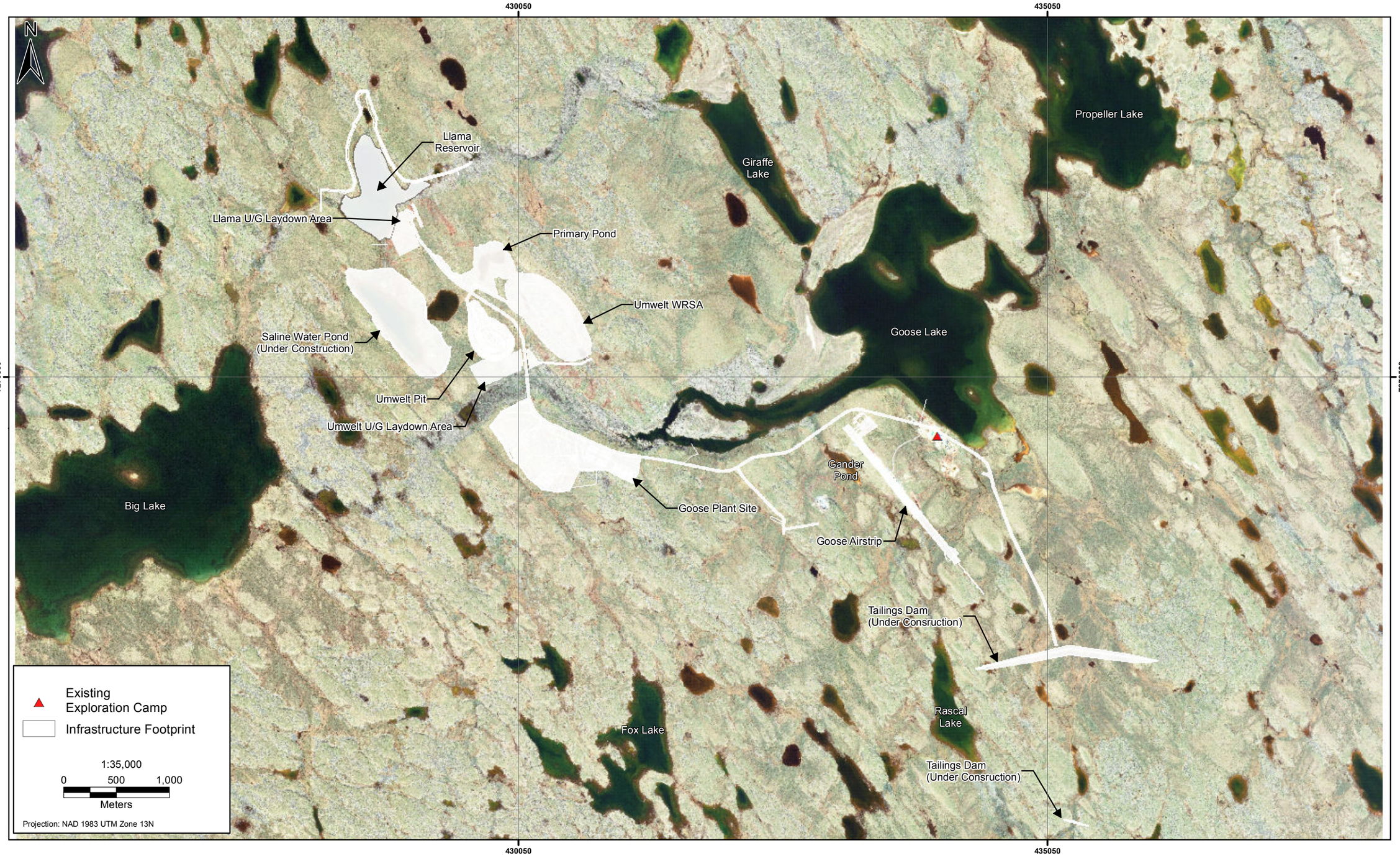
Goose Property
Orthophoto overlain by Infrastructure
Pre-Construction (current disturbance)

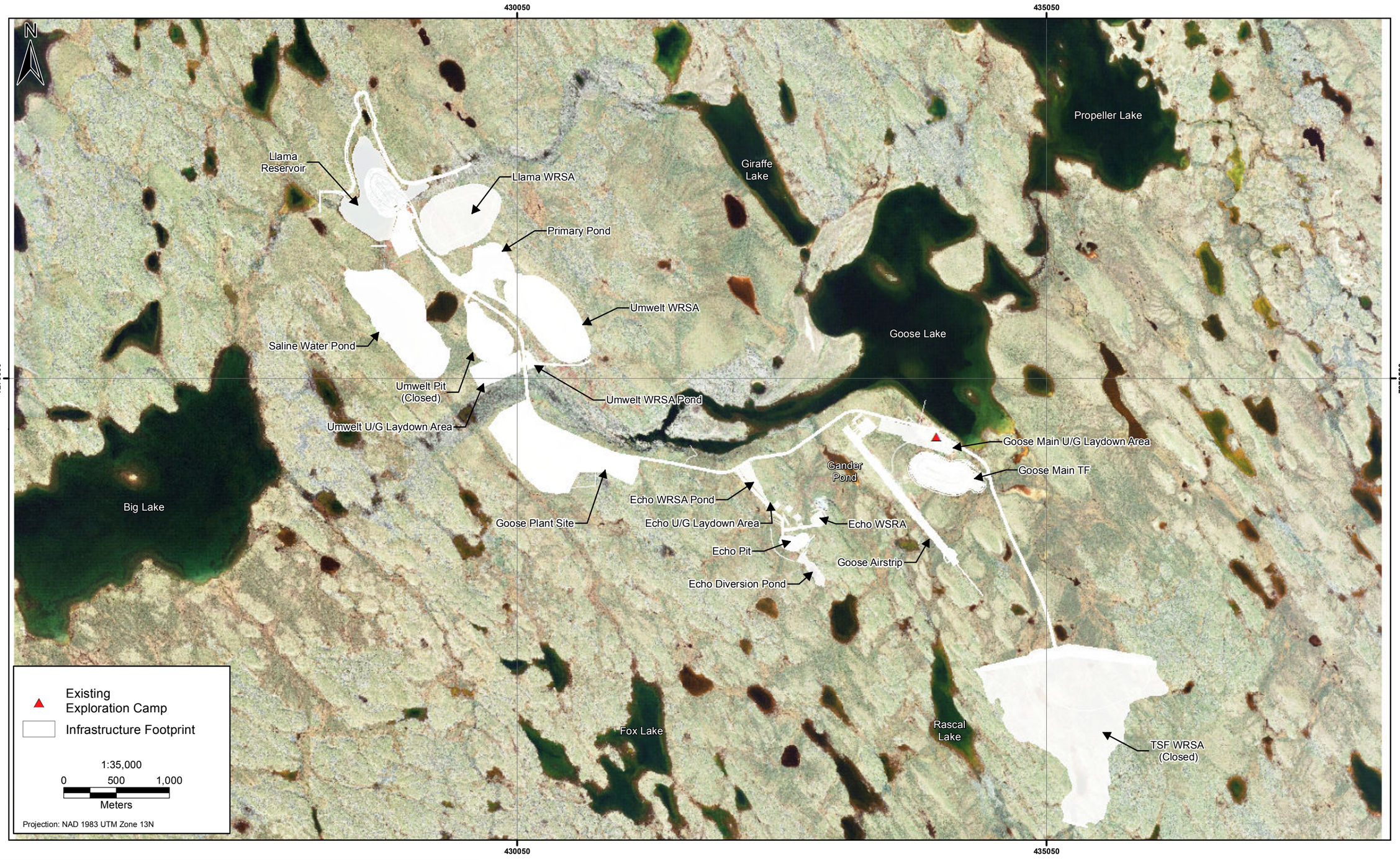
Figure 1



Sabina GOLD & SILVER CORP.

Goose Property
Orthophoto overlain by Infrastructure
Construction Phase (maximum disturbance)

Figure 2



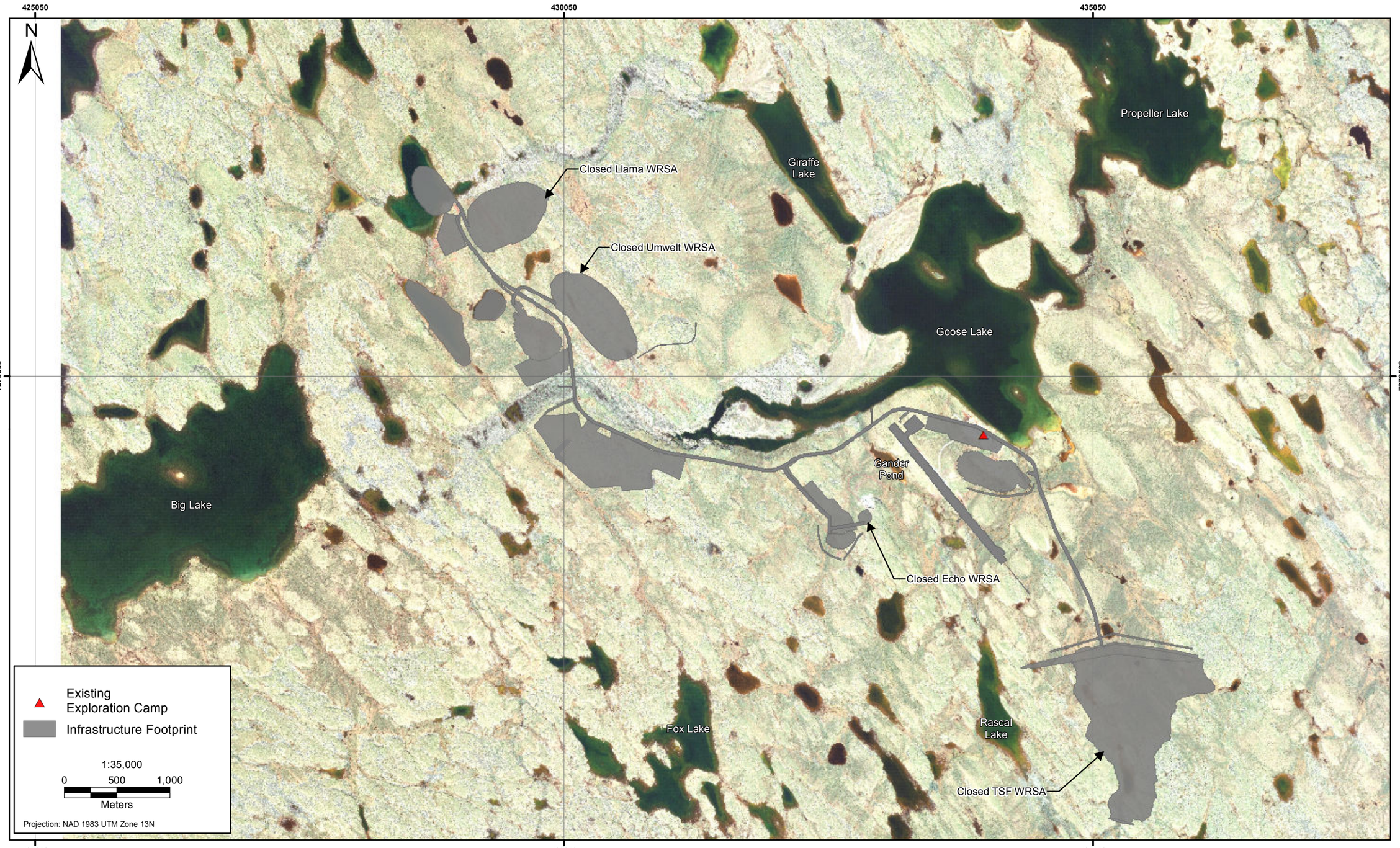
Sabina GOLD & SILVER CORP.

Goose Property
Orthophoto overlain by Infrastructure
Operations Phase (maximum disturbance)

Figure 3

GIS # **BAC-50-016_S**

October 7, 2015



Sabina GOLD & SILVER CORP.

Figure 4

Goose Property
Orthophoto overlain by Infrastructure
Post-Closure (maximum disturbance)

GIS # **BAC-50-019_S**

October 7, 2015

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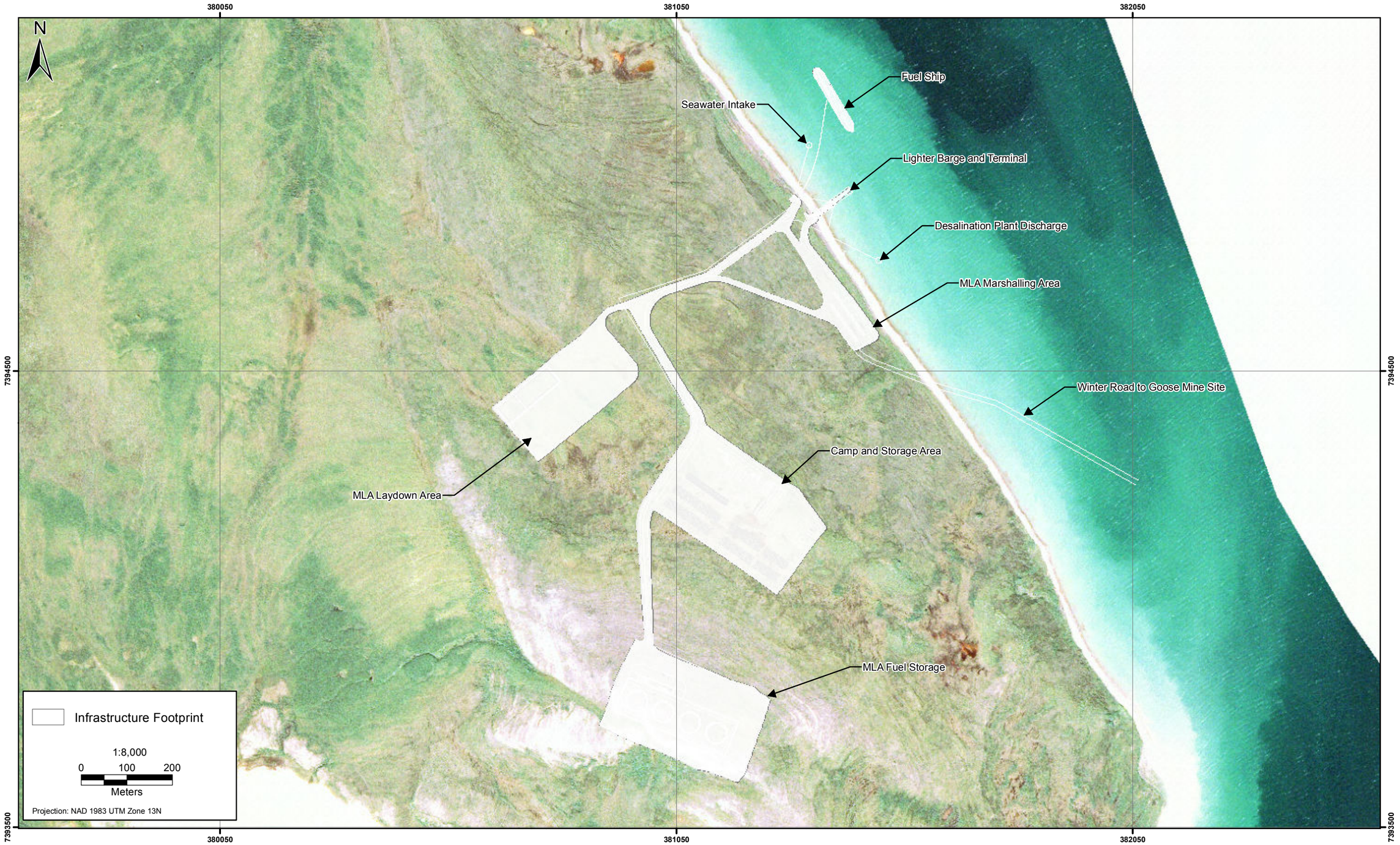
GOLD & SILVER CORP.

Figure 5

Marine Laydown Area
Orthophoto overlain by Infrastructure
Pre-Construction (current disturbance)

GIS # **BAC-50-017_S**

October 7, 2015



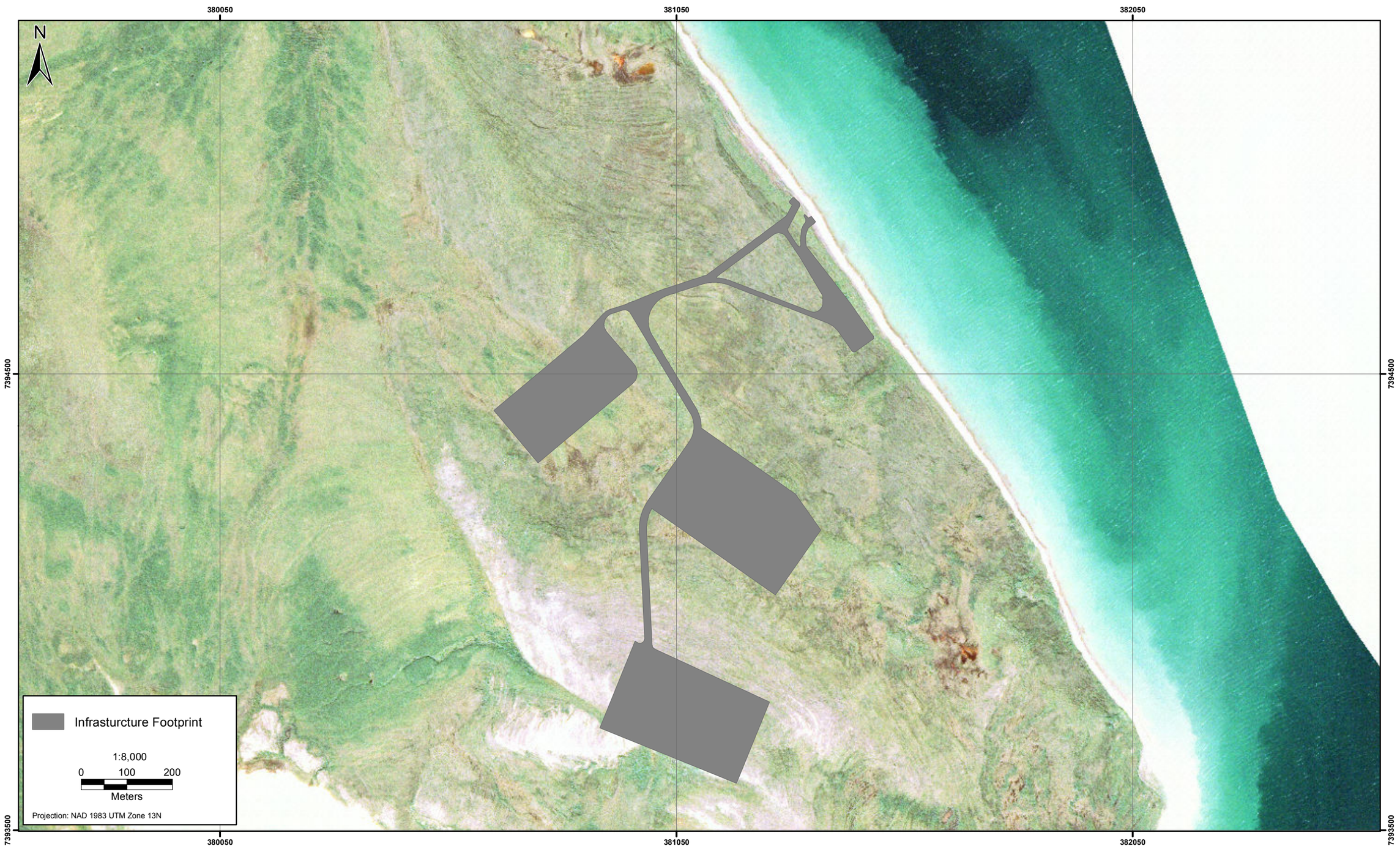
Sabina GOLD & SILVER CORP.

Figure 6

Marine Laydown Area
Orthophoto overlain by Infrastructure
Operations Phase (maximum disturbance)

GIS # **BAC-50-018_S**

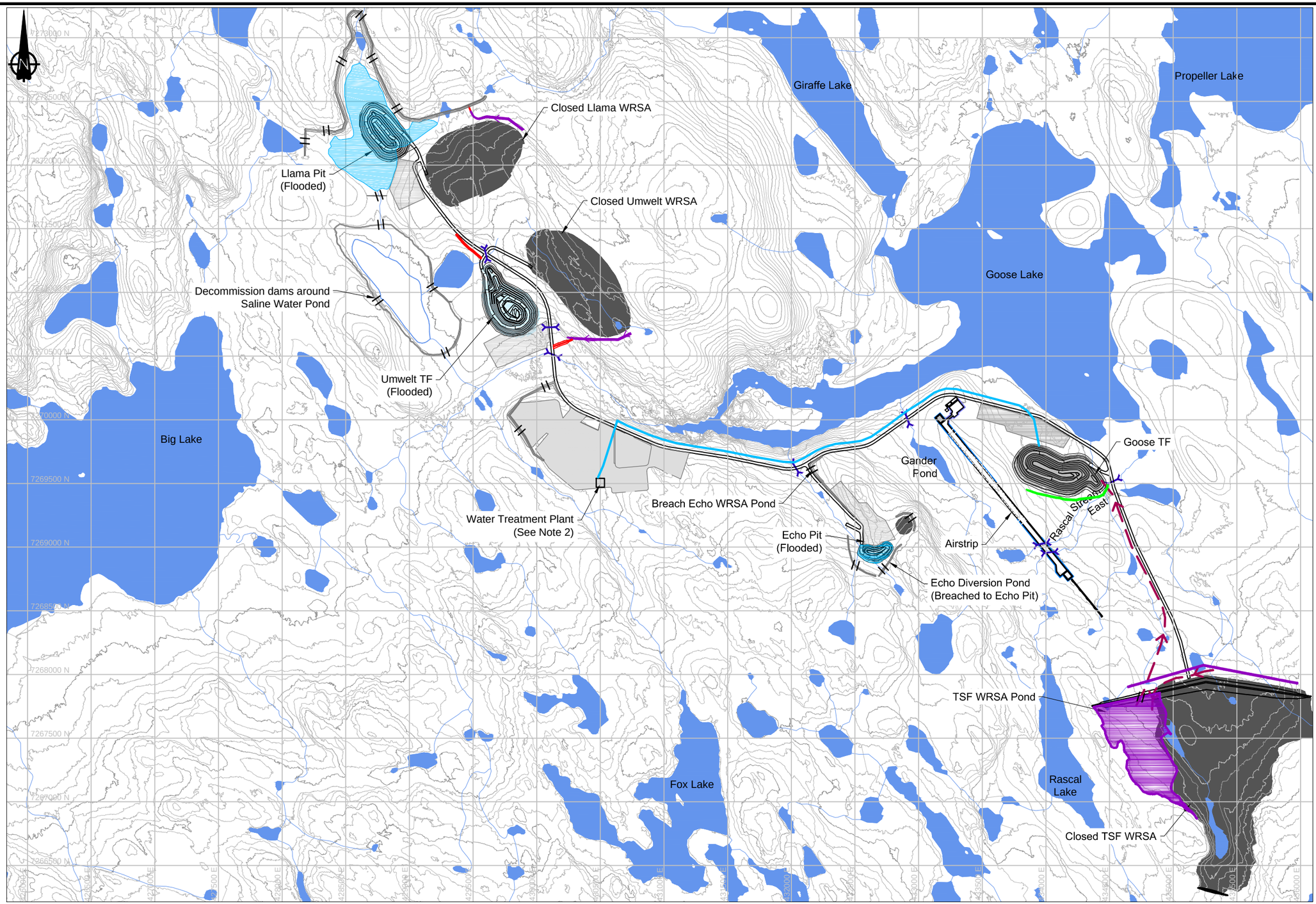
October 7, 2015



Sabina
GOLD & SILVER CORP.

MLA
Orthophoto overlain by Infrastructure
Post-Closure (maximum disturbance)

Figure 7



LEGEND

- Contact Water Event Pond
- Culvert Location
- Centerline of Creek
- Major Contour
- Minor Contour
- Road Infrastructure
- Non-contact Diversion Berm (Unlined)
- Contact Water Diversion Berm (Lined)
- Non-contact Diversion Berm (Unlined)
- Breached Berms
- Pumped Contact Water Pipeline
- Water Treatment Pipeline
- Breach Location
- Covered Waste Rock Pile
- Inactive TF
- Water Treatment Plant
- Decommissioned Pad
- Pit Lake (Closed)

NOTES

1. Contours shown at 2m intervals.
2. Treated water from Goose TF is pumped back in parallel pipeline.
3. Water schematics shown only; not all reclaim and other water infrastructure is shown.

REFERENCE

NAD83 UTM Zone 13.
NTS Mapsheet: 076

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srk consulting

SRK JOB NO.: 1CS020.008
FILE NAME: 1CS020.008 - Goose_Closure.dwg

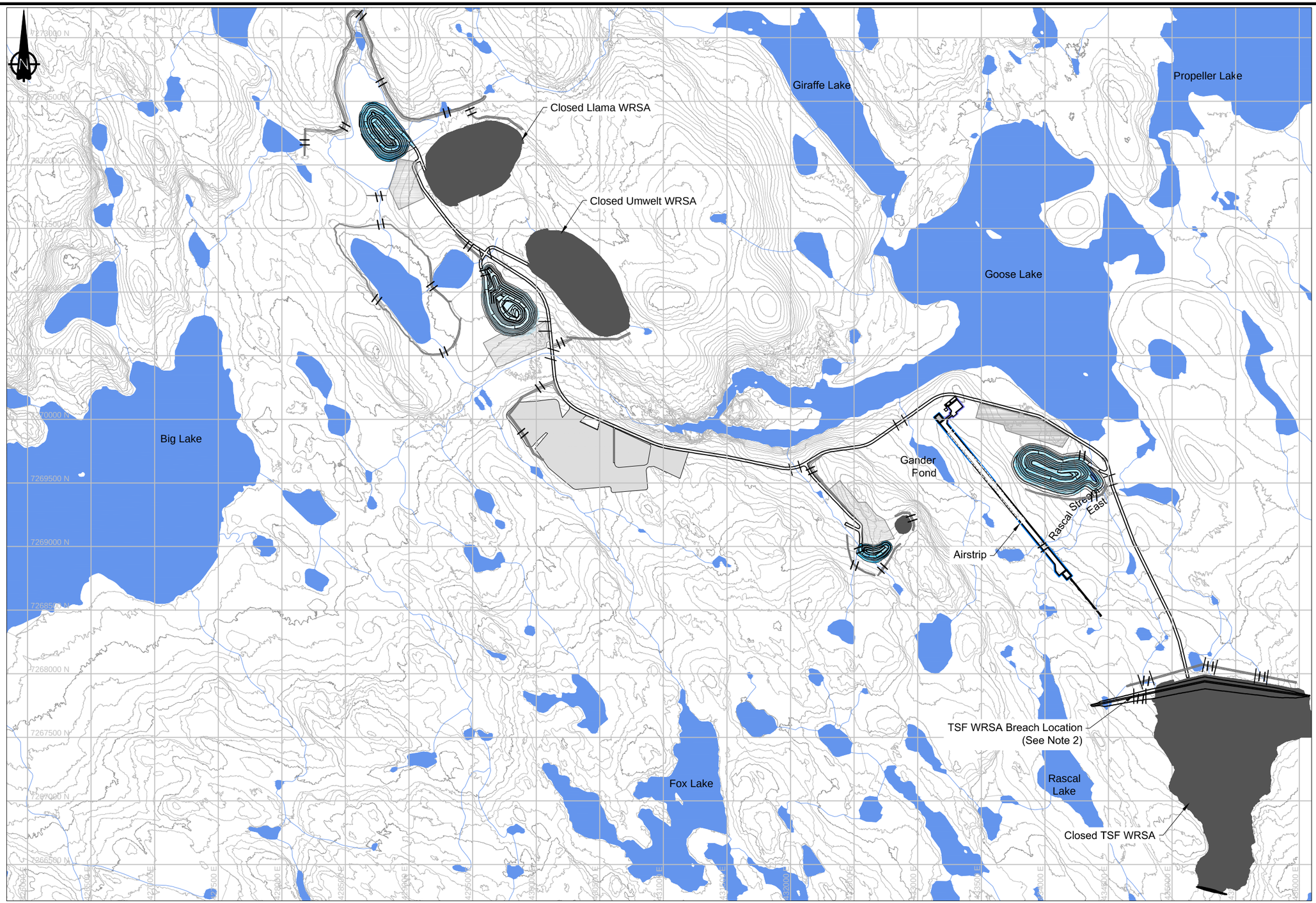
Sabina GOLD & SILVER CORP.

BACK RIVER

WATER MANAGEMENT FEIS

PHASE 3
Goose Site - Closure
Year 11 to Year 18

DATE:	APPROVED:	FIGURE:
2015/07/21	-	8



LEGEND

- Centerline of Creek
- Major Contour
- Minor Contour
- Proposed Road Infrastructure
- Breached Berm
- Breach Location
- Covered Waste Rock Pile
- Decommissioned Pad
- Inactive TF
- Pit Lake (Closed)

NOTES

1. Contours shown at 2m intervals.
2. TSF WRSA pond breached to Goose TF.
3. Water schematics shown only; not all reclaim and other water infrastructure is shown.

REFERENCE

NAD83 UTM Zone 13.
NTS Mapsheet: 076

srk consulting

SRK JOB NO.: 1CS020.008
FILE NAME: 1CS020.008 - Goose_Post-Closure.dwg

Sabina GOLD & SILVER CORP.

BACK RIVER

WATER MANAGEMENT FEIS

PHASE 4
Goose Site - Post-Closure
Year 19+

DATE:	APPROVED:	FIGURE:
2015/07/21	-	9

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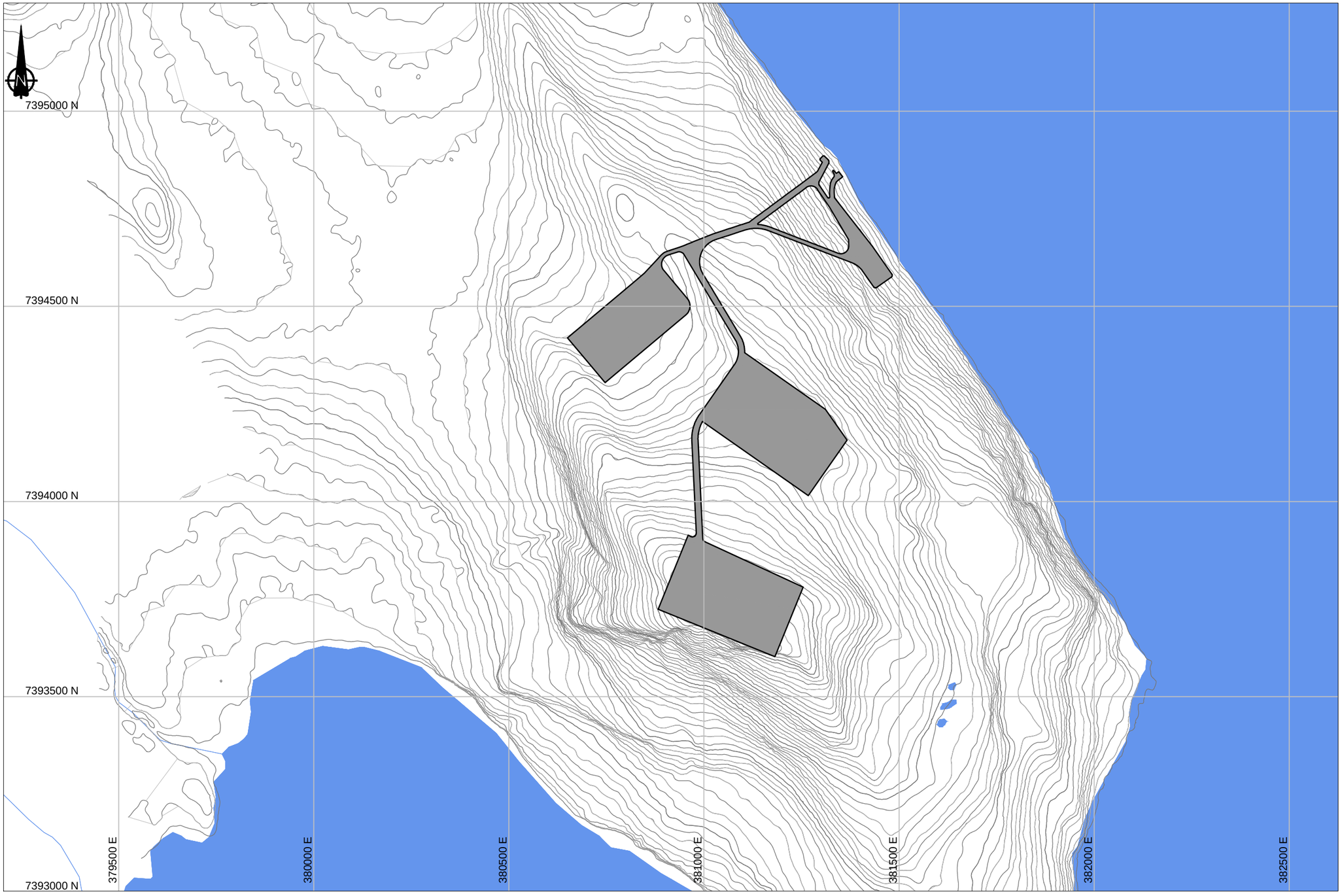

LEGEND

- Centerline of Creek
- Major Contour
- Minor Contour
- Decommissioned Pad
- Waterbody

NOTES

1. Contours shown at 2m intervals.
2. Water schematics shown only; not all reclaim and other water infrastructure is shown.

REFERENCE

NAD83 UTM Zone 13.
NTS Mapsheet: 096H

0m 100 200 300 400

srk consulting

SRK JOB NO.: 1CS020.008
FILE NAME: 1CS020.008 - MLA Phase 3&4.dwg

Sabina GOLD & SILVER CORP.

BACK RIVER

WATER MANAGEMENT FEIS

PHASE 3 & 4
Closure
Marine Laydown Area (Year 11+)

DATE:	APPROVED:	FIGURE:
2015/07/21	-	10

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