Sabina
GOLD & SILVER CORP.

The BACK RIVER PROJECT

Final Environmental Impact Statement

Volume 2: Project Description and Alternatives

November 2015

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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 2:

Project Description and Alternatives

November 2015
Project #0283709-0002

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Prepared by:

Sabina GOLD & SILVER CORP.

Sabina Gold & Silver Corp.

Volume 2: Revisions Log

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 1	All sections	George Property	Remove George as a source of ore; defer development of the Property.
	1.3, 1.4	Land and mineral tenure	Update status of tenures.
	1.5	Permits and licences	Update status of authorizations in place for exploration and baseline activities.
Chapter 2	2.3.1	Exceptions from review	No plans to request additional exemptions, e.g., Site Preparation, other than those for ongoing exploration and camp operations.
	2.3.1	Site preparation	Remove Site Preparation as a phase in Project development and hence, from permitting requirements.
Chapter 3	3.1	George resources	Defer developing George Property for its resources and infrastructure.
Chapter 4	4.1	More explicit analysis for alternatives assessments	Sabina commits to updating the alternatives assessment to include a more explicit analysis of alternatives and evaluation criteria in the FEIS.
	4.1	More explicit analysis for alternatives assessments	Add summary table for alternatives assessments.
	4.1.5	Expand on community input to alternatives	Described public consultation activities as they informed alternatives assessments.
	4.2	Tier 1 alternatives	Update and describe alternatives.
	4.3	Tier 2 alternatives	Update and describe alternatives.
Chapter 5	5.1	Project expenditures	Update figures for economic impacts based on results from FEIS modelling.
	5.2	Project employment	Update socio-economic figures based on results from FEIS modelling.
	5.6	Employee transportation	Expand on the transportation plan for personnel based on a fly-in/fly-out model.
Chapter 6	6.2	Winter ice road to BIPR	PDA includes winter ice road extension from George Exploration Camp to BIPR all-weather road.
	6.3.3.1	Shipping season	Confirm open water seasons for western and eastern marine routes.
	6.4.5	Freight quantities	Update various types of freight for their estimated transport quantities.
	6.4.12	MLA water management	Employ BMP for water management at MLA.
	6.4.14	MLA waste management	Provide basis for an estimate of waste generation incl. direct incineration of sewage.
	6.5	Winter ice road usage	Provide basis for an estimate of transportation statistics.
	6.6.1.2	Big Lake Pump Station	Supplemental freshwater sourcing from Big Lake instead of Propeller Lake.
	6.6.7, 9.2.6	Hazardous materials	Identify more hazardous materials subject.
	6.6.8	Goose waste management	Provide basis for an estimate of waste generation.

Chapter	Section	Subject	Description (Major Revisions Only)
Chapter 6 *(cont'd)*	6.6.11	Power generation	Developed basis for diesel generation and heat recovery for plant site and underground mine.
	6.6.13.2, 7.1.5.1	Geotechnical investigations	Provide details of 2015 geotechnical site investigation.
	6.6.13.3	Tailings Storage Facility	Relocate facility to Crown land and expand on design basis and operating criteria.
	6.6.13.3, 7.10	Goose Property is not zero discharge	Contact, non-contact, and groundwater will be managed separately; not all will report to the TSF as per DEIS.
	6.6.13.4	TSF design basis	Location has changed so the geotechnical and constructability requirements have changed to suit.
	6.7	Project schedule	Update for estimated development schedule for the Project.
Chapter 7	7.1	Mineral resources and reserves	Provide revised data for resources and reserve including basis for calculating the latter.
	7.1	Mineral resources and reserves	George Property resources are deferred for future development but the equivalent reserves quantities are added to those of Goose Property.
	7.2	Mining and permafrost	Provide more details about the interactions between mining activities and the permafrost incl. referring to a new hydrogeological characterization report.
	7.2.4	OP mine plan	Provide updated schedule of ore and waste rock production.
	7.2.5	UG mine plan	Provide updated schedule of ore production and methods of development and mining.
	7.2.6	Waste rock: ML and ARD	Provide details on testing methods and results on metal leaching and acid rock drainage.
	7.2.7	Waste rock management	Define WRSA locations and their design and construction basis including capping for freeze back.
	7.9	Tailings deposition	Provide details on deposition plan incl. use of mined out open pits (Umwelt and Goose Main).
	7.10	Water management	Revise water use, sourcing, and treatment statistics.
	7.10.2.2	Water withdrawal	Revise withdrawal limits based on effects assessments.
	7.10.2.6	Umwelt Lake	Umwelt Lake will be dewatered to store saline groundwater.
	7.10.2.9, 8.4	Meromictic lake	Mine-out Llama Open Pit will become a meromictic lake to store saline groundwater.
Chapter 8	8.1	Closure schedule	Mine closure estimated to take eight years incl. six years for water treatment as passive closure.
	8.4	Open pit fill times	Provide fill times for open pits and reservoirs based on model results.
	8.13.1	Goose water management	Provide details on closure activities related to Goose water management.
Chapter 9	9.2	Table 9.2-1	Updated named of management plans for FEIS.
	9.2	Water management and monitoring	Combined all water management related sections of 9.2 and 9.3 in Section 9.2 Water Management and Monitoring.
	9.2.3	Ammonia Management	Updated summary and references to more detail on AN management in the FEIS.
	9.2.4	Hazardous Materials	Added detail to list of potential hazardous materials to be handled.

Executive Summary

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Executive Summary

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

The Project is comprised of two main areas with interconnecting winter ice roads: the Goose Property and a Marine Laydown Area (MLA) situated along the western shore of southern Bathurst Inlet. Sabina has prepared an Environmental Impact Statement to identify and assess potential environmental and social effects resulting from the Project that meets the requirements outlined in the Nunavut Land Claim Agreement and the Nunavut Impact Review Board Guidelines for the Preparation of an Environmental Impact Statement for the Back River Project (NIRB File No. 12MN036; NIRB 2013).

Sabina intends to build a mine which is safe, environmentally responsible, and beneficial to all parties involved. Sabina will balance good stewardship in the protection of human health and the natural environment with the need for economic growth. The Project will bring much needed training and employment opportunities, as well as increased investment in services, to the people of the Kitikmeot region and Nunavut as a whole. The Feasibility Study, completed in June 2015, positively identified the economic viability and potential of the Back River Project.

<u>Mine Plan</u>

The mine plan reflects an estimated ten year operating mine life based on currently identified ore reserves, with a total ore feed of 19.8 million tonnes to a single process plant at the Goose Property. Continued exploration may extend projected mine life. Any significant increases to the Project may trigger a subsequent Environmental Assessment process.

The Project includes several mineral deposits: Umwelt, Llama, Echo, and Goose Main at the Goose Property. Ore will be mined using conventional open pit and underground methods and trucked to the process plant. Waste rock will be stored in several designated waste rock storage areas (WRSAs) on the surface or backfilled in mined out workings. Tailings from the process plant will first be stored in a Tailings Storage Facility (TSF) located near the process plant and then backfilled in mined out open pits.

Annual resupply will be completed using the MLA, located in Bathurst Inlet, and winter ice roads will be utilized to interconnect these sites.

<u>Project Phases</u>

The life of the Back River Project, from mobilization to post-closure, is 27 years. It is expected that mobilization and construction activities could begin as early as 2016 (Table 1). The Operations Phase is expected to continue for 10 years, based on the mine plan proposed. Sabina will continue exploration activities in the area and further discoveries may extend the mine operation phase.

The available mineral reserves will ultimately be exhausted, whereupon the mine will enter the closure and reclamation phase. During this phase, which is expected to last approximately eight years, the mine, equipment, and infrastructure will be decommissioned and the site will be returned to a stable condition having no significant effect on the environment. Post-closure monitoring will be conducted for a period of approximately five years to ensure the area remains both chemically and physically stable.

Table 1. Project Phases

Phase Name	Activities	Duration	Project Year
Mobilization and Construction	Mobilization, earthworks, facilities, equipment, mine development	4 years	-4 to -1
Operation	Mining, processing, progressive reclamation	10 years	1 to 10
Reclamation and Closure	Deconstruction, decommissioning, reclamation, WRSA closure, water treatment	8 years*	10 to 18
Post-Closure Monitoring	Monitoring of water quality, geotechnical, terrestrial and aquatic effects	5 years*	18 to 23

**years do not sum due to rounding*

Alternatives

Alternatives within the Project have been evaluated according to the following criteria: technical feasibility; economic validity; potential impacts to the environment; and amenability to reclamation. Input received during community and government engagement and consultation has been considered in the alternatives assessments. As the Project planning advances, alternatives assessment criteria will also include community acceptability or preference as well as the potential for enhancing socio-economic effects.

Two categories of alternatives are identified. Tier one alternatives outline options for different methods of executing the project in key areas, for example open-pit versus underground mining. Once the decisions have been made related to these larger alternatives, a second tier of alternatives will be considered with the aim of optimizing performance. These alternatives will consider various ways to execute each of the chosen key components. Trade-off analyses will be undertaken to choose the best approach. As the Project advances, alternatives will be further refined and evaluated. This refinement may alter the final Project plan.

Economic and Operating Environment

The Project will create significant socioeconomic benefits. If the mineral resource is not developed, the potential effects and predicted benefits would not be realized. The total GDP impact is estimated to be over $500 million during the Construction phase. The Project will substantially benefit Nunavut and will contribute as much as $44 million in GDP to Nunavut during these two years. Construction is estimated to result in a total of about 4,300 person-years of direct, indirect, and induced employment across Canada.

Total Canadian GDP impacts of the Project are predicted at $2.5 billion over the 10 years of production. Total tax revenue during operation is estimated at $400 million, consisting of $200 million in federal, $200 million in provincial/territorial tax revenue, and Nunavut mining royalties of nearly $100 million over the life of the mine. The Project will substantially benefit Nunavut and will contribute as much as $380 million in GDP to Nunavut during the Operation phase. The total direct, indirect and induced employment for Canada as a whole will be approximately 21,000 person-years over the 10-year operations phase of the Project.

Throughout the Project life, Sabina will seek to recruit a stable workforce capable of operating the mine efficiently and safely while giving first opportunity to northern residents.

The remote location, long supply route, and Arctic climate pose challenges to the project that most southern Canadian projects do not face. As a result, the Project depends on the relatively high gold grades discovered to date and the gold prices of the past few years. Low gold prices and rising costs for wages, materials, and supplies could impact Sabina's ability to economically construct and sustain the Project.

Logistics

The preferred methods of accessing this remote location are via year-round air transportation; two open water marine shipping routes to Bathurst Inlet; and winter ice road links between the Properties. An all-weather airstrip at the Goose Property will be used for the life of the project. The Marine Laydown Area at Bathurst Inlet may be serviced by an ice strip in the winter and float planes in the open water season. Crew movements to the Goose Property and the MLA will be facilitated by chartered air service from Edmonton, Yellowknife, Cambridge Bay and Kugluktuk. The current use of helicopters and fixed-wing aircraft to service exploration crews will continue in proportion to Sabina's continued exploration and environmental monitoring efforts during mine construction and operation.

The majority of freight will be brought in by sea during summer sealifts. This freight is expected to originate from one of two ports: from Bécancour, Quebec in the east or from Vancouver, BC in the west. Ports will be selected mainly based on the origin of the goods and international ports may also be utilized. Freight staged at Bécancour will travel by barges and by ships and freight at Vancouver will travel by barges. 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 terminal barge.

Fuel will travel in tanker ships and/or barges and then will be transferred using floating hose to storage tanks on land at the Marine Laydown Area. Incoming and outgoing cargo and incoming fuel will be staged at the Marine Laydown Area while awaiting transfer to the project sites by winter ice road or awaiting the appropriate vessel for back-haul.

Winter ice roads will be constructed for the Back River Project. The Goose-Marine Laydown Area Winter Ice Road is approximately 160 km in length. The George Winter Ice Road is a spur road connecting George Exploration Camp to a junction on the Goose-Marine Laydown Area Winter Ice Road and is approximately 13 km in length. This spur may further extend to provide a connection to the proposed Bathurst Inlet Port and Road (BIPR) all-weather road. These spur roads are being proposed to allow for additional regional flexibility for ongoing exploration and project advancement. Ground transportation within each site is by all-weather roads. These routes cross only shallow, seasonal creeks. These crossings will comprise of culverts.

Project Infrastructure

Both Project locations will have self-sufficient operating infrastructure including: accommodations, administration, laydown areas, diesel-fired power generation, maintenance shops, warehousing, and water and waste management facilities.

The Goose Property is the hub of the Project with the process plant, all-weather air strip, four open pits, four underground operations, and a camp capable of housing a maximum of 465 employees (or 611 including the existing exploration camp) during construction and operations. A diesel fuel tank farm will store in excess of one year's supply of fuel in three 15 ML tanks. A 40,000 m^2 pad has been designated for bulk storage for freight. At the AN Facility and explosives storage magazines, there will be capacity for up to 3,900 tonnes of ammonium nitrate and 32 tonnes of explosives.

The Marine Laydown Area at Bathurst Inlet is located approximately 130 km north-northwest of the Goose Property. It is the primary staging area for equipment, material, fuel, and other supplies required for the construction and operation of the Project. It is comprised of a single grounded terminal barge that will accept lightering barges, laydown areas, and storage/maintenance facilities. A tank farm will contain diesel fuel in four 15-ML field erected tanks. There will be dedicated storage for ammonium nitrate shipped in sea containers. No storage or mixing of explosives takes place at the MLA. The camp is capable of housing a maximum of 75 people for during both construction and operations.

A direct implication of the remoteness of the site is a heavy emphasis on all aspects of health and safety and the proper maintenance of the equipment and infrastructure. Equipment must be well-maintained and safety provisions must be rigorously enforced as assistance from external sources is not readily available. Thus, on-site emergency and medical facilities will be relatively self-reliant.

Borrow Pits and Quarry Sites

Initial open pit mining will provide the bulk of crushed rock and aggregate to build local all-weather roads, laydown areas, airstrip extension, and support other such construction and maintenance activities. Sabina will establish borrow pits and/or quarries as supplemental sources of crushed rock and aggregate. At the Marine Laydown Area, small borrow pits and/or quarries are planned for building the required infrastructure. The need for material will be minimized by balancing cut-to-fill ratios where possible.

Mineralogy and Mining

The gold is hosted in iron formations that are found in Archaean-age rock types common in the Canadian Shield. The sulphide content of the ore ranges from near 0 to 5%. Silver is the only other valuable metal present in the ore. Silver is not currently accounted for in the project's economic assessment but some will be recovered along with the gold. The gold occurs as fine native gold, only occasionally visible to the naked eye. The minable mineral reserves for the Back River Project total 19,792 kt at 5.70 g/t for a quantity of contained gold of 3,628 koz.

The ore at all open pits (Umwelt, Llama, Echo, and Goose Main) will be recovered using conventional truck and shovel open pit mining methods. All four deposits extend below the depth proposed for the open pits. The maximum open pit depth will be approximately 150 m below ground surface. All four deposit extensions have been identified as economically viable for underground mining operations. Different underground mining methods have been proposed to suit the various deposit. Umwelt will be mined using post pillar cut-and-fill, Llama and Goose Main by drift and fill, and Echo by longhole stoping.

Ore from the Goose workings will be stockpiled to a maximum of 400 kt of high-grade material, 750 kt of medium grade, and a maximum of 2,000 kt of low-grade material.

Exploration has identified several prospective targets in the general Project area. Sabina will continue to explore these during mine construction and operation with the possibility of extending the mine life beyond current expectations. Such deposits would likely be mined as satellites of the currently planned operation centered on Goose in order to make full use of existing infrastructure.

Waste Rock and Tailings Management

The Tailings Storage Facility (TSF) is sited south-southeast of the Goose Main open pit. It will be capable of accepting 4 Mt of process tailings with the balance of material produced during the mine life being stored in two mined out workings. The storage capacities also account for collected and managed flows of water. The containment-side of the TSF dam's embankment will be lined with high-density polyethylene (HDPE) geomembrane which will be sandwiched between nonwoven geotextile to mitigate damage and losses.

The Goose Property will utilize three waste rock storage areas designed to properly manage potentially acid-generating (PAG) and non-potentially acid-generating (NPAG) mining waste. After the TSF has received the design quantity of tailings, it will also be covered with waste rock. Over the life-of-mine, a total of 77 Mt of mining waste will be produced, including the overburden. Of that, it is estimated that 38 Mt is PAG material, 33 Mt is NPAG material, and 6 Mt is overburden.

Progressive reclamation will begin during operations, which entails capping all WRSAs and the TSF with a 5-m NPAG cover to promote aggregation of permafrost and encapsulation.

Mineral Processing

During operations, all ore will be processed using conventional gravity concentration and cyanidation techniques. The process plant's nominal capacity is 6,000 tonnes of ore per day. Three separate facilities will house the process: two-stage crushing plant; fine ore stockpile including related feeding and reclaim systems; and the main processing plant. The process will comprise crushing (primary and secondary), grinding by ball mill followed by fine grinding mill, gravity concentration cyanide leaching by intensive leaching, whole ore leaching followed by carbon-in-pulp, and gold recovery by electrowinning from the solution loaded after carbon stripping. Gold doré bars will be produced on site at an average rate of approximately 350,000 ounces per annum. The product will be flown off-site for further refinement.

Water Management

The base source of process water will be as reclaimed from supernatant residual from the consolidated tailings. The reclaim pumping system located at the TSF will consist of a reclaim barge and insulated overland plastic piping. Water will be similarly reclaimed from the other tailings facilities once they are active. Additional make-up water may be required from a fresh water source during periods of insufficient reclaim.

Freshwater will also be required to support the domestic and industrial water requirements at the Goose Property and Marine Laydown Area. The Goose Property will draw fresh water from Goose Lake with supplemental water from Big Lake. A desalination unit will be installed at the MLA drawing seawater from Bathurst Inlet. Water treatment facilities will provide potable water at both properties.

The terrain at both sites is relatively flat with weakly developed, wandering, seasonal creek drainage. However, the overall approach to site water management is to divert water around mine workings and infrastructure to minimize impacts.

In order to access mineral resources at Goose, partial or complete dewatering of some surface lakes will be required. Llama Lake will need to be dewatered to access the Llama deposit and Umwelt Lake will be dewatered for use as a temporary connate water reservoir. A dewatering plan will be prepared and implemented upon regulatory approval prior to any dewatering. The Goose Main pit will require a diversion berm to route non-contact water around it and into a tributary to Goose Lake.

All open pits will be situated in permafrost with the exception of Llama open pit which intercepts the talik associated with Llama Lake. Significant groundwater inflow is not expected. Inflow from snowmelt and summer precipitation will be addressed by conventional pumping to settling ponds prior to discharge to the environment. Dewatering of the underground mines will be achieved using a combination of submersible and horizontal pumps located in sumps throughout the working levels, pumping via multiple lifts. At the Goose Property, contact water will be diverted to the Tailings Storage Facility, mined out open pits (Tailings Facilities), or pumped into mined out underground mines, treated beforehand if required.

Waste Management

Waste products will be sorted at the source or at waste management facilities located at each site, after which the material will be reused or recycled wherever possible. The Goose Property will utilize landfills for approved nonhazardous solid waste. Other materials will then be safely stored pending transportation to approved offsite recycling or disposal facilities. Both sites will have hazardous waste storage area and incinerators for combustion of nonhazardous and combustible wastes including sewage sludge. Sewage and grey water from the camp and maintenance facilities will be treated in wastewater treatment plants at the Goose Property. Treated sewage effluent will then be discharged to the tailings storage facilities or a designated and approved area in the terrestrial environment. Sewage generated at the MLA will be collected and incinerated. Grey water will undergo oil-water separation and be discharged to a designated and approved area in the terrestrial environment. Any discharge will be conveyed through structures designed to minimize erosion and degradation of the permafrost.

Closure and Reclamation

Sabina will undertake significant progressive reclamation activities throughout the mine life. Facilities will be decommissioned and removed at the end of their useful life. Achieving chemical and physical stability will be a key focus of final mine closure. This will include encapsulation of mine wastes (potentially acid-generating waste rock and tailings) with non-potentially acid-generating rock, flooding the open pits, and treating out-of-compliance water. In order to minimize water treatment, the open pits will be passively and actively filled with lake water to mitigate the generation of acid and the leaching of metals. Mine closure is expected to take eight years and consist of two stages (active and passive) followed by five years of post-closure monitoring. The two years of active closure will focus on the bulk of the infrastructure closure activities. Six more years will be required for water treatment and final decommissioning and demobilization of the remaining Project elements.

Industry standard reclamation methods will be employed to close out the remainder of the Project sites. Hazardous materials will be collected for off-site disposal. Equipment stripped of hazardous materials will be disposed in an open pit or within a closure landfill constructed in one of the waste rock storage areas. Buildings will be demolished and disposed of in the same closure landfill. Culverts will be removed from roads and the natural drainage restored, but the roads will otherwise remain intact.

At the MLA, surface infrastructure will be similarly handled; however, all elements designated for landfilling will be shipped off-site for disposal at a designated landfill at Goose Property or near the port of destination. At both sites, once all buildings and equipment have been removed, the footprints (whether bedrock or thermal pads) will be re-contoured to allow for sheet flow drainage to the receiving environment.

Environmental Management

Sabina's Environmental Management System, contained in Volume 10, provides a framework for the environmental and socio-economic monitoring activities to be implemented through the life of the Project. The System incorporates the strategies employed for adaptive management using the precautionary principle to pursue the goals of sustainable development. Within this framework, individual management plans have been drafted to address all aspects of the company's activities and contain the detailed mitigation measures and monitoring programs to be implemented throughout the life of the Project in order to eliminate or minimize adverse effects. The System also verifies that standard operating procedures reflect legal requirements pertaining to the Project, and that conditions set at the time of the Project's authorizations as well as requirements pertaining to the relevant laws, regulations and permits are met. All Project employees and contractors are required to comply with these management plans. The reporting and documentation requirements for these management plans, auditing, and process of management review and revisions are all specified in the Environmental Management System. The Environmental Management System will offer enough flexibility to respond to the monitoring results in a timely fashion to reduce or eliminate potential adverse residual effects to the natural and socio- economic environments.

ᐊᐅᓚᑦᑎᔾᑦ ᓇᐃᓪᓕᒋᐊᖅᓯᒪᔫᒃᑯᑦ ᐅᓂᒃᑳᓕᐊᖓ

Hᐊᓐᓂᖓᔪᕐᒥ ᐱᓕᕆᐊᖅ (ᐱᓕᕆᐊᖅ) ᒎᑐᓂ ᐱᓕᕆᐊᒃᓴᐅᔪᖅ ᓇᖏᓂᕆᔭᐅᓪᓗᓂ ᓴᐲᓇ ᒎᑐᓄᑦ ᐊᒻᒪᓗ ᓵᓚᕋᔭᓄᑦ ᑯᐊᐳᕇᓴᒃᑯᓐᓂ (ᓴᐲᓇ) ᐅᐊᓕᓂᕐᒥ ᕿᑎᕐᒥᐅᓂ ᓄᓇᕗᑦ ᐃᓗᐊᓂ. ᓂᒋᐊᓂ ᐱᓇᓐᓇᖓ ᓄᓇᕗᑦ. ᑕᒫᓂᑦᑐᖅ ᖃᓂᒌᔭᓂ 400 ᑭᓚᒥᑕᓯ ᓂᒋᐊᓂ ᐱᓇᓐᓇᖓᓂ ᐃᖃᓗᒃᑑᑦᑎᐊᖅ, 95 ᑭᓚᒥᑕᓯ ᓂᒋᐊᓂ ᑲᓇᓐᓇᖓᓂ ᐃᓱᐊᓂ ᓂᒋᐊᓂ ᕿᖓᐅᖅ, ᐊᒻᒪᓗ 520 ᑭᓚᒥᑕ ᐅᐊᓐᓇᖓᓂ ᑲᓇᓐᓇᖓ ᔭᓗᓇᐃ, ᓄᓇᑦᓯᐊᖅ.

ᐱᓕᕆᐊᒃᓴᖅ ᓴᓇᔭᐅᓯᒪᓂᖃᖅᑐᖅ ᐅᓇ ᐱᓕᕆᐊᖑᔪᖅ ᐊᑐᖅᑐᖅ ᒪᕿᖕᓂ ᐊᕐᑰᖕᓂᒃ ᐅᐸᒍᑎᖃᑦᑕᕐᒪᑕ ᑲᑎᖓᔪᑦ ᐊᕐᑎᑦ ᓯᑯᒃᑯᑦ ᐊᕐᑎᑦ: ᒎᓯ ᓄᓇᕐᑰᓂ ᐊᒻᒪᓗ ᐃᒪᐅᑉ ᓴᓂᐊᓂ ᓄᐊᑦᑎᕙᒃ ᑖᒨᑦᑐᖅ ᐱᓇᓐᓇᖓᓂ ᓯᒃᔭᖓᓂ ᓂᒋᐊᓂ ᕿᖓᐅᖅ. ᓴᐲᓇ ᑎᑎᕋᖅᓯᒪᓕᖅᑐᖅ ᐊᕙᑎᑦᑎᓂᒃ ᐊᒃᑐᐃᖓᔭᖅᑐᓄᑦ ᐅᖃᖅᓯᒪᔪᓂᒃ ᓇᓗᓇᐃᖅᓱᕆᑦ ᐊᒻᒪᓗ ᖃᐅᔨᓇᓱᑦᑎᐊᖅᓱᕆᑦ ᐊᕙᑎᑦᑎᓂᒃ ᐊᒻᒪᓗ ᐃᓅᓯᓕᕆᓂᕐᒧᑦ ᐊᒃᑑᑎᖓᔭᖅᑐᑦ ᑕᐃᒪᓐᓇᐃᑎᑕᐅᖓᔭᖅᑐᓂᑦ ᐱᓕᕆᐊᖑᔪᒥᑦ ᐅᑯᐊᓗ ᑎᑭᐅᑎᑦᑎᐊᖅᓯᒪᔪᑦ ᐊᑐᖅᑕᐅᔭᕆᐊᖃᖅᑎᑕᐅᔪᓂᒃ ᑎᑎᕋᖅᓯᒪᔪᓂᒃ ᓄᓇᕗᒻᒥ ᓄᓇᑖᕈᑎᑦ ᐊᖏᕈᑎᖏᓐᓂᒃ ᐊᒻᒪᓗ ᓄᓇᕗᒻᒥᒃ ᐱᕙᓪᓕᐊᓂᖓᑕ ᐊᒃᑐᖅᑕᐅᓇᔭᕐᓂᖏᓄ ᕿᒥᕐᕈᔾᑦ ᑐᑭᒧᐊᒍᑎᖏᓐᓂᒃ ᑎᑎᕋᖅᑕᐅᕙᓪᓕᐊᓂᖓ ᐱᓕᕆᔭᐅᕙᓪᓕᐊᓂᖓᓄᑦ ᐊᕙᑎᑦᑎᓂᒃ ᐊᒃᑐᐃᒐᔭᖅᑐᑦ ᐅᕐᑲᖅᓯᒪᔪᑦ ᑕᐃᒃᓱᒧᖓ Hᐊᓐᓂᖓᔪᖅ ᐱᓕᕆᐊᖑᔪᖅ (ᓄᓇᕗᒻᒥᒃ ᐱᕙᓪᓕᐊᓂᖓᑕ ᐊᒃᑐᖅᑕᐅᓇᔭᕐᓂᖏᓄ ᕿᒥᕐᕈᔾᑦ ᑎᑎᕐᑲᕐᑯᑎᖏᓄ 12MN036; ᓄᓇᕗᒻᒥᒃ ᐱᕙᓪᓕᐊᓂᖓᑕ ᐊᒃᑐᖅᑕᐅᓇᔭᕐᓂᖏᓄ ᕿᒥᕐᕈᔾᑦ 2013).

ᓴᐲᓇᒃᑯᑦ ᒪᑭᑎᑦᑎᓇᓱᐊᕐᓂᐊᖅᑐᑦ ᐅᔭᕋᖕᓂᐊᕐᕙᖕᒥᒃ ᐊᑕᓇᕐᓂᖅᑳᒋᑦᑐᒥᒃ, ᐊᕙᑎᓕᕆᓂᕐᒥ ᑲᒪᒋᔭᖅᑎᐊᕐᓗᑎᒃ, ᐊᒻᒪᓗ ᐃᑲᔫᑕᐅᓇᔭᖅᑐᒥᒃ ᑕᒪᕆᒃᓄᑦ ᐃᓚᓕᐅᑎᓯᒪᕐᑲᑕᐅᔪᓄᑦ. ᓴᐲᓇ ᐱᓕᕆᖃᑎᕆᖕᓂᖃᑦᑎᐊᕐᓂᖅᑐᑦ ᓴᐳᔾᔨᓂᕐᒥᒃ ᐃᓄᐃᑦ ᐃᓅᓯᑦᑎᐊᕙᖏᓐᓂᒃ ᐊᒻᒪᓗ ᓄᓇᒦᓵᖅᓯᒪᔪᑦ ᐊᕙᑎᖓᓂᒃ ᕿᓇᐅᔾᔭᒃᓴᒐᓱᐊᕐᓂᖃᕈᒪᓪᓗᑎᒃ. ᐱᓕᕆᐊᖅ ᓴᖅᑮᔾᔪᑕᐅᓂᐊᖅᑐᖅ ᐊᔪᕈᓐᓂᖅᓴᕆᐊᖅᑲᕐᓂᕐᒥᒃ ᐊᒻᒪᓗ ᐃᖅᑲᓇᐃᔾᔮᒃᓴᓂᒃ, ᐊᒻᒪᓗᑦᑕᐅᖅ ᖁᓪᓗᕙᓯᒋᐊᖅᑎᑦᑎᓗᑎᒃ ᕿᓇᐅᔭᓕᐅᕋᓱᐊᕈᑎᓂᒃ ᐱᔾᔪᑎᕋᐅᑎᑎᒍᑦ, ᕿᑎᕐᒥᐅᑕᓄᑦ ᐊᒻᒪᓗ ᓄᓇᕗᑦ ᐃᓘᓐᓇᑎᒃ. ᐅᑯᐊ ᑲᔪᓯᔪᓐᓇᕐᒪᖔᑕ ᐃᓕᑕᐅᓇᓱᒃᓯᒪᔪᑦ ᐱᔭᕇᖅᓯᒪᔪᑦ ᔫᓐ 2015, ᓇᓗᓇᐃᖅᓯᑦᑎᐊᖅᓯᒪᔪᑦ ᕿᓇᐅᔭᓕᐅᕈᑕᐅᔫᓇᕐᓂᖓᓂᒃ ᐊᒻᒪᓗ ᐱᕈᕐᓇᖅᑐᖅ Hᓐᓂᐊᖓᔪᖅ ᐱᓕᕆᐊᖑᔪᖅ.ᐅᔭᕋᖕᓂᐊᕐᓂᕐᒧᑦ ᐸᕐᓇᐅᑦ.

<u>ᐅᔭᕋᖕᓂᐊᕐᓂᕐᒧᑦ ᐸᕐᓇᐅᑦ</u>

ᐅᔭᕋᖕᓂᐊᕐᓂᕐᒧᑦ ᐸᕐᓇᐅᑦ ᓇᓗᓇᐃᕈᑕᐅᕗᖅ ᐊᑯᓂᐅᓂᐊᕋᓱᒋᔭᐅᓪᓗᓂ ᐅᑭᐅᓂᒃ 10-ᓂ ᐊᐅᓚᓂᖅᑲᕐᓗᓂ ᐅᔭᕋᖕᓂᐊᕐᕙᒃ ᒫᓐᓇᐅᔪᖅ ᐱᔾᔪᑎᒃᓴᐃᑦ ᑕᐅᑐᒃᑕᐅᑎᓪᓗᒋᑦ, ᑲᑎᓪᓗᒋᑦ ᓴᕙᕋᔭᒃᓴᑦ ᐱᔭᐅᕙᓪᓕᐊᑎᓪᓗᒋᑦ 19.8 ᒥᓕᐊᓐᓂᒃ ᐅᕐᑯᒪᐃᓐᓂᖅᐹᓂᒃ ᑕᓐᓂᒃ ᑕᐅᑐᑉᓗᒍ ᐊᑕᐅᓯᑐᐊᕐᒥ ᐱᓕᕆᕙᐅᔪᖅ ᓯᖃᓕᕝᕙᖕᒥ ᒎᓯ ᓇᖏᓂᕐᑯᑎᒋᔭᖓᓂᒃ. ᕿᓂᖅᐸᓪᓕᐊᕋᐅᔭᕐᓂᖅ ᑕᑭᓪᓕᒋᐊᕈᑕᐅᑐᐃᓐᓇᕆᐊᖅᑲᖅᐳᖅ ᐅᔭᕋᖕᓂᐊᕐᕚᐅᑉ ᑲᔪᓯᓐᓇᐅᔭᕐᓂᖓ. ᐅᔾᔨᕐᓇᒻᒪᕆᒃᑐᑦ ᖁᓪᓕᕆᐊᕈᑕᐅᔪᑦ ᐱᓕᕆᐊᕐᒧᑦ ᓴᖅᑮᔪᑕᐅᑐᐃᓐᓇᕆᐊᓕᒃ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᓴᕈᑎᖏᓐᓄᑦ.

ᐱᓕᕆᐊᖅ ᐃᓚᖃᖅᑐᖅ ᐊᒥᓱᒃᓚᖕᓂ ᐅᔭᕋᖕᓂᐊᕐᕕᒃᓴᓂ ᑐᕌᕐᕕᓂᒃ ᐅᔭᕋᖕᓂᐊᕐᕕᒃᓴᐃᑦ: ᐅᒻᐃᓪᓪ, ᑏᒪ , ᐃᑯ, ᐊᒻᒪ ᒎᓯ ᒪᐃᓐ, ᒎᓯ ᓇᖏᓂᕐᑯᑎᒋᔭᖓᓂᒃ; ᔫᓐ ᑲᐅ ᐹᓐ ᓄᐊᑦ, ᐃᓂ 1, ᐊᒻᒪᓗ ᐃᓂ 2 ᔾᔮ ᓇᖏᓂᕐᑯᑎᖓᓂ. ᐊᕐᕌᒍᑕᒫᑦ ᑎᑭᓯᐃᒃᑲᓐᓂᐊᓂᒋᐊᖅᑲᖅᑐᑦ ᐊᑐᕐᓗᑎᒃ ᑕᕆᐅᕐᒥ ᐃᓂᒃᓴᖅᕝᕕᒥ ᐃᓂᖓᓂ, ᕿᖓᐅᕐᒥ, ᐊᒻᒪᓗ ᐅᑭᐅᒃᑯᑦ ᓯᑯᒃᑯᑦ ᐊᖅᑯᑎ ᐊᑐᖅᑕᐅᕙᓪᓗᓂ ᑲᑎᔾᔪᑎᒋᕙᓪᓗᓂᔾᔪᒃ ᑖᒃᑯᓄᖓ ᐃᓂᓄᑦ. ᐊᕐᕋᒍᒥ ᐅᓯᖅᑕᑲᓐᓂᕐᓗᑎᒃ ᐱᔭᕇᓪᓗᒍ ᐊᑐᖅᑕᖓ ᐃᒫᓂ ᓄᓇᖓᓂ, ᖃᓂᒌᔭᓂ ᕿᖓᐅᖅ, ᐊᒻᒪᓗ ᐅᑭᐅᒃᑯᑦ ᓯᑯᒃᑯᑦ ᐊᕐᑰᑦ ᐊᑐᖅᑕᐅᓕᕐᓗᑎᒃ ᑲᑎᖓᐅᑎᒋᓗᒍ ᑖᑉᑯᓄᖓ ᐃᓂᒋᔭᐅᔪᓄᑦ.

ᐊᕐᕌᒍᑕᒫᑦ ᐱᕐᑯᑎᒃᓴᖏᓐᓂᒃ ᑎᑭᕝᕙᐅᕐᑲᑦᑕᕐᓂᐊᖅᑐᑦ ᐊᑐᖅᓯᓗᑎᒃ ᐃᒪᐅᑉ ᓴᓂᐊᓂ ᓄᐊᑦᑎᕙᒃ ᐃᓂᖅᑲᕝᕙᐅᔪᖅ, ᑖᒨᑦᑐᖅ ᕿᖓᐅᖅ ᐊᒻᒪᓗ ᐊᑐᖅᓯᐊᖅᑐᑦ ᐅᑭᐅᒃᑯᑦ ᓯᑯᒃᑯᑦ ᐊᕐᑎᓂᒃ ᐅᑯᐊ ᐃᒻᒥᖕᓄᑦ ᑲᑎᖓᔪᖅ ᐃᓂᖏᓐᓄᑦ.

<u>ᐱᓕᕆᐊᐸ ᑲᒪᒋᔭᐅᕙᓪᓕᐊᔾᔪᑎᖏᑦ</u>

ᐊᑯᓂᐅᑎᒋᓂᖓ Hᐊᓐᓂᖓᔫᐸ ᓄᒃᑕᕐᓗᑎᒃ ᐱᓕᕆᐊᖓ 27 ᐅᑭᐅᖑᓂᐊᖅᑐᖅ (ᐃᓂᓕᐅᖅᑕᐅᕙᓪᓕᐊᓂᕐᒧᑦ ᑎᑭᐅᑎᓗᒍ ᒪᑐᔭᐅᕙᓪᓕᐊᓂᖓᓄᑦ). ᓂᕆᐅᒋᔭᐅᑦᑕᖅ ᐃᓂᐅᐸ ᒪᑭᑎᑕᐅᕙᓪᓕᐊᓂᖏᑦ ᐱᒋᐊᕈᓐᓇᖅᑐᖅ ᕿᓚᒻᒥᐅᓐᓂᖅᐸᒥ 2016-ᖑᓕᖅᐸᑦ ᒪᕿᑦᓂᒃ ᐅᑭᐅᓂᒃ ᓴᓇᔭᐅᓂᕐᑲᕐᓗᓂ.

ᑕᑯᑎᑦᑎᔪᖅ 1. ᐱᓕᕆᐊᖑᔪᖅ ᓱᕌᓂᖏᑦ

ᓱᕌᓂᖓᑕ ᐊᑎᖓ	ᖃᓄᐃᓕᐅᖅᑐᑦ	ᐊᑯᓂᐅᑎᒋᓂᖓ	ᐱᓕᕆᔪᑦ ᐊᕌᒍᐊᑦ
ᓄᒃᑕᕐᓂᖏᑦ ᐊᒻᒪᓗ ᓴᓇᔭᐅᓂᖓ	ᓄᒃᑕᖅᑕᐅᓂᖓ, ᓄᓇᖓ ᓴᓇᔭᐅᓂᖓ, ᐃᒡᓗᓕᐅᖅᑐᑦ, ᓴᓇᕈᑎᒃᓴᑦ, ᐅᔭᕋᖕᓂᐊᕐᕕᒃ ᓴᕿᑕᐅᓗᓂ ᓴᓇᔭᐅᓗᓂ	4 ᐊᕌᒍᑦ	-4 ᑎᑭᓪᓗᒍ -1
ᐊᐅᓚᓂᖓ	ᐅᔭᕋᖕᓂᐊᕐᓗᑎᒃ, ᐱᓕᕆᓗᑎᒃ, ᐱᕙᓪᓕᐊᑎᐊᖅᑐᒥᒃ ᐃᓂᑐᖃᖓᓄᑦ ᐅᑎᖅᑎᑦᑎᕆᓗᑎᒃ	10 ᐊᕋᒍᑦ	1 ᑎᑭᓪᓗᒍ 10
ᓴᓪᒪᖅᓴᐃᓂᖏᑦ ᒪᑐᓯᓂᖏᓪᓗ	ᓴᓇᔭᐅᓚᐅᖅᑐᑦ ᐲᔭᖅᑕᐅᓗᑎᒃ, ᐲᔭᖅᑕᐅᕙᓪᓕᐊᓗᑎᒃ ᐱᑎᐊᓕᓗᑎᒃ, ᐃᓂᑐᖃᖓᓄᑦ ᐅᑎᖅᑎᑕᐅᓗᓂ ᓄᓇ, ᐊᒃᑕᖅᑕᐅᓂᑯᑦ ᐃᒋᐅᖃᖅᑕᐅᓗᑎᒃ ᒪᑐᓗᓂ, ᐃᒪᕐᒧᑦ ᓴᓪᒪᖅᓴᖅᑕᐅᓗᓂ	8 ᐊᕌᒍᑦ	10 ᑎᑭᓪᓗᒍ 18
ᒪᑐᔭᐅᓯᒪᓕᖅᑎᓪᓗᒍ ᖃᐅᔨᓴᖅᑕᐅᓂᖓ	ᒥᐊᓂᕆᓗᒍ ᐃᒪᖓ, ᓄᓇᖓ ᖃᓄᐃᓕᖓᓂᖓ ᐊᒻᒪᓗ ᐃᒪᕐᒥᐅᑕᐃᑦ ᐊᒃᑐᖅᑕᐅᓂᖏᑦ	5 ᐊᕌᒍᑦ	18 ᑎᑭᓪᓗᒍ 23

ᒎᓗᑦ ᐅᔭᕋᖕᓂᐊᓚᒃᓴᑦ ᓄᖑᑦᑐᒃᓴᐅᕙᖓᑕ, ᑕᐃᒫᒃ ᐅᔭᕋᖕᓂᐊᕐᕕᒃ ᒪᑐᔭᐅᓗᓂ ᐊᒻᒪᓗ ᐅᑎᖅᑎᑦᑎᕙᓪᓕᐊᓇᓱᐊᓕᕐᓗᑎᒃ ᓄᓇᐅᐸ ᐃᓕᖅᑯᓕᕆᓚᐅᖅᑕᖓᓄᑦ. ᑖᒪᓐᓇ ᑲᒪᒋᔭᐅᕙᓪᓕᐊᓂᖅ, ᓂᕆᐅᒋᔭᐅᔪᖅ 8-ᓂ ᐅᑭᐅᓂᒃ ᐊᑯᓂᐅᑎᒋᔪᒥᒃ, ᐊᑐᕈᓐᓃᕐᓗᓂ ᐅᔭᕋᖕᓂᐊᕐᕕᒃ, ᑲᑖᒃᑎᑕᐅᓗᑎᒃ ᐃᒡᓗᕐᑯᑎᖏᑦ, ᐊᒻᒪᓗ ᐃᓂ ᐅᑎᖅᑎᑕᐅᓗᓂ ᖃᓄᐃᓕᖓᓂᕆᓚᐅᖅᑕᖓᓂᒃ ᐊᒃᑐᖅᑕᐅᓂᖃᓗᐊᖏᓪᓗᓂ ᐊᕙᑎᒧᑦ. ᒪᑐᔭᐅᕌᓂᒃᓯᒪᓕᖅᑎᓪᓗᒍ ᖃᐅᔨᓴᖅᑕᐅᖁᐅᔭᕐᓂᕐᑲᕐᓂᐊᖅᑐᑦ ᖃᓄᐃᓕᐅᖅᐸᓪᓕᐊᓂᖓ ᖃᓄᐃᓕᖓᓂᕆᔭᖓᓗ ᓈᒪᐃᓐᓇᐅᔭᕐᓂᐊᕋᓗᐊᕐᒪᖔᑕ. ᑲᔾᔫᓐᓇᐅᔭᕐᓂᖓᑕ ᐱᓕᕆᐊᐸ, ᓴᐲᓇᒃᑯᑦ ᕿᓂᖃᑦᑕᐅᔭᕐᓂᐊᖅᑐᑦ ᐃᖅᑲᓇᐃᔭᖅᑎᑦᑎᐊᕙᖓᓂ ᐊᐅᓚᑦᑎᑦᑎᑦᑎᐊᕐᓂᐊᖅᑐᓂᒃ ᐅᔭᕋᖕᓂᐊᕐᕕᖕᒥ ᐊᑦᑕᓇᖏᑦᑐᒥᒃ ᓯᕗᓪᓕᐅᑎᑦᑎᓗᑎᒃ ᐅᑭᐅᖅᑕᖅᑐᒥᐅᑕᓂᒃ.

<u>ᐊᓯᐊᒎᕈᑎᑦ</u>

ᐊᓯᐊᒎᕈᑎᑦ ᐱᓕᕆᐊᐸ ᐃᓗᐊᓂ ᖃᐅᔨᓴᖅᑕᐅᓯᒪᔪᑦ ᒪᓕᒃᓗᑎᒃ ᐅᑯᓂᖓ: ᐊᑑᑎᖃᑦᑎᐊᕈᓐᓇᕐᓂᖏᑦ; ᐊᑮᑦ; ᐊᒃᑐᐊᔾᔪᑕᐅᑐᐃᓐᓇᕆᐊᓖᑦ ᐊᕙᑎᒧᑦ; ᐊᒻᒪᓗ ᐅᑎᖅᑎᑦᑎᐊᕈᓐᓇᕐᓂᖅ ᐃᓂᑐᖃᕐᓄᑦ. ᓂᐸᓕᕆᑎᒋᔭᐅᓚᐅᖅᑐᑦ ᑭᒃᑯᓕᒫᓂ ᒐᕙᒪᓂᓪᓗ ᑲᑎᒪᓂᖃᖅᑎᓪᓗᒋᑦ ᐅᖃᖃᑎᖃᖅᑎᓪᓗᒋᓪᓗ ᐃᓱᒪᒋᔭᐅᓚᐅᖅᑐᑦ ᐊᓯᐊᒎᕈᑎᓂ ᖃᐅᔨᓴᕐᓂᖃᖅᑎᓪᓗᒋᑦ. ᑕᐃᒪᓗ ᐱᕆᐊᖑᔪᖅ ᐸᕐᓇᒃᑕᐅᑎᓪᓗᒍ ᐱᕙᓪᓕᐊᑦᑎᐊᑦᑎᓪᓗᒍ ᐊᑑᑎᖃᕐᓂᐊᕋᓗᐊᕐᒪᖔᑦ ᖃᐅᔨᓴᕈᑎᓂᒃ ᓯᕗᒻᒧᐊᒍᑎᖃᖅᑎᓪᓗᒋᑦ, ᐊᓯᐊᒎᕈᑎᑦ ᖃᐅᔨᓴᕐᓂᕐᒧᑦ ᒪᓕᒋᐊᓖᑦ ᐃᓚᖃᕐᓂᐊᖅᑐᑦ ᓄᓇᓕᒃ ᐊᖏᕈᖃᕐᓂᖏᑦ ᐅᕝᕙᓘᓐᓃᑦ ᐱᔪᒪᓂᖏᑦ ᐊᒻᒪᓗᑦᑕᐅᖅ, ᐱᐅᓯᒋᐊᕈᑎᒋᔭᐅᑐᐃᓐᓇᕆᐊᓖᑦ ᐃᓅᓯᓕᕆᓂᖅ-ᑮᓇᐅᔭᐅᒃᓴᐅᑎᓂ ᐊᒃᑐᖅᑕᐅᓃᑦ.

ᒪᕿᒃ ᐃᓛᒃᑯᕈᑎᑦ ᐊᓯᐊᒎᕉᑎᑦ ᓇᓗᓇᐃᖅᑕᐅᓯᒪᕗᑦ. ᓯᕗᓪᓕᖅ ᐊᓯᐊᒎᕈᑎᑦ ᓇᓗᐃᖅᓯᕗᖅ ᐊᔾᔨᒌᙱᑦᑐᓂᒃ ᖃᓄᐃᓕᐅᕈᑕᐅᔾᔪᑎᓂᒃ ᐊᑐᖅᑕᐅᔪᓐᓇᖅᐳᑦ ᐱᓕᕆᐊᕐᒧᑦ ᐱᓪᓚᕆᐅᓂᐅᔪᓂᒃ, ᐆᒃᑑᑎᒋᓗᒍ ᖄᖓᒍᑦ ᐅᔭᕋᖕᓂᐊᕐᕕᖕᑲᕐᓂᖅ ᐅᕙᓘᓐᓃᑦ ᓄᓇᐅᐸ ᐊᑖᒍ ᐅᔭᕋᖕᓂᐊᕐᕕᖕᑲᕐᓂᖅ. ᐃᓱᒪᓕᐅᖅᑐᖄᓂᒃᑯᓂ ᑐᕌᖓᔪᓄᑦ ᑕᒪᒃᑯᓂᖓ ᐊᖏᓂᖅᓴᐅᔪᓂᒃ ᐊᓯᐊᒎᕈᑎᓂᒃ, ᑐᒡᓕᐊᓂ ᐊᓯᐊᒎᕈᑎᑦ ᐃᓱᒪᒋᔭᐅᓂᐊᖅᑐᑦ ᑐᕌᖓᕐᑲᕐᓗᑎᒃ ᐱᐅᓯᒋᐊᖅᑎᓐᓇᓱᐊᕐᓗᒋᑦ ᐱᓕᕆᐊᕆᔾᔪᑎᑦ. ᑕᒪᒃᑯᐊ ᐊᓯᐊᒎᕈᑎᑦ ᐃᓱᒪᓕᐅᕈᑕᐅᓂᐊᖅᑐᑦ ᐊᔾᔨᒌᙱᑦᑑᑎᓂ ᖃᓄᖅ ᐊᑐᕋᔭᕐᒪᖔᑕ ᓂᕈᐊᖅᑕᐅᔪᖅ ᐱᒻᒪᕆᐅᓂᓕᒃ ᐃᓚᒋᔭᐅᔪᓂᒃ ᐊᒻᒪᓗ ᓇᓪᓕᐊᖕᓂ ᑭᐳᒍᑎᖃᕈᓐᓇᕐᓂᕐᒥᒃ ᕿᒥᕐᕈᓂᕐᒥᒃ ᐊᑐᖅᑕᐅᓇᔭᕐᒪᖔᑦ ᓂᕈᐊᕐᓂᐊᕐᓗᓂ ᓇᓪᓕᐊᒃ ᐱᐅᓂᖅᐹᖑᓇᔭᕐᒪᖔᑦ. ᓴᓇᕙᓪᓕᐊᓂᕐᒧᑦ ᓯᕗᓪᓗᐊᒍᑎᑦ ᐊᓯᒎᕈᑎᑦ ᐱᐅᓯᕚᓪᓕᕈᑕᐅᓂᐊᕐᒪᑦ ᐊᒻᒪᓗ ᖃᐅᔨᓴᖅᑕᐅᓗᑎᒃ ᐊᒻᒪᓗ ᐊᓯᙳᖅᑎᑕᐅᑐᐃᓐᓇᕆᐊᖃᕐᓗᓂ ᑭᖑᓪᓕᕐᒧᑦ ᐱᓕᕆᐊᕐᒧᑦ ᐸᕐᓇᐅᑎᒧᑦ.

<u>ᐱᕙᓪᓕᐊᔾᔪᑎᑦ ᐊᒻᒪᓗ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐊᕙᑎᖏᑦ</u>

ᐱᓕᕆᐊᖅ ᑖᒃᑯᓴᕈᖅᑎᑦᑎᕗᖅ ᐊᖏᔪᒥᒃ ᐃᓅᓯᓕᕆᓂᕐᒧᑦ ᐱᕙᓪᓕᐊᔾᔪᑎᓄᑦ ᐃᑲᔪᑎᓂᒃ. ᐅᔾᔨᖕᓂᐊᒐᒃᓴᓂᒃ ᐱᕕᒃᓴᓂᒃ ᓴᖅᑭᑕᐅᙱᒃᑯᓂ, ᐊᒃᑐᐊᔾᔪᑕᐅᓇᔭᖅᑐᑦ ᐊᒻᒪᓗ ᐃᑲᔪᑎᒋᔭᐅᙳᐊᕋᔭᖅᑐᑦ ᓴᖅᑭᑦᑐᓐᓇᔾᔭᙱᑦᑐᑦ. ᑲᑎᓪᓗᒋᑦ ᐊᖏᔪᒥᒃ ᓂᐅᕕᖅᑕᐅᓂᒃᑯᑦ ᑮᓇᐅᔭᓕᐊᕆᔭᐅᓯᒪᔪᑦ ᐊᒃᑐᐃᔾᔪᑎᖓ ᐃᓱᒪᒋᔭᐅᔪᖅ ᐅᖓᑖᓂ $500 ᒥᓕᔭᓐᓂ ᓴᓇᔭᐅᕙᓪᓕᐊᓂᖅᑲᖅᑎᓪᓗᒍ. ᐱᓕᕆᐊᖅ ᐊᖏᔪᒥᒃ ᐃᑲᔪᕐᓂᖅᑲᕐᓂᐊᖅᑐᖅ ᓄᓇᕗᒥ ᐊᒻᒪᓗ ᐃᑲᔫᑎᖅᑲᕐᓗᓂ ᐊᖏᓂᖅᑲᖅᑐᒥᒃ $44 ᒥᓕᔭᓐᓂᒃ ᐊᖏᔪᒥᒃ ᓂᐅᕕᖅᑕᐅᓂᒃᑯᑦ ᑮᓇᐅᔭᓕᐊᕆᔭᐅᓯᒪᔪᓄᑦ ᓄᓇᕗᒧᑦ ᐊᑐᖅᑕᐅᔪᓄᑦ ᒪᕐᕿᓂ ᐅᑭᐅᓂᒃ. ᓴᓇᔭᐅᕙᔾᓕᐊᓂᖅ ᐃᓱᒪᒋᔭᐅᔪᖅ ᓴᖅᑮᔪᑕᐅᓂᐊᕋᓱᒋᔭᐅᓗᓂ ᑲᑎᓪᓗᒍ ᐃᒻᒪᖄ 4,300 ᐃᖅᑲᓇᐃᔮᒃᓴᑦ ᐊᕌᒍᒧᑦ ᑕᐃᑯᖓᑲᐅᑎᒋ, ᐊᓯᖏᑦᑎᒍᑦ ᐊᒻᒪᓗ ᓴᖅᑮᔪᑕᐅᓗᓂ ᐃᖅᑲᓇᐃᔮᒃᓴᓂ ᑲᓇᑕᒥᓗᒃᑖᖅ.

ᑲᑎᓪᓗᒋᑦ ᑲᓇᑕᒥᐅᑦ ᐊᖏᔪᒥᒃ ᓂᐅᕕᖅᑕᐅᓂᒃᑯᑦ ᑮᓇᐅᔭᓕᐊᕆᔭᐅᓯᒪᔪᓄᑦ ᐊᒃᑐᖅᑕᐅᓂᖏᑦ ᐱᓕᕆᐊᕐᒧᑦ ᐃᓱᒪᒋᔭᐅᔪᖅ $2.5 ᐱᓕᐊᓐᓂᒃ ᐅᖓᑖᓄᑦ 10-ᓂᒃ ᐅᑭᐅᓂᒃ ᐅᔾᔨᖕᓂᐊᕐᓂᖅᑲᖅᑎᓪᓗᒍ. ᑲᑎᓪᓗᒋᑦ ᑖᒃᓱᔭᐃᔾᔪᑎᓄᑦ ᑮᓇᐅᔭᓕᐊᖑᔪᑦ ᐊᐅᓚᓂᖅᑲᖅᑎᓪᓗᒍ ᐃᓱᒪᒋᔭᐅᔪᖅ $400 ᒥᓕᔭᓐᓂ, ᐃᓚᖃᖅᑐᓂ $200ᒥᓕᐊᓐ ᒐᕙᒪᒃᑯᓄᑦ ᐊᒻᒪ $200 ᐊᕕᒃᑐᖅᓯᒪᔪᓂ/ᐅᑭᐅᖅᑕᖅᑐᒥ ᐊᒻᒪᓗ ᓄᓇᕗᒻᒥ ᐅᔾᔨᖕᓂᐊᖅᑐᑦ ᐅᑎᕐᕕᐅᔪᑦ ᖃᓂᒋᔮᓂ $100 ᒥᐊᓕᒻ ᐅᖓᑖᓂ ᐆᒪᓂᓕᒫᖓᓂ ᐅᔾᔨᒃᑕᕐᕕᐅᔪᖅ ᐊᕕᒃᑐᖅᓯᒪᔪᓂ ᑖᒃᓲᔭᐃᔾᔪᑎᓄᑦ ᑮᓇᐅᔭᓕᐊᖑᓂᐊᖅᑐᑦ. ᐱᓕᕆᐊᖅ ᐊᖏᔪᒥᒃ ᐃᑲᔪᕐᓂᖅᑲᕐᓂᐊᖅᑐᖅ ᓄᓇᕗᒥ ᐊᒻᒪᓗ ᐃᑲᔫᑎᖅᑲᕐᓗᓂ ᐃᒻᒪᖄ $380 ᒥᓕᔭᓐᓂᒃ ᐊᖏᔪᒥᒃ ᓂᐅᕕᖅᑕᐅᓂᒃᑯᑦ ᑮᓇᐅᔭᓕᐊᕆᔭᐅᓯᒪᔪᓄᑦ ᓄᓇᕗᒧᑦ ᐊᐅᓚᓂᖅᑲᖅᓯᒪᑎᓪᓗᒍ. ᐱᓕᕆᐊᖅ ᓂᕆᐅᙱᖅᑲᕐᒥᔪᖅ ᑕᐃᑯᖓᑲᐅᑎᒋ, ᐊᓯᖏᑦᑎᒍᑦ ᐊᒻᒪᓗ ᓴᖅᑮᔪᑕᐅᓗᓂ ᐃᖅᑲᓇᐃᔮᒃᓴᓂ ᑲᓇᑕᒥᓗᒃᑖᖅ ᖃᓂᒋᔭᖓᓂᒃ 21,000–ᓂ ᐃᖅᑲᓇᐃᔮᒃᓴᓂ ᐊᕌᒍᓂ ᐅᖓᑖᓂ 10-ᓂ.

ᑕᐃᒪᖓᓂ ᐱᓕᕆᐊᖑᔪᖅ ᐊᑐᖅᑕᐅᓂᖓᓂ, ᓴᐁᓇ ᕿᓂᖅᑦᑕᕐᓂᐊᖅᑐᖅ ᐃᖅᑲᓇᐃᔭᕐᑎᑦᑎᓗᓂ ᐊᔪᕐᖏᑦᑎᐊᖅᑐᓂᒃ ᐊᐅᓚᑦᑎᔪᓐᓇᖅᑐᓂᒃ ᐅᔾᔨᖕᓂᐊᕐᕕᖓᓂᒃ ᐱᐊᓚᔪᒥᒃ ᐊᒻᒪᓗ ᐱᕈᓗᐊᕿᓐᓇᖅᑐᖃᖖᒋᑦᑐᒥᒃ ᑐᓂᓯᓯᒪᓗᒋᓪᓗ ᓯᕗᓪᓕᕐᒥᒃ ᐱᕕᖃᕐᑎᓪᓗᒋᑦ ᐅᑭᐅᖅᑕᖅᑐᒥ ᓄᓇᖃᖅᑐᑦ.

ᐅᖓᓯᒃᑐᓂ ᐃᓂᓂ, ᐊᒡᔭᖅᓯᓂᐊᕐᓗᓂ ᐊᖅᑯᑎᒋᔭᐅᔪᑦ ᐅᖓᓯᓗᐊᕐᓂᖏᑦ ᐊᒻᒪᓗ ᐅᑭᐅᖅᑕᖅᑐᒥ ᓯᓚᕐᓗᖃᑦᑕᕐᓂᖓᑦ ᐊᔪᕐᓇᕈᑕᐅᓂᖅᑲᑦᑕᕐᒪᑕ ᐱᓕᕆᐊᕐᒧᑦ ᑕᐃᒫᒃ ᐊᑐᖅᑕᐅᕙᙱᑐᑦ ᖃᓪᓗᓈᑦ ᓄᓇᖏᓐᓂᒃ ᑲᓇᑕᒥ ᐱᓕᕆᐊᖑᕙᒃᑐᓂᒃ ᒥᑦᕕᒃ ᑕᐃᑲᓂ ᒨᔅ ᓄᓇᖓᓂᖓᓂ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᖅ ᖏᕋᓂᓕᒫᖓᓂ ᐱᓕᕆᐊᖑᔪᖅ. ᑕᐃᒪᒃᑲᒥ, ᐱᓕᕆᐊᖅ ᑕᑎᒋᔭᖅᑲᖅᑕᖅᐳᖅ ᐱᐅᓂᖅᐹᖑᓂᖅᓴᓂᒃ ᒨᓗᓂᒃ ᓇᓂᔭᐅᓯᒪᓂᖅᑐᓂᒃ ᒫᓇᒧᑦ ᐊᒻᒪᓗ ᐊᑭᑐᓂᖅᐹᓇᔭᕆᓐᓂᒃ ᒨᓗᑦ ᐊᑭᕆᓐᓂᒃ ᓴᙱᓂᖅᑲᖅᓯᒪᔪᑦ ᐅᑭᐅᒐᓴᖕᓂ. ᑲᑦᒃᐸᓪᓕᐊᓂᕐᒋᑦ ᒨᓗᑦ ᐊᑭᖏᑦ ᐊᒻᒪᓗ ᑯᒻᕙᓯᕙᓪᓕᐊᓂᕐᒋᑦ ᐊᑭᖏᑦᑕ ᐊᑭᓕᖅᑐᐃᓂᖏᒥᒃ ᐃᖅᑲᓇᐃᔭᖅᑎᓂᒃ, ᓱᓇᒃᑯᑏᑦ ᐱᖁᑎᒃᓴᐃᓪᓗ ᐊᒃᑐᐊᓂᖅᑲᕈᓐᓇᖅᒪᑕ ᓴᐁᓇᒃᑯ ᐱᔪᓐᓇᕐᓂᕐᒋᓐᓂᒃ ᓴᓇᓗᓂᔾᔪᒃ ᑲᔪᓯᓇᐅᔭᕈᓐᓇᓂᖏᓪᓗ ᐱᓕᕆᐊᖅ.

<u>ᐊᐅᓚᔾᔪᑎᓅᖓᔪᑦ</u>

ᐊᑐᖅᑕᐅᔪᒪᓂᖅᓴᐅᕙᒃᑐᑦ ᐅᕐᓂᒐᓯᐊᕐᓗᒍ ᐅᖓᓯᒃᑐᒻᒪᕆᐅᔪᖅ ᐅᑯᑎᒍᓇ ᐊᕐᕌᒍᓕᒫᑦ ᖃᖓᑦᑕᐅᓯᐊᒃᑯᑦ; ᒪᕐᕿᒃ ᒪᑐᐃᖓᔪᓂ ᐃᒪᒃᑯᑦ ᐅᒥᐊᕐᔪᐊᑎᒍᑦ ᕿᖓᐅᒻᒧᑦ; ᐊᒻᒪᓗ ᐅᑭᐅᒃᑯᑦ ᐊᖅᑯᑎᑦ ᐊᑯᓐᓂᖓᓂᒃ ᐱᖓᓯᑦ ᓇᖅᒥᓂᕆᔭᐅᔪᓄᑦ. ᒦᕕᖅᑲᖅᑐᓂ ᓯᓚᐅᑉ ᖃᓄᐃᒃᑲᓗᐊᖅᐸᑦ ᐊᑐᖅᑕᐅᔾᔭᕐᓇᖅᑐᓂ ᒪᕐᕿᒃ ᑕᒪᒃᑮᖕᓂᒃ ᒨᔅ ᐊᒻᒪᓗ ᔫᔮ ᓇᖕᒥᓂᖅᑯᑎᒋᔭᖕᒋᓐᓂᒃ ᑕᕆᐅᕐᒥ ᐃᓂᒃᓴᖅᑲᖅᕕᖕᒥ ᐊᕙᑎᖓᓂ ᕿᖓᐅᑉ ᑲᖏᖅᔫᖓᓂ ᒥᑦᑕᕐᕕᖅᑲᖅᑐᑎᒃ ᓯᑯᒥ ᐅᑭᐅᒃᑯᑦ, ᐊᒻᒪᓗ ᐃᒪᐃᑦ ᓄᓇᖏᓐᓂ ᓵᑦᑕᖅᐸᓪᓗᑎᒃ ᑎᖕᒥᓱᒃᑯᑦ ᐊᐅᔭᐅᑎᓪᓗᒍ. ᐱᓕᕆᓘᑦ ᐅᓯᔭᐅᕙᓪᓗᑎᒃ ᔫᔅ ᓇᖕᒥᓂᖅᑯᑎᖓᓄᑦ ᐊᒻᒪᓗ ᐃᒪᐃᑦ ᓄᓇᖏᓐᓂ ᓵᑦᑕᖅᐸᓪᓗᑎᒃ ᑎᖕᒥᓱᓂᒃ. ᔫᔮ ᓇᖕᒥᓂᖅᑯᑎᖓᑦ ᐃᖅᑲᓇᐃᔭᖅᑎᖏᑦ ᐅᓯᔭᐅᕙᓪᓗᑎᒃ ᑕᐃᑲᙵᑦ ᒨᔅ ᓇᖕᒥᓂᖅᑯᖓᓂᒃ ᑎᖕᒥᓱᖃᕈᖅᑎᒍᑦ ᐃᒻᒪᑕᓐ, ᔭᓗᓇᐃ, ᐃᖃᓗᒃᑑᑦᑎᐊᖅ ᐊᒻᒪᓗ ᖁᖅᓗᖅᑑᖅ. ᒫᓐᓇᐅᔪᖅ ᐊᑐᖃᑦᑕᕐᓂᖅ ᖁᓕᒥᒨᓕᕐᒥᒃ ᕿᓂᖅᑦᑕᕐᓂᕐᒧᑦ ᐃᖅᑲᓇᐃᔭᖅᑎᐅᔪᑦ ᑲᔪᓯᑎᑕᐅᓂᐊᖅᑐᖅ ᐃᓚᖓᓂᒃ ᓴᐁᓇᒃᑯᑦ ᕿᓂᖅᑦᑕᐅᔭᕐᓂᕐᒋᓐᓄᑦ ᐊᒻᒪᓗ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᖃᐅᔾᔭᐅᔭᖅᑦᑕᕐᓂᕐᒧᑦ ᐅᔾᔨᖕᓂᐊᕐᕕᒃ ᓴᓇᔭᐅᑎᓪᓗᒍ ᐊᒻᒪᓗ ᐊᐅᓚᓂᖅᑲᖅᑎᓪᓗᒍ.

ᐅᓄᑖᑦ ᐅᓯᔭᒃᓴᐅᖅᑳᑕᖅᑐᑦ ᑎᑭᑎᑕᐅᔪᑦ ᐅᒥᐊᕐᔪᐊᒃᑯᑦ ᐊᐅᔭᐅᔪᒥ. ᐅᓇ ᐅᓯᔭᐅᑎᑦᑎᔪᑦ ᓂᕈᐅᕆᔭᐅᔪᑦ ᑖᒃᑯᓇᖕᒫᖅᑐᑦ ᒪᖅᐲᖕᓂᑦ ᑐᓚᒃᑕᕝᕕᖕᓂᑦ: ᑕᐃᑲᖕᖓᑦ ᐋᓐᑲᓄᐊ, ᑯᐸᐃᒃ ᑲᓇᖕᓇᖕᖓᓂ ᐅᕝᕙᓘᓐᓃᑦ ᕚᓐᑰᕙ ᑕᐃᕙᖕᖓᑦ ᐱᓇᖕᓇᖕᖓᓂ. ᑐᓚᒃᑕᕝᕚᑦ ᓂᕈᐊᖑᓂᐊᖅᑐᑦ ᓂᐅᕕᕝᕕᐅᔪᓂᑦ ᓇᑭᖕᓖᕐᓂᖕᒥᑦ ᐊᒻᒪᓗ ᓄᓇᕐᔪᐊᒥᑦ ᐊᑐᖅᑕᐅᔪᑦ ᑐᓚᒃᑕᕝᕚᑦ ᐊᑐᖅᑕᐅᔪᓐᓇᕐᓂᐊᓇᓪᓗᑎᒃ. ᐅᓯᔭᐅᔪᑦ ᐅᓯᑲᖅᑕᖅᑕᐅᓗᑎᒃ ᐱᓐᑳᑯᐊ ᐅᓯᑲᑦᑕᕐᓂᐊᖅᑐᑦ ᑲᓚᑕᓇᐊᓚᖕᓂᒃ ᐊᒻᒪᓗ ᐅᒥᐊᕐᔪᐊᓂᑦ ᐊᒻᒪᓗ ᐅᓯᓚᖅᑕᐅᔪᑦ ᕚᓐᑯᕙᒥᑦ ᑲᓚᑖᒃᓴᐅᓂᐊᓇᓪᓗᑎᒃ. ᐅᒥᐊᕐᔪᐊᑦ ᐊᒻᒪᓗ ᑲᓚᑖᒃᓴᐃᑦ ᐃᒻᒥᖕᓂᒃ ᐅᓯᑲᖅᑕᕈᓐᓇᕐᓗᑎᒃ. ᐅᖁᒪᐃᓕᓗᐊᖅᑕᐃᓕᔪᑏᑦ ᑲᑎᑕᐅᓗᑎᒃ ᓄᒃᑕᕐᓗᒋᑦ ᐅᓯᔭᒃᓴᐃᑦ ᐅᒥᐊᒃᑯᑦ ᑕᐃᑲᓂ ᐃᒫᓂ ᓄᓇᖕᒋᓐᓂ ᐅᓲᔭᕝᕕᕆᔭᒥᖕᓂ.

ᒪᖅᐹᒃ ᐅᑭᐅᒃᑯᑦ ᐊᖅᑯᓯᐅᕐᓂᐊᖅᑐᑦ Hᐊᓐᓂᖕᖓᔫᑉ ᐱᓕᕆᐊᖕᖓᓄᑦ. ᒎᔅ-ᔮᔾᐳ ᐃᓂᒃᓴᖅᑲᖅᕕᖕᒥ ᐅᑭᐅᒃᑯᑦ ᐊᖅᑯᑎᖕᖓᑦ ᓇᖕᖓᕐᕕᕆᔭᐅᖅᑳᑦᑕᕐᓂᐊᖅᑐᖅ ᑲᑎᔾᔨᑎᕇᖅᑲᑦᑕᕐᓗᑎᒃ ᔮᔾᐳ ᒎᔅ–ᑕᓇᐅᕐᒥ ᐃᓂᒃᓴᖅᑲᖅᕕᖕᒥ ᐃᓂᖕᖓᑕ ᐊᖅᑯᑎᖕᖓᓄᑦ ᐅᖕᖓᓯᖕᓂᖅᑲᖅᑐᓂ ᐃᒻᒪᖅᑲ 13 ᑭᓛᒥᑕᓂᒃ. ᓄᓇᒃᑯᑦ ᐃᖕᒋᖅᓯᕝᕕᐅᖅᑲᑦᑕᖅᑐᑎᒃ ᑖᒃᑯᓄᖕᖓ ᐃᓂᐅᔪᓄᑦ ᐊᕐᕌᒍᓕᒫᑦ ᐊᖅᑯᑕᐅᓗᑎᒃ. ᑕᒪᒃᑯᐊ ᐃᖕᒋᕐᕋᕝᕚᑦ ᐃᒃᑲᑦᑐᒃᑰᖅᑲᑦᑕᖅᑐᑎᒃ ᑰᕋᓖᓂ, ᐃᓚᐃᓐᓇᒃᑯᑐᐃᓐᓇᖅ ᑰᕋᓖᖑᕙᒃᑐᑦ. ᑕᒪᒃᑯᐊ ᐃᑳᕝᕚᑦ ᐃᓚᖅᑲᖅᓂᐊᖅᑐᑦ ᐱᖕᖓᓱᓂᒃ ᑕᓪᓕᒪᓂᓪᓘᓐᓃᑦ ᐃᑳᕝᕕᓂᒃ, ᐊᓯᖕᒋᑦ ᑰᓪᕕᖅᑲᖅᑐᑎᒃ.

ᒪᑭᑎᑕᐅᓯᒪᔪᑦ ᐱᓕᕆᐊᒥ

ᒎᔅ ᓇᒥᓂᕐᑯᑎᖕᖓ, ᔮᔾᐳ ᓇᖕᒥᓂᕐᑯᑎᖕᖓ ᐊᓪᓄᓗ ᑕᓇᐅᕐᒥ ᐃᓂᒃᓴᖅᑲᖅᕕᖕᒥ ᐃᓂᖕᖓ ᓇᖕᒥᓂᖅ ᐊᐅᓚᔾᔪᑎᖕᒋᓐᓂ, ᓯᓂᒃᑕᕝᕕᖕᒋᓐᓂᒃ, ᐊᐅᓚᑦᑎᕝᕕᖕᒋᓐᓂᒃ, ᓯᓂᒡᕕᖕᒋᓐᓂᒃ, ᑐᖅᑯᖅᑕᕝᕕᖕᒋᓐᓂᒃ, ᔭᓄᓃᑕᖕᒋᓐᓂᒃ ᐃᑯᒪᓕᖕᓅᕈᑎᓄᑦ ᐊᐅᓚᑕᐅᔪᓂᒃ, ᓴᓇᕝᕕᕆᕙᒃᑕᖕᒋᓐᓂᒃ ᐃᑯᒪᓂᒃ, ᓯᕐᓗᐊᖕᒋᓐᓂᒃ, ᐃᒻᒪᖅᑲᐅᓯᕝᕕᖕᒋᑦ ᐊᒻᒪ ᖁᕐᕕᖅᑲᕐᕕᖕᒋᓐᓂᒃ.

ᒎᔅ ᓇᖕᒥᓂᖕᖑᑦ ᐱᓕᕆᕝᕕᐅᓂᖅᐹᖑᔪᖅ ᐱᓕᕆᐊᖕᖓᓂᒃ ᐅᔭᕋᖕᓂᐊᖅᑕᐅᔪᓂ ᓴᓇᔭᐅᕙᓪᓕᐊᕝᕕᖕᒥ, ᐱᖕᖓᓱᑦ ᖃᖕᖓᓂ ᐅᔭᖅᑕᓇᐊᕕᓂᒃ, ᐊᑕᐅᓯᕐᒥᒃ ᐅᔭᖅᑕᓇᐊᕕᖕᒥ, ᐊᒻᒪᓗ ᐅᔭᕋᖕᓂᐊᖅᑎᑦ ᓇᔪᕕᖕ ᐃᖅᑲᐃᔭᖅᑎᖃᕈᓐᓇᖅᑐᒥᒃ ᓴᓂᔭᐅᕙᓪᓕᐊᑎᓪᓗᒍ ᐊᒻᒪᓗ 465-ᓂ ᐊᐅᓚᓂᖅᑲᖅᑎᓪᓗᒍ. ᐃᑯᒪᓕᒃᔪᐊᓄᑦ ᐅᖅᓱᐊᓗᒃᓴᖅᑲᖅᑐᑎᒃ ᐊᑕᐅᓯᕐᒧᑦ ᐅᑭᐅᒧᑦ ᓈᓪᒪᒐᔭᖅᑐᓂᒃ ᓯᑕᒪᓂᒃ 10-M ᑖᑕᓂᒃ ᐊᒻᒪᓗ ᐊᑕᐅᓯᕐᒥ 5–M ᑖᑕᓂᒃ ᐅᖅᓱᐊᖅᑲᕝᕕᓂᒃ. ᓯᕐᓗᐊᖅᑲᖅᑐᓂ 40,000 ᑕᓐᓂ ᐅᖁᒪᐃᓐᓂᓕᖕᓂ ᖄᖅᑕᖅᑐᓂᒃ.

ᒪᓈᓐ ᐃᓂᒃᓴᖅᑲᖅᕕᖕᒥ ᕿᖕᖑᐅᓪᒥ ᐃᓂᖅᑲᖅᑐᖅ ᖃᓂᕆᔭᖕᖑᓂᒃ 130 ᑭᓛᒥᑦ ᐅᐊᖕᓂᖅᐸᓯᐊᓂᒃ ᒎᔅ ᐃᓂᖕᖑᓂᒃ. ᐃᓂᕆᔭᐊᓚᔪᒃᐸᒃᑐᓂ ᐱᖁᑎᓄᑦ, ᓱᓇᒃᑯᑎᓄᑦ, ᐅᖅᓱᐊᓗᖕᓄᑦ ᐊᒻᒪ ᐱᖁᑎᓗᓚᐃᑦ ᐊᑐᖅᑕᐅᔭᓇᐊᑖᑦ ᓴᓇᔭᐅᓂᖅᑲᖅᑎᓪᓗᒍ ᐊᒻᒪᓗ ᐊᐅᓚᓂᖅᑲᖅᑎᓪᓗᒍ ᐱᓕᕆᐊᖅ. ᑕᓇᐅᕐᒥ ᐃᓂᒃᓴᖅᑲᖅᕕᖕᒥ ᐃᑐᓕᖅᑲᖅᑐᖅ ᓯᑲᐅᒧᑦ ᓂᐅᕋᐃᒥᒃ ᒪᖅᐲᖕᓄᑦ ᓈᓪᒪᒃᑐᒥᒃ, ᑐᓚᒃᑕᕝᕕᐅᓚᐅᒃᑐᒥᒃ ᐊᕐᕌᒍ ᐃᓚᖕᖑᓂᒃ ᐊᑐᖅᑕᐅᖅᑲᑦᑕᕐᓂᐊᖅᑐᒥᒃ ᐊᒻᒪᓗ ᐃᓂᒃᓴᖅᑲᖅᕕᖕᒥ ᐊᒻᒪᓗ ᑐᖅᑯᖅᓯᕝᕕᖕᒥ ᐊᒻᒪᓗ ᐋᖅᑭᒪᑎᑦᑎᐅᔭᖅᑲᖅᑐᓂ. ᐅᖅᓱᐊᓗᖅᑲᕝᕚᑦ ᐃᑐᓕᖅᑲᖅᑐᖅ ᐃᑯᒪᓕᒃᔪᐊᓄᑦ ᐅᖅᓱᐊᓗᒃᓴᖅᑲᖅᑐᑎᒃ ᓯᑕᒪᓂᒃ 10-M ᑖᑕᓂᒃ ᐊᒻᒪᓗ ᐊᑕᐅᓯᕐᒥᒃ 15-M ᑖᑕᓂᒃ ᐅᖅᓱᐊᓗᖅᑲᖅᕕᒥᒃ. ᑐᖅᑯᖅᓯᕝᕕᖅᑲᖅᑐᓂ ᐅᖁᒪᐃᓐᓂᓕᖕᓂ ᖄᖅᑕᖅᑐᓂᒃ. ᓇᔪᕕᒃ ᐃᓄᖅᑲᕈᓐᓇᖅᑐᓂ 75-ᓂ ᐃᓄᖕᓂ ᓴᓇᔭᐅᓂᖅᑲᖅᑎᓪᓗᒍ ᐊᒻᒪ ᐊᐅᓚᓂᖅᑲᓪᓚᖅᑎᓪᓗᒍ. ᐊᒃᑐᖅᑕᐅᔪ ᐃᓄᖅᑲᓐᓇᖅᕆᑦᑐᒥ ᐃᓂᕆᔭᖅᕆᓇ ᐅᖁᒪᐃᑦᑐᑦ ᑕᕗᑦ ᑕᒪᐃᓐᓄᑦ ᖃᓄᐃᓕᖕᖑᓂᓕᒫᖕᖑᓗ ᐃᑑᓯᖅ ᐊᒻᒪᓗ ᐱᕈᖅᑐᐊᕐᑭᑦᑕᐃᓕᑎᑦᑎᓂᖅ ᐊᒻᒪᓗ ᓴᓇᔭᐅᑦᑎᐊᖅᓯᒪᓗᑎᒃ ᓴᓇᕈᑎᖕᒋᑦ ᐊᒻᒪᓗ ᓇᐸᖅᓯᒪᔪᑦ.

ᓴᓪᓚᖅᑕᐅᕝᕕᐅᔪᑦ ᐊᒻᒪᓗ ᖄᖕᖓᒍ ᐅᔭᕋᖕᓂᐊᖅᑕᐅᔪᑦ

ᐱᑎᐊᓵᖅᑎᓪᓗᒍ ᒪᑐᐃᖕᖑᔪᖅ ᐅᔭᕋᖕᓂᐊᖅᑕᐅᔪᖅ ᑐᓂᓯᒪᓂᐊᖅᑐᖅ ᐊᖕᒋᔪᓂᒃ ᓯᕐᑲᓕᓯᒪᔪᓂᒃ ᐅᔭᖅᑲᓂᒃ ᐊᒻᒪᓗ ᓯᕋᑎᓯᒪᔪᑦ ᐅᔭᒃᑦ ᓇᖕᒥᓂᖅ ᐃᓚᐅᖅᑕᐅᓯᒪᔪᑦ, ᓴᓂᓕᓪᑎᑕᐅᓯᒪᔪᑦ. ᓴᐲᓇᒃᑯᑦ ᓴᓪᓚᖅᓂᐊᖅᑐᑦ ᐊᒻᒪᓗ/ᐅᕝᕙᓘᓐᓃᑦ ᖄᖕᖓᒍ ᐅᔭᕋᖕᓂᐊᖅᕕᓕᐅᖅᑐᑎᒃ ᒎᔅ ᐃᓂᖕᖑᓂ ᐊᒻᒪᓗ ᐊᑐᕐᑐᓂᒃᔪᒃ ᓯᕐᑲᓕᕝᕕᐅᑐᓂ ᐅᔭᖅᑲᓂᒃ ᐊᒻᒪᓗ ᑲᑎᖅᓯᖅᑕᐅᓯᒪᔪᓂᒃ ᐊᖕᒋᔪᓕᒫᖅ ᐊᖅᑯᒥᒃ ᐅᓯᔭᐅᔪᓂᒃ, ᐃᓂᖅᓯᕙᓂᒃ, ᒥᕝᕕᒥ ᑕᑭᓪᓕᕆᐊᖅᑎᑎᓗᑎᒃ ᐊᒻᒪᓗ ᐃᑲᔪᖅᑲᑎᑮᖕᓂᐊᖅᑐᑎᒃ ᓴᓇᕙᓪᓕᐊᑎᓪᓗᑎᒃ ᐊᒻᒪ ᐋᖅᑭᐅᔭᐅᔭᖅᑎᑎᑎᓪᓗᑎᒃ. ᒪᑐᐃᖅᑎᓪᓗᒎ ᖄᖕᖓᒍ ᐅᔭᕋᖕᓂᐊᕐᓂᖅ ᓴᖅᑮᔭᖅᑕᐅᓂᐊᖅᑐᑦ ᐅᔭᖅᑲᓂᒃ ᓯᖅᑲᓕᑎᖅᓯᒪᔪᓂᒃ ᐊᒻᒪᓗ ᑲᑎᖅᓯᖅᑕᐅᓯᒪᔪᓂᒃ. ᔭᔪᒧᑦ ᐊᒻᒪᓗ ᑕᓇᐅᕐᒥ ᐃᓕᓯᕝᕕᒃᓴᖅ ᐃᓂᖕᖑᓂ ᒥᑭᔪᒃ ᓴᓪᓚᖅᕕᐅᔪᒥᒃ ᐊᒻᒪᓗ/ᐅᕝᕙᓘᓐᓃᑦ ᖄᖕᖓᒍ ᐅᔭᕋᖕᓂᐊᕐᓂᖅ ᐸᕐᓇᒃᑕᐅᔪᑦ

ᒪᑭᑎᑦᑎᓂᐊᕐᓗᓂ ᒪᑭᑕᐅᔪᓇᐊᖅᑲᐅᓂᒃ. ᐱᔪᓇᐊᖅᑳᓂᖅ ᐊᑐᖅᑕᐅᔪᓇᐊᓕᖓᓂ ᒥᑭᓪᓕᖏᐊᖅᑎᑕᐅᓂᐊᖅᑐᖅ ᓈᒻᒪᓈᖅᑎᑕᐅᓇᓯᐊᕐᓗᑎᒃ ᐊᒡᒍᖅᑕᐅᓯᒪᓃᑦ ᐃᓗᓪᓕᖅᑕᐅᔪᓇᐊᓖᓪᓗ ᐱᔪᓇᐊᖅᑲᖅᑕᖏᓐᓂᒃ ᒪᓕᒡᓗᑎᒃ.

<u>ᐅᔭᕋᖓᓂᐊᕈᒃᓴᓕᓇᓂᖅ ᐊᒻᒪᓗ ᐅᔭᕋᖓᓂᐊᕐᓂᖅ</u>

ᒎᓗ ᐃᓂᖅᑲᖅᑕᖅᑐᑦ ᓴᕙᕋᔪᒃᓴᓂ ᐃᓂᖅᑯᓂᒃ ᐅᔭᕋᑐᖅᑲᒪᓇᖓᓂ ᓇᓂᔭᐅᓚᔪᒃᑐᓂ ᑲᓇᑕᒥᐅᑦ ᐅᔭᕋᕐᔪᐊᖅᑳᕚᖓᓂᒃ. ᐅᔭᕋᖓᓂᐊᕈᒃᓴᑦ ᐃᓗᓕᖏᑦ ᓴᕙᒃᓴᓂ 5 ᐳᓴᖏᓐᓂ ᐱᑕᖅᑲᖅᑕᖅᑐᑦ. ᓯᐅᕗ ᓴᕙᕋᔪᒃᓴᖅ ᑕᒡᕙ ᐊᑭᑐᔪᑐᐊᖅ ᐱᖅᑲᒫ ᐊᓯᖏᓐᓂ ᐱᑕᖅᑲᖕᖏᕆᓗᑎᒃ ᓴᕝᑎᐊᕙᖓᓂ ᓴᕙᕋᔪᓂᒃ ᐲᔭᖅᑕᐅᔭᓐᓇᖅᐸᒃᑐᓂᒃ ᕿᓇᐅᔾᔭᒃᑕᐅᔭᓂᒃ. ᓯᐅᕗ ᒦᓐᓇᐅᔭᖅ ᐊᑐᖅᑕᐅᕗᖅ ᕿᓇᐅᔭᓚᐅᕈᑕᐅᓪᓗᓂ ᖃᐅᔮᔭᐅᓇᓯᑎᐊᖅᓂ ᑭᓯᐊᓂᓕ ᐃᓚᖓ ᐱᔭᐅᓂᐊᖅᑐᖅ ᐱᖃᑎᒋᓗᒍ ᒎᓗ. ᐱᓕᕆᐊᖑᔪᒥᑦ ᒎᓗᖅᑲᖅᑕᖅᑐᖅ ᓯᖃᓚᐅᔪᓪᓗᒪᓇᖓᓂ ᓅᓇᒥ ᒎᓘᓪᓗᓂ, ᐃᓈᓐᓂᒃᑯᐃᓐᓇᖅ ᑕᑯᔭᐅᔭᓐᓇᖃᖅᑕᖅᓗᑎᒃ ᐃᔪᓄᑦ. ᐅᔭᕋᖓᓂᐊᖅᑕᐅᔭᓐᓇᖅᑐᑦ ᐅᔭᕋᖓᓂᐊᕈᒃᓴᑦ Hᐊᓐᓂᖓᓚᔪᖅ ᐱᓕᕆᐊᖓᓄᑦ ᑲᑎᓪᓗᒋᑦ 19,792 ᑭᓗᑕᓐᓂᒃ 5.70 ᒍᕿᒻ ᑕᐃᑲᖖᒐᑦ ᑖᓐᓂᒃ ᐊᒥᓲᓂᖏᑦ ᒎᓗᓂ 3,628 ᑯᓗᐊᐅᓯᓂᒃ.

ᓴᕙᕋᔪᒃᓴᖅ ᑕᒪᒃᑮᖓᓂ ᖄᖓᒍ ᐅᔭᕋᖓᓂᐊᖅᕙᓂ (ᐅᒻᐃᐅᓪᓪ, ᑖᒪ ᐊᒻᒪ ᒎᔅ ᒪᐃᓐ) ᐲᔭᖅᑕᐅᓂᐊᖅᑐᑦ ᐊᑐᕐᓗᑎᒃ ᐅᓯᒃᑲᖅᑕᐅᓗᑎᒃ ᐅᔭᕋᖓᓂᐊᕐᓂᒃᑯᑦ. ᑕᒪᒃᑭᖅ 4-ᖑᔪᑦ ᐅᔭᕋᖓᓂᐊᕈᒃᓴᓖᑦ ᑎᑭᐅᑎᔪᑦ ᐊᑦᑎᖓᓂᖅᓴᒥᒃ ᐃᑎᓂᖅᐹᓇᔪᓇᐊᖅᑲᖅᑕᖏᓐᓂᒃ ᖄᖓᓂ ᐅᔭᕋᖓᓂᐊᕐᓂᕐᒥᒃ ᐊᒻᒪᓗ ᐊᖏᓂᖅᐹᓇᔭᓐᓇᖅᑕᖓᓂᒃ ᐊᖏᓂᖅᑲᕐᓂᖓ ᖃᓂᒋᔭᖓᓂᒃ 150 ᒦᑕᓂᒃ ᐊᑖᓄᑦ ᓄᓇᐅᑉ ᖄᖓᓂ.

ᕿᓂᕐᓂᖅ ᓇᓗᓇᐃᖅᓯᔾᔭᑕᐅᓚᐅᖅᐳᖅ ᐊᒥᓯᒃᑲᓪᓚᖓᓂ ᐱᕝᕙᐅᔭᓐᓇᕋᔭᖅᑐᓂᒃ ᑕᒪᐃᓐᓄ ᐲᓕᓇᐊᑉ ᐃᓂᖓᓂ. ᓴᐲᓇᒃᑯᑦ ᕿᓂᖅᑲᖅᑕᐅᔾᔪᓂᐊᖅᑐᑦ ᐅᔭᕋᖓᓂᐊᕐᕕᒥᒃ ᓴᓇᑎᓪᓗᒋᑦ ᓯᓚ ᐊᒻᒪ ᐊᐅᓚᓂᖅᑲᖅᑎᓪᓗᒋᑦ ᐅᖓᕙᓇᐊᕐᓂᖅᑐᐃᓐᓇᓇᐊᖅᑲᓇᓪᓗᑎᒃ ᐅᔭᕋᖓᓂᐊᕐᓂᖅ ᐅᖓᑖᓄᑦ ᓂᓇᐅᒋᔭᐅᔪᓂᒃ. ᑕᐃᒪᐃᑦᑐᑦ ᐅᔭᕋᖓᓂᐊᕈᒃᓴᖖᓂᑦ ᐅᔭᕋᖓᓂᐊᖅᑕᐅᑐᐃᓐᓇᓇᐊᖖᑦ ᖃᖓᑦᑕᖅᓯᒪᔪᑎᒍᑦ ᒦᓐᓇᐅᔪᖅ ᐸᕐᓇᒃᑕᐅᓯᒪᔪᓂᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑐᕌᖅᓯᒪᖓᒪᑕ ᒎᔅᒥ ᑕᐃᒦᒃ ᐊᑐᑎᖅᑦᑎᐊᕋᓯᐊᖅᒍᑎᒃ ᐃᓕᓯᒫᓂᒃᑐᓂᒃ ᒪᑭᑎᑕᐅᓯᒪᔪᓂᒃ.

<u>ᐊᒥᐊᒃᑯᕐᓗᐃᑦ ᐅᔭᕋᐃᑦ ᐊᒻᒪᓗ ᐊᒥᐊᒃᑯᕐᓗᐃᑦ ᑯᕙᔭᐅᔪᓂ ᐊᐅᓚᑦᑎᓂᖅ</u>

ᐊᒥᐊᒃᑯᕐᓗᖕᓄᑦ ᑯᕙᔭᐅᕝᕕᑦ ᐃᓂᖅᑲᖅᑐᑦ ᓂᒋᖅᐸᓯᐊᓂ ᑕᐃᒃᓯᒪ ᒎᔅ ᒪᑐᐃᖓᔪᖅ ᐅᔭᕋᖓᓂᐊᕐᕙᐅᔪᖅ. ᐃᓗᓪᓕᖅᓯᔭᓐᓇᖅᑐᖅ 4 ᒥᑐᓕᒃ ᑖᓐᓴ ᐅᔭᕋᖓᓂᐊᖅᑕᐅᓂᑯᓂᑦ ᐊᒃᑕᖅᐸᓪᓕᐊᔭᖏᓐᓂᑦ ᒪᓕᒃᓗᒍ ᖃᓄᖅ ᐊᖏᑎᒋᓂᖓᓂᒃ ᐲᖅᓯᕗᓪᓕᐊᓂᑎᒃ ᐅᔭᖃᑦᑕᕐᒥᖓᓂᑦ ᐅᑯᐊᓗ ᑐᕐᑯᖅᑕᐅᕗᓪᓕᐊᔪᑦ ᒪᕿᖓᓂᑦ. ᐅᑯᐊ ᑐᕐᑯᖅᓯᒪᕝᕕᖏᑦ ᐃᓗᓕᕈᓐᓇᖅᑐᑦ ᓄᐊᑕᐅᕗᓪᐊᔪᓂᑦ ᐊᒻᒪᓗ ᐊᐅᓚᑕᐅᓪᓗᓂ ᑕᐃᑲᓂ ᐃᒪᖓ ᐃᖏᕋᓂᖓ. ᑕᒪᓐᓇ ᖃᑦᑕᖓᓂᒃ ᐃᓂᖅᑲᕝᕙᐅᔪᖅ ᓯᕙᖓᓂᖓ ᓇᓕᖅᑲᓅᓕᖅᑎᑕᐅᓗᓂ ᑎᖏᑳᖅᑐᒧᑦ ᐅᑯᐊᓗ ᕿᓯᑎᑦᑎᔾᔪᑎᒋᓂᐊᖅᑐᑦ ᐊᕗᑖᓂᑦ ᐊᒃᑐᓗᐊᖅᑕᐃᓕᑎᑦᑎᓂᐊᕐᒪᑦ ᓱᕋᔾᔪᓂᒃ ᐊᒻᒪᓗ ᐊᓯᐅᑐᐃᓐᓇᕐᓂᐊᓐᖏᒪᑦ.

ᐅᓇ ᒎᔅ ᐃᓂᖓᓂ ᐊᑐᖅᓯᓗᑎᒃ ᐱᖓᓱᓂᒃ ᐅᔭᕐᑲᓂᒃ ᐊᒥᐊᒃᑯᕐᓗᑯᓂᒃ ᑐᕐᑯᖅᓯᒪᕝᖓ ᓄᓇᖓᓂ ᐊᐅᓚᑕᐅᔪᖅ ᐊᐅᒃᑎᑎᕈᑎᓄᑦ ᐊᒻᒪᓗ ᓱᕈᖅᓯᔪᓇᓐᖏᑦᑐᒥᒃ ᐊᐅᒃᑎᓇᔪ ᐅᔭᕋᖓᓂᐊᖅᑕᐅᓂᕐᑯᓂᒃ. ᐱᔭᕇᕐᒪᑦ ᐅᔭᕋᒃᑕᖅᑕᐅᓐᖏᓂᕐᓗᑯᐃᑦ ᑐᕐᑯᖅᓯᒪᕝᖓ ᓴᓇᓯᒪᑦᑎᐊᖅᑐᖅ ᐅᔭᕋᖓᓂᐊᖅᑕᒥᑦ ᑯᕙᑎᑕᐅᔪᑦ ᐃᒋᑕᒃᓴᓂᒃ, ᒪᑐᓯᒪᓂᐊᓇᓪᓗᓂ ᐅᔭᕋᒃᑕᖅᑕᐅᓐᖏᓂᕐᓗᑯᓂᒃ ᐅᔭᕐᑲᓂᒃ. ᐅᔭᕋᒃᑕᖅᑐᖅᑲᖅᓂᖓᓂ ᐅᔭᕋᖓᓂᐊᖅᕝᕕᒥ, ᑲᑎᓪᓗᒋᑦ 77 ᒥᑐᓕᒃ ᑖᓐᓴ ᐅᔭᕋᖓᓂᐊᖅᑕᐅᔪᒥᑦ ᐊᒃᑕᖅᑕᐅᔪᑦ ᓴᕿᓐᓂᐊᖅᑐᑦ, ᐃᓚᒋᔭᐅᓗᑎᒃ ᑕᑕᐅᑎᔪᑦ. ᑖᒃᑯᓇᖓᑦ, ᓂᕆᐅᒋᔭᐅᔪᖅ ᐅᓇ 38 ᒦᑕ ᐊᐅᒃᑎᑕᐅᓯᒪᔪᓂᑦ, 33 ᒥᑐᓕᒃ ᑖᓐᓴ ᐊᐅᒃᑎᓯᒪᔪᖅ ᐆᓇᖅᑐᒧᑦ, ᐊᒻᒪᓗ 6 ᒥᑐᓕᒃ ᑖᓐᓴ ᑕᑕᓗᐊᖅᓯᒪᔾᔪᑎᔪᖅ. ᓱᑲᔪᒥᒃ ᐃᓂᑐᖅᑲᖓᓄᑦ ᐅᑎᖅᑎᓯᒪᕗᓪᓕᐊᓂᐊᖅᑐᑦ ᐃᖏᕋᓯᑎᑕᐅᑐᐊᕈᑎᒃ, ᐅᑯᐊᓗ ᐊᑐᖅᑕᐅᔪᓇᐊᓕᑦ ᑕᒪᕐᒥᒃ ᐅᔭᕐᑲᓂᒃ ᐊᒥᐊᒃᑯᕐᓗᑯᓂᒃ ᐊᒻᒪᓗ ᐅᔭᕋᖓᓂᐊᖅᑕᐅᔪᒥᑦ ᑯᕙᔭᐅᔪᑦ ᐊᑕᖅᑕᐅᕗᓪᓕᐊᔪᑦ ᑕᒪᓐᓇ 5-ᒥᑕ ᐊᐅᒃᑎᓯᒪᔪᑦ ᐅᔭᖅᑲᑦ ᖃᓇᓗᖑ ᐸᒡᕙᓂᐊᓐᖏᒪᑦ ᐊᐅᒍᓐᓇᖕᖏᑦᑐᒥᒃ ᓄᓇᒥᒃ ᐊᒻᒪᓗ ᐃᔅᓴᓐᖏᑦᑐᓂᒃ ᒪᑐᓯᒪᓗᓂ.

<u>ᐅᔨᕋᖅᓂᐊᕐᕕᖕᓂ ᓴᓇᕝᕆᓐᓂᐊᕐᓂᖅ</u>

ᐊᐅᓚᓂᖅᑲᖅᑎᓪᓗᒍ, ᑕᒪᕐᒥ ᓴᕕᕋᔭᒃᓴᑦ ᓴᓇᔪᐅᕝᕆᓐᓂᐊᓂᐊᖅᑐᑦ ᐊᑐᕐᓗᑎᒃ ᐊᑐᖅᑕᐅᓚᐅᓚᐅᒧᖅ ᐅᖁᒪᐃᓐᓂᒃᑯᑦ ᐊᕕᒃᑐᐃᓂᖅ ᐊᒻᒪ ᓯᖅᑲᓕᑎᑦᑎᕝᕆᓐᓂᐊᓂᒃᑯᑦ. ᐅᔨᕋᖅᓂᐊᕐᕕᐅᑉ ᓯᖅᑲᓕᖓᕕᖕᒐᑦ ᖃᔅᓯᐅᓂᕆᐊᓐᓇᖅᑕᖕᒐᑦ 6,000 ᑕᓐᓂᒃ ᓴᕕᕋᔭᒃᓴᓂ ᐅᓪᓗᖅ ᐊᑕᐅᓯᕐᒥ. ᐱᖕᒐᓱᑦ ᐃᓛᒃᑰᖅᑐᑦ ᓯᖅᑲᓕᖓᕐᑲᕐᓂᐊᖅᑐᖅ: ᓯᖅᑲᓕᕕᒃ; ᓴᕕᕋᔭᒃᓴᖅ ᓯᖅᑲᓕᓯᒪᑦᑎᐊᖅᑐᓂᒃ ᑯᕕᖓᕕᒃ ᐊᒻᒪᓗ ᐊᔾᔮᐸᓗᖕᒋᓐᓂᒃ ᐃᓕᓯᖓᕖᑦ ᐲᔪᐅᕖᑦ; ᐊᒻᒪᓗ ᓯᖅᑲᓕᖓᕕᐅᓪᓗᐊᕐᕕᒃ. ᓴᓇᔪᐅᕝᕆᓐᓂᐊᓂᖅ ᐃᓚᕐᑲᕐᓂᐊᖅᑐᖅ ᓯᖅᑲᓕᖅᑕᕐᓂᖅ (ᐱᐅᓂᖅᐹᓂ ᐱᒋᐊᕐᓗᑎᒃ ᐱᐅᓗᐊᖕᒋᑦᑐᓄᑦ), ᐊᖕᒪᓗᖅᑐᒧᑦ ᓯᖅᑳᓗᑎᒃ, ᐅᖁᒪᐃᓐᓂᖅᑎᒍᑦ ᐊᕕᒃᑐᐃᓂᖅ, ᓯᖅᑲᓕᑎᑦᑎᕝᕆᓐᓂᐊᓂᒃᑯᑦ ᖃᐅᓯᖅᑎᖅᓯᒪᔪᑎᒍᑦ ᐊᒻᒪᓗ ᒨᓗᓂ ᐲᔪᓗᑎᒃ ᖃᐅᓯᖅᑎᖅᓯᒪᔪᑦ ᐃᖕᒋᕋᕋᑎᑕᐅᓗᑎᒃ. ᒨᓗᑦ ᑭᒃᐸᕆᒃᑑᓕᖅᑎᑕᐅᓗᑎᒃ ᑕᐃᑲᓂ ᓴᓇᔪᕕᖕᒥ ᖃᓂᒋᔭᖕᒐᓂᒃ 350,000 ᐊᐅᓐᓯᓂᒃ ᐊᕌᒍᑕᒫᑦ. ᓴᓇᔪᐊᑦ ᖃᖕᒐᑕᔪᒃᑯᑦ ᐊᐅᓪᓚᖅᑎᑕᐅᓗᑎᒃ ᐱᐅᓯᒋᐊᖅᑎᑕᐅᓂᐊᕐᓗᑎᒃ.

<u>ᐃᒪᕐᒥ ᐊᐅᓚᑦᑎᓂᖅ</u>

ᐱᕝᕕᐅᒐᔪᓛᕐᒥ ᐃᒪᖅ ᐱᓕᕆᕝᕕᒡᔪᐊᒃᑰᖅᐸᒃᑐᑦ ᐊᑐᖅᑕᐅᒃᑲᓐᓂᕐᓂᐊᖅᑐᖅ ᑕᐃᑲᙶᑦ ᐲᔭᖅᑕᐅᓯᒪᓂᑯᓂᒃ ᑲᑎᖅᓯᖅᑕᐅᓯᒪᔪᓂ ᐊᒥᐊᒃᑯᕐᓗᓂᒃ. ᐊᑐᒃᑲᓐᓂᕐᓂᕐᒧᑦ ᐳᓚᒃᓴᖅᑕᐅᔾᔪᑎᑎᒍᑦ ᐱᒋᐊᖅᓯᒪᕗᖅ ᑕᐃᑲᙶᑦ ᐊᑭᐊᒃᑯᓪᓘᑎᕐᑲᕕᖕᒐᓂᒃ ᐃᓚᕐᓂᐊᖅᑐᖅ ᑯᕕᖓᕐᒥ ᐅᔨᖃᖅᑕᐅᓂᖁᓂᑦ ᐊᑎᖅᑎᑕᐅᓗᓂ ᐅᒥᐊᕐᔪᐊᓂᑦ ᑲᓚᑕᐅᓗᓂ ᐊᒻᒪᓗ ᐆᓇᖅᑐᖅᑲᐅᑎᑎᒍᑦ ᐊᒻᒪᓗ ᐃᑭᐊᕈᑎᕐᑲᕐᓗᑎᒃ ᓱᓪᓗᖕᒋᑦ. ᐃᒪᒃᑲᓐᓂᕐᒥᒃ ᐊᑐᖅᑕᐅᔨᓇᐊᖅᑲᑐᐃᓐᓇᓇᐊᓕᒃ ᑕᐃᑲᙱᑦ ᐃᒪᑦᑎᐊᕝᕆᖕᒥ ᓈᒻᒪᙱᓗᐊᓕᕐᓂᕈᓂ ᐃᒪᖅ ᐊᑐᖅᑕᐅᒃᑲᓐᓂᕋᓯᐊᖅᑐᖅ.

ᐊᒻᒪᒃᑲᓐᓂᖅ, ᐃᒪᑦᑎᐊᕝᕗ ᐊᑐᖅᑕᐅᔪᓇᐊᖅᑲᕐᓂᐊᖅᑐᖅ ᐃᑲᔪᕈᑕᐅᔪᒃᓴᐅᓗᓂ ᐊᖕᒋᕋᓇᔪᐅᔪᒥ ᐊᒻᒪᓗ ᐱᓕᕆᕝᕕᒡᔪᐊᕐᒥ ᐃᒪᕐᑲᓇᐊᕐᑲᕐᓂᕐᒧᑦ ᑕᐃᑲᓂ ᒍᓯ ᓇᖕᒥᓂᖁᑎᖕᒐᓂᒃ, ᔫᔾᔮ ᓇᖕᒥᓂᖁᑎᖕᒐᓂᒃ, ᐊᒻᒪᓗ ᑕᕆᐅᕐᒥ ᐃᓕᓯᕝᕕᒃᓴᒥ ᐃᓂᖕᒐᓂᒃ. ᒍᓯ ᐊᒻᒪ ᔫᔾᔮ ᐃᓂᖕᒋᑦ ᐃᒪᖅᑖᕐᑲᑦᑕᕐᓂᐊᖅᑐᑦ ᑕᐃᑲᙶᑦ ᒍᓯ ᐊᒻᒪᓗ ᔫᔾᔮ ᑕᓯᖕᒋᓐᓂᒃ, ᐃᓛᒃᑰᖅᓯᒪᔪᓂᒃ. ᐃᓚᒃᑲᓐᓂᖕᒋᑦ ᐃᒪᖅᑖᕐᕖ ᑕᐃᑲᓂ ᐳᐸᓗ ᑕᓯᖕᒐᓂᒃ ᒍᓯ ᓇᖕᒥᓂᖁᑎᖕᒐᓂ ᐊᒻᒪᓗ ᕗᓪᓪᑦ ᑕᓯᖕᒐᓂ ᔫᔾᔮ ᓇᖕᒥᓂᖁᑎᖕᒐᓂ. ᐃᒪᕐᒥ ᓴᓗᒪᖅᓴᐃᕕᖅᑲᕐᓗᑎᒃ ᐃᒥᖅᑕᐅᔪᓐᓇᑦᑎᐊᖅᑐᒥᒃ ᑕᒪᕐᒥ ᐃᓂᐅᔪᓂᒃ. ᐊᒻᒪᒃᑲᓐᓂᖅ, ᑕᓇᐅᖕᒋᔭᐅᔾᔪᑎᖅᑲᕐᓗᑎᒃ ᑕᐃᑲᓂ ᑕᓇᐅᕐᒥ ᐃᓂᒃᓴᖅᑲᕕᖕᒐᓂᒃ.

ᓄᓇᖕᒐ ᐃᓂᒋᔭᐅᔪᓗᒃᑖᓂ ᒪᓂᕋᐃᓐᓇᑲᓴᐅᔪᖅ ᓴᓇᓯᒪᑦᑎᐊᓗᐊᙱᑦᑐᖅ, ᑖᒍᖕᒐᐅᔫᓗᕿᐅᓪᓗᓂ, ᐅᑭᐅᑉ ᐃᓗᐊᓂ ᑰᕋᙯᖅ ᑰᒃᐸᓪᓕᐊᓂᖅᑲᖅᑲᑦᑕᖅᑐᖅ. ᑭᓯᐊᓂ, ᐊᑐᖅᑕᐅᓂᖅ ᐃᓂᓗᑦ ᐃᒪᕐᒥ ᐊᐅᓚᑦᑎᓂᖅ ᐊᓯᐊᓄᑦ ᑐᕌᑎᑕᐅᔪᓐᓇᖅᑐᖅ ᐃᒪᖅ ᐅᔨᕋᖅᓂᐊᕐᕕᓄᑦ ᐊᒻᒪ ᒪᑭᑎᑕᐅᓯᒪᔪᓄᑦ ᐊᒃᑐᐊᓂᖅᑲᓗᖅᑕᐃᓕᖁᓪᓗᒋᑦ. ᒍᓯ ᐅᔨᕋᖅᓂᐊᕐᕕᖕᒐ ᒥᑭᔪᒥᒃ ᓅᑎᓐᓂᖅᑭᓐᓇᖅᑐᖅ ᐊᒻᒪᓗ ᐸᕐᓇᐅᑎᑦ ᒍᓯ ᒥᕝᕕᖕᒐᓄᑦ ᑕᑭᒡᓕᕆᐊᕈᑎᖕᒐ ᓴᙳᑎᕆᐊᖅᑲᓗᒍ ᑯᕋᓛᖅ ᐃᖕᒋᕋᔪᖅ ᑕᑭᒡᓕᕆᐊᕐᕕᐅᔪᒪᔪᒧᑦ. ᑕᒪᒃᐹᒃ ᑯᕋᓛᑦ ᐃᖕᒋᕈᑦ ᒍᓯ ᑕᓯᖕᒐᓄᑦ ᐊᒻᒪ ᐊᖕᒋᓂᖕᒋᑦ ᐊᒃᑐᖅᑕᐅᓂᖅᑲᕐᓂᐊᙳᕆᑦᑐᑦ, ᑭᓯᐊᓂ ᐃᓂᖕᒐ ᐱᒋᐊᕐᕕᖕᒐᓂᒃ ᑐᑫᖕᒐᔪᑦ ᑕᓯᕐᒧᑦ ᐊᓯᔾᔨᕐᓂᐊᖅᑐᖅ.

ᐱᕕᒃᓴᐅᓂᐊᕐᓗᓂ ᐅᔨᕋᖅᓂᐊᕐᕕᖕᓴᑦ, ᐃᓚᖕᒐᓂᒃ ᐅᕝᕙᓘᓐᓃᑦ ᑕᒪᑭᖅ ᐃᒪᐃᔭᕐᕕᐅᔪᓇᐊᖅᑲᕋᔭᖅᑐᖅ ᖃᖕᒐᓂ ᑕᓯᐅᑉ. ᒍᓯ ᓇᖕᒥᓂᖁᑎᖕᒐᓂ, ᑖᒪ ᑕᓯᖕᒐ ᐃᒪᐃᔭᕐᕕᐅᔪᓇᐊᖅᑲᕐᓂᐊᖅᑐᖅ ᐱᕕᒃᓴᐅᓂᐊᕐᓗᓂ ᑖᒪ ᐅᔨᕋᖅᓂᐊᕐᓚᖕᒥ. ᑕᐃᑲᓂ ᔫᔾᔮ ᓇᖕᒥᓂᖁᑎᖕᒐᓂᒃ, ᐃᓚᖕᒐᓂᒃ ᐃᒪᐃᔭᕐᕕᐅᔪᓇᐊᖅᑲᕐᓂᐊᖅᑐᖅ ᓴᓇᕝᕕᐅᓗᓂ ᑭᒡᓕᖅᑳᖅᑐᒥᒃ ᐃᒪᖅᓯᖕᒥ ᒪᕿᖕᓂᒃ ᐃᒃᑲᑦᑐᓂᒃ ᑕᓯᕐᓂᒃ, ᓚᐃᑐᓪ ᑕᓯᖕᒐᑦ ᐊᒻᒪᓗ ᐊᑰᓇᓐᓴ ᑕᓯᖕᒐᑦ, ᐃᓚᖕᒐᓂᒃ ᓴᓇᓗᑎᒃ ᓴᒡᒐᕐᕕᓂᒃ ᐃᓂᒥᒃ 1 ᐊᒻᒪᓗ ᐃᓂᒥᒃ 2. ᑰᒃᑎᑕᐅᔪᓐᓇᖕᒋᑦᑐᑦ ᐃᒪᖅᓯᐃᑦ ᓴᓇᔪᐅᓂᐊᖅᑐᑦ ᐊᕝᕗᔭᐅᔪᒃᓴᐅᓗᓂ ᓴᒡᒐᕐᕖᑦ ᑕᐃᑲᙶᑦ ᑕᓯᕐᓂᒃ. ᐃᒪᐃᔭᐃᓂᕐᒧᑦ ᐸᕐᓇᐅᑎᓕᐅᕐᓂᐊᖅᑐᑦ ᐊᒻᒪᓗ ᐊᑐᓕᖅᑎᑕᐅᓗᓂ ᒪᓕᒐᕋᓃᑎᒍᑦ ᐊᖕᒋᖅᑕᐅᒍᑎᒃ ᓴᓇᔪᐅᖅᑳᖅᑎᓐᓇᕆᑦ ᐃᒪᖅᓯᐃᑦ ᓚᐃᑐᓪ ᐊᒻᒪᓗ ᐊᑰᓇᓐᓴ ᑕᓯᖕᒋᓐᓂᒃ.

ᑕᒪᕐᒥ 6-ᖑᔪᑦ ᓴᒡᒐᕐᕖᑦ ᐃᓂᖅᑲᕐᓂᐊᖅᑐᑦ ᓄᓇᐅᑉ ᐊᑖᓂ ᖁᐊᖅᓯᒪᓂᕐᒥ ᑕᐃᒪᐃᒃᑲᒥ ᐊᖕᒋᔪᒥᒃ ᐃᒪᖅᑲᕐᓂᐊᙳᕆᓚᖅ ᓄᓇᒥᙳᖅᑐᒥᒃ. ᑯᖕᓃᑦ ᐊᐅᒃᐸᓪᓕᐊᔪᓂᑦ ᐊᐳᒥᙳᖅᑐᑦ ᐊᒻᒪᓗ ᐊᐅᔾᔪᒃᑯᑦ ᒪᕐᑯᖕᓂᕐᒥᒃ ᑲᒪᒋᔭᐅᓂᐊᖅᑐᑦ ᐳᓪᓚᒃᑕᐅᓗᑎᒃ ᑕᓯᐊᑖᓄᑦ ᑰᒃᑎᑕᐅᖅᑳᖅᑎᓐᓇᑎᒃ ᐊᕙᑎᒧᑦ. ᐃᒪᐃᔭᐃᕝᕆᓐᓂᐊᓂᖅ ᐊᑖᓂ ᓄᓇᐅᑉ ᐅᔨᕋᖅᓂᐊᕐᕕᖕᒥ ᐊᑐᕐᓗᑎᒃ ᐊᑕᐅᑦᑎᒃᑯᑦ ᐃᒪᕐᒧᐊᖅᐸᒃᑐᒃᑯᑦ ᐊᒻᒪᓗ ᐳᓪᓚᓂᒃ ᒪᑭᑕᓂᖅᑲᓇᐊᖅᑲᙳᕆᑦᑐᓂᒃ ᐱᓕᕆᕝᕕᐅᔪᓕᒫᓂᒃ,

ᐳᓪᓚᐃᓂᖅ ᐊᒥᓱᓂᒃ ᖁᕝᕙᒃᑎᑕᐅᔪᒃᑯᑦ. ᒎᔅ ᓇᖕᒥᓂᖁᑎᖓᓂᒃ, ᐃᒪᐃᑦ ᑐᕌᖅᑎᑕᐅᓂᐊᖅᑐᑦ ᐊᒥᐊᒃᑯᖅᑐᐃᑦ ᐊᑦᑕᕐᕕᖓᓄᑦ ᐊᒻᒪᓗ ᔫᔾᔨ ᓇᖕᒥᓂᖁᑎᖓᓂᒃ, ᐃᒪᖅ ᐃᖏᕐᕋᓂᐊᖅᑐᖅ ᐃᒪᕐᒧᑦ ᐊᐅᓚᑦᑎᕝᕕᖏᓐᓄᑦ.

ᐊᑦᑕᑯᓂ ᐊᐅᓚᑦᑎᓂᖅ

ᐊᑦᑕᑯᑦ ᐊᕕᒃᑐᖅᑕᐅᓂᐊᖅᑐᑦ ᐊᑦᑕᑯᓂ ᐊᐅᓚᑦᑎᕕᖏᓐᓂᒃ ᐃᓂᖃᖅᑐᑦ ᐃᓛᒃᑯᑦ ᐃᓂᐅᔪᓂᒃ. ᓱᓇᕈᔪᐃᑦ ᒥᑭᓪᓕᒋᐊᑕᐅᓂᐊᖅᑐᑦ, ᐊᑐᖅᑕᐅᒃᑲᓐᓂᕐᓗᑎᒃ ᐅᕝᕙᓘᓐᓃᑦ ᐊᑐᒃᑲᓐᓂᖅᑐᒃᓴᐅᑎᑕᐅᓗᑎᒃ ᐊᔪᙱᑐᐊᕈᑎᒃ. ᒎᔅ ᐊᒻᒪᓗ ᔫᔾᔨ ᓇᖕᒥᓂᖁᑎᖏᑦ ᐊᑐᕐᓂᐊᖅᑐᑦ ᓄᓇᒧᑦ ᓴᐅᓯᖃᑦᑕᕐᓗᑎᒃ ᐅᓗᕆᐊᓇᙱᑦᑐᑕᖕᓂᒃ ᐊᖏᖅᑕᐅᓯᒪᔪᓂᒃ. ᐊᓯᖏᑦ ᓄᐊᑕᐅᓯᒪᓗᑎᒃ ᐊᐅᓪᓚᖅᑎᑕᐅᓂᐊᕐᓗᑎᒃ ᐊᖏᖅᑕᐅᓯᒪᓂᖃᖅᑐᓂᒃ ᐊᑐᒃᑲᓐᓂᖅᑐᒃᓴᐅᑎᑕᐅᔪᓂᒃ ᐅᕝᕙᓘᓐᓃᑦ ᐊᒃᑕᑰᕐᕕᓄᐊᖅᑐᒃᓴᐅᓗᑎᒃ. ᑕᒪᕐᒥ ᓇᔪᕐᕖᑦ ᐃᑯᐊᓪᓚᒃᑐᖃᕐᕕᖃᕐᓗᑎᒃ ᐃᑯᐊᓪᓚᒃᑎᑦᑎᓂᐊᕐᓗᑎᒃ ᐅᓗᕆᐊᓇᕐᓂᖃᙱᑦᑐᑕᓂᒃ ᐊᒻᒪᓗ ᐃᑲᐊᓪᓚᒍᓐᓇᖅᑐᓂᒃ ᐊᑦᑕᑯᓂᒃ ᐊᒻᒪᓗ ᐅᓗᕆᐊᓇᖅᑐᓖᑦ ᑐᖅᑯᖅᑕᐅᓯᒪᓗᑎᒃ.

ᒪᑐᓯᓂᖅ ᐅᑎᖅᑎᑦᑎᓂᕐᓗ

ᓴᐲᓇᒃᑯᑦ ᐱᕚᓪᓕᖅᐸᓪᓕᐊᔪᓪᒪᕆᖕᒥ ᐅᑎᖅᑎᑦᑎᕙᓪᓕᐊᓂᖃᕐᓂᐊᖅᑐᑦ ᑕᐃᒪᙵᓂ ᐅᔭᕐᓂᐊᕐᕕᒃ ᑲᔪᓯᓂᖃᖅᑎᓪᓗᒍ. ᐱᓕᕆᕝᕖᑦ ᐊᑐᕈᓐᓃᖅᑎᑕᐅᓗᑎᒃ ᐲᖅᑕᐅᓗᑎᒡᓗ ᐊᑑᖅᑲᕈᓐᓃᖅᑎᓪᓗᒋᑦ. ᐃᓚᒃᓴᐅᑎᑦ ᐊᒻᒪᓗ ᖃᓄᐃᓕᖓᔾᔪᑎᐅᔪᑦ ᓈᒻᒪᒃᑎᑦᑎᓇᓯᐊᕐᓂᖅ ᐲᒻᒪᕆᐅᔪᒥᒃ ᑕᐅᑐᒃᑕᐅᓗᐊᓂᐊᖅᑐᑦ ᒪᑐᒪᐅᒻᒪᕆᖕᓂᐊᓕᖅᑎᓪᓗᒍ ᐅᔭᕐᓂᐊᕐᕕᒃ. ᐃᓚᖃᕐᓂᐊᖅᑐᖅ ᔫᖅᑐᐃᓂᕐᒥᒃ ᐅᔭᕐᓂᐊᕐᕕᐅᑉ ᐊᑦᑕᑯᖏᓐᓂᒃ (ᐆᑕᕐᓇᑐᓕᐅᕈᑎᖃᑐᐃᓐᓇᓇᐊᑖᑦ ᐅᔭᖅᑲᑦ ᐊᑦᑕᑯᑦ ᐊᒻᒪᓗ ᐊᒥᐊᒃᑯᕐᑐᐃᑦ) ᐆᑕᕐᓇᖅᑐᖃᖏᑦᑐᑦ ᐅᔭᖅᑲᑦ ᐊᒻᒪᓗ ᓴᒡᒐᖅᑕᐅᓂᑯᑦ ᐃᒻᒥᖅᓯᖅᑕᐅᓗᑎᒃ. ᒥᑭᓪᓕᑎᕋᓯᐊᕐᓗᒍ ᐃᒪᕐᒧᑦ ᓴᓗᒻᒪᖅᓴᐃᓂᖅ, ᐃᒻᒥᖅᓯᖅᑕᐅᓂᐊᖅᑐᑦ ᓴᒡᒐᖅᑕᐅᓂᑯᑦ ᑕᓯᕐᒥᙴᖅᑐᓂᒃ ᒥᑭᓪᓕᑎᕋᓯᐊᕐᓗᒍ ᖃᖕᒎᓗᖕᓂ ᐅᑕᕐᓇᖅᑐᓂ ᐊᒻᒪ ᐲᔭᐅᓯᒪᓂᕐᒥᒃ ᓴᕙᖕᓂ. ᒪᑐᓯᓂᖅ ᐅᔭᕐᓂᐊᕐᕕᖕᒥ ᓂᕆᐅᒋᔭᐅᔪᖅ 10-ᓂᒃ ᐅᑭᐅᓂᒃ ᐊᑯᓂᐅᑎᒋᔪᒥᒃ ᐃᓚᖃᕐᓗᓂ ᐱᖓᓱᓂᒃ ᑲᒪᒋᔭᖃᖅᐸᓪᓕᐊᓂᕐᒥᒃ ᑕᐃᑲᙵᓗ ᐊᑯᓂᐅᓂᖅᐹᒥ ᑕᓪᓕᒪᓂᒃ ᐅᑭᐅᓂᒃ ᒪᑐᓯᒪᓕᖅᑎᓪᓗᒍ ᖃᐅᔨᓴᖃᑦᑕᐅᔭᕐᓂᕐᒥᒃ. ᒪᕐᕉᒃ ᐃᓂᒋᔭᐅᔪᑦ (ᐊᑐᖅᑐᖅ ᐊᒻᒪᓗ ᐱᔭᕇᖅᑐᖅ) ᐱᔭᕇᖅᑎᓪᓗᒋᑦ ᑕᓪᓕᒪᑦ (5) ᐊᕐᕌᒍᑦ ᒪᑐᕙᒃᓴᖕᒐ ᒥᐊᓂᕆᔭᐅᓗᓂ. ᒪᕐᕉᖕᓄᑦ ᐊᕐᕌᒍᓄᑦ ᒪᑐᔭᐅᕝᕕᓪᓕᐊᑎᐊᕐᓗᓂ ᐊᐅᓪᓗᑎᓂᐊᖅᑐᑦ ᐊᖏᔫᑎᓂᒃ ᓇᐸᔪᒥᒃ ᒪᑐᓯᓗᑎᒃ. 6 ᐊᕐᕌᒍᑲᓐᓂᕐᓄᑦ ᐃᒪᕐᒧᑦ ᓴᓗᒻᒪᖅᓴᕐᓗᒍ ᐊᒻᒪᓗ ᑭᖑᓪᓕᖅᐹᖅ ᐲᔭᕐᓗᒋᑦ ᐊᒻᒪᓗ ᓄᒃᑕᖅᑐᖅᑲᕈᓐᓃᕐᓗᓂ ᐊᒥᐊᒃᑯᓂᑦ ᐱᓕᕆᐊᖑᔪᓂᑦ ᐊᑐᖅᑕᕕᓃᑦ.

ᐱᓕᕆᕝᕕᐅᔪᓄᑦ ᐊᑐᒐᒃᓴᙳᖅᑎᑕᐅᓯᒪᔪᖅ ᐅᑎᖅᑎᑦᑎᓇᓱᐊᕐᓂᕐᒥᒃ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᖅ ᒪᑐᓯᓂᐊᕐᓗᓂ ᑭᖑᓕᖕᒋᓐᓂ ᐱᖕᒐᓱᑦ ᐱᓕᕆᐊᖑᔪᑦ ᐃᓂᖏᓐᓂᒃ. ᐅᓗᕆᐊᓇᖅᑐᖅᑲᖅᑐᑦ ᑲᑎᖅᓯᖅᑕᐅᓗᑎᒃ ᓅᑕᐅᔭᓴᐅᓗᑎᒃ ᐊᑦᑕᑯᖅᑕᐅᓂᐊᕐᓗᑎᒃ ᐃᓚᖃᕐᓗᓂ ᐅᓗᕆᐊᓇᖅᑐᖅᑲᖅᑐᑦ ᓄᓇᓯᐅᑎᑦ ᐊᒻᒪ ᐱᖁᑎᑦ ᐱᖁᑎᑦ ᐲᔭᖅᑕᐅᓯᒪᔪᑦ ᐅᓗᕆᐊᓇᖅᑐᖅᑲᖅᑐᑦ ᐊᑦᑕᑯᖅᑕᐅᓗᑎᒃ ᓴᒡᒐᖅᑕᐅᓂᑯᓄᑦ ᐅᑕᕐᓇᖅᑐᓂᒃ ᓄᓇᓯᐅᑎᑦ ᐊᑦᑕᑯᓄᑦ. ᑯᓕᐅᕌᑦ ᐲᔭᖅᑕᐅᓗᑎᒃ ᐊᖅᑯᑎᓃᑦᑐᑦ ᐊᒻᒪᓗ ᓇᒥᓂᖅ ᐃᖅᑲᖅᓯᖅᑕᐅᓂᑦᑐᑦ ᐅᓗᕆᐊᓇᖅᑐᑦ, ᑭᓯᐊᓂ ᐊᖅᑯᑏᑦ ᑕᐃᒪᐅᖅᑕᐅᓗᑎᒃ.

ᑕᐃᑲᓂ ᐃᒪᖓᓂ ᓄᓇᒥ, ᖃᖓᓂ ᓇᐸᔪᑦ ᑕᐃᒪᓐᓇᑦᑕᐃᓐᓇᖅ ᑲᒪᒋᔭᐅᓗᑎᒃ; ᑕᐃᒪᓐᓇᐅᒐᓗᐊᕐᑎᓪᓗᒍ, ᑕᒪᕐᒥᒃ ᐃᓚᓕᒫᕐᒋᑦ ᓴᐳᔾᔭᐅᓂᐊᖅᑐᑦ ᐊᒻᒪᓗ ᐊᐅᓚᑦᑎᑕᐅᓗᑎᒃ ᓄᓇᒋᓐᖓᑕᓄᑦ ᐃᒋᑕᐅᔅᓯᖅᑐᕐᓗᑎᒃ ᑕᐃᑲᓂ ᓴᐳᔾᔭᐅᓗᑎᒃ ᒎᔅ ᓄᓇᖓᓂ ᐅᕝᕙᓘᓐᓃᑦ ᖃᓂᒋᔭᖓᓂ ᑐᓚᒃᑕᕐᕕᒃ. ᑕᒪᕐᒥᒃ ᐃᓂᖏ, ᑕᐃᒪᓗ ᐃᒡᓗᑦ ᐊᒻᒪᓗ ᓴᓇᕐᕈᑎᑦ ᐲᖅᑕᐅᒃᐸᑕ, ᐃᓂᕕᓂᑐᖃᖅᑎᑦ (ᓇᓕᐊᑐᐃᓐᓇᖅ ᐅᔭᕐᓂᐊᕈᑎᑦ ᓴᓗᒻᒪᖅᓯᒪᔪᑦ ᓇᑎᖅᑎᑦ) ᐊᕐᕌᒍᑦᑕᐃᓐᓇᖅ ᐊᑐᖅᑕᐅᓂᐊᕐᒪᑕ ᑕᒪᐅᖓ ᐊᕐᕌᒍᓂ.

ᐊᕙᑎᓕᕆᓂᕐᒥ ᐊᐅᓚᑦᑎᓂᖅ

ᓴᐲᓇᒃᑯᑦ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐊᐅᓚᑦᑎᔾᔪᑎᖏᑦ ᑎᑎᕋᖅᓯᒪᔪᕐᒦᑦᑐᑦ 10-ᒥ, ᐊᑐᐃᓐᓇᐅᑎᑦᑎᔪᖅ ᖃᓄᐃᓕᖓᓂᓇᔭᖏᓐᓂᒃ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐊᒻᒪ ᐃᓅᓯᕐᒧᑦ-ᑮᓇᐅᔾᔭᐅᑎᓄᑦ ᖃᐅᔨᓴᕈᑎᓂᒃ ᐊᑐᓕᖅᑎᑕᐅᔪᒃᓴᑦ ᑕᐃᒪᙵᓂ ᐊᐅᓚᑎᓪᓗᒍ ᐅᔭᕋᖕᓂᐊᕐᕕᒃ. ᐊᐅᓚᑦᑎᔾᔪᑎ ᐃᓚᓕᐅᑎᓯᒪᕗᖅ ᐅᐸᓗᖓᐃᔭᐅᑎᓂᒃ ᐊᑐᖅᑕᐅᔪᑦ ᓈᒻᒪᐅᑎᔪᓐᓇᖅᑐᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧ, ᖃᓄᐃᓕᑦᑕᐅᓕᔾᔪᑎᒥᒃ ᑐᙵᕝᕕᒥᒃ ᐊᒻᒪᓗ ᐊᑐᒃᑲᓐᓂᖅᑐᒃᓴᐅᓂᕐᒧᑦ ᐱᕙᓪᓕᐊᑎᑦᑎᓂᕐᒧᑦ. ᐃᓗᐊᓂ ᖃᓄᐃᓕᖓᓴᓇᐊᕐᑲᕐᓂᕐᒧᑦ, ᐊᑕᐅᓯᖅ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐸᕐᓇᐅᑎᑦ ᑎᑎᕋᖅᖃᖅᑕᐅᓯᒪᔪᑦ ᑲᒪᒋᔭᖅᑐᒃᓴᐅᓗᑎᒃ ᑕᒪᐈᖕᓂ ᑲᓪᐸᓂᐅᔫᑉ ᖃᓄᐃᓕᐅᕐᓂᓇᔭᖏᓐᓂᒃ ᐊᒻᒪᓗ ᐃᓗᓂᖅᑲᓇᑦᓗᓂ ᓇᓗᓇᐃᔭᑦᑎᐊᖅᓯᒪᔪᓂᒃ ᐋᖅᑮᒍᑎᒃᓴᓂᒃ ᐊᒻᒪᓗ ᖃᐅᔨᓴᐃᓐᓇᐅᔭᕈᑎᓂᒃ ᐊᑐᓕᖅᑎᑕᐅᔪᒃᓴᐅᓗᑎᒃ ᐱᓕᕆᐊᖅ ᐊᐅᓚᓂᓗᒃᑖᖓᓂᒃ ᑕᐃᒫᒃ ᐲᖅᓯᓂᐊᕐᓗᓂ ᐅᕝᕙᓘᓐᓃᑦ ᒥᑭᓈᖅᓯᒥᐊᕐᓗᒥᑦ ᐱᐅᖕᒋᑦᑐᓄᑦ ᐊᒃᑐᐊᔾᔪᑕᐅᔪᓂᒃ. ᐊᐅᓚᑦᑎᔾᔪᑎ ᓴᖅᑮᔾᔪᑕᐅᒋᕗᖅ ᐊᑐᒐᒃᓴᐅᔪᓂ ᐊᐅᓚᑦᑎᔾᔪᑎᓂ ᓇᓗᓇᐃᖅᓯᔾᔭᑕᐅᔪᓂᒃ ᒪᓕᒐᖅᑎᒍᑦ ᐊᑐᖅᑕᐅᔪᓇᐊᓕᖕᓂ ᑐᕌᖓᔪᓄᑦ ᐱᓕᕆᐊᕐᒧᑦ, ᐊᒻᒪᓗ ᐊᑐᓇᐊᖅᑲᖅᑎᑕᐅᓯᒪᔪᓂᒃ ᐋᖅᑭᑕᐅᓯᒪᔪᑦ ᐱᒋᐊᓂᓇᔭᖓᓂᒃ ᐱᓕᕆᐊᑉ ᐱᔪᓐᓇᖅᑎᑕᐅᔭᑎᓂᒃ ᐊᒻᒪᓗ ᐊᑐᓇᐊᖅᑲᖅᑎᑕᐅᓯᒪᔪᑦ ᑐᕌᖓᔪᓄᑦ ᐊᑑᖅᑲᖃᔭᖅᑐᓄᑦ ᒪᓕᒐᕐᓂ, ᒪᓕᒐᒃᓴᓕᐊᓂ ᐊᒻᒪᓗ ᐱᔪᓇᐅᑎᑦ ᑎᑭᐅᑎᔭᐅᓯᒪᒐᓗᐊᕐᒪᖔᑕ. ᑕᒪᒃᑭᖅ ᐱᓕᕆᐊᕐᒧᑦ ᐃᖅᑲᓇᐃᔭᖅᑎᖏᑦ ᐊᒻᒪᓗ ᑳᓐᑐᕌᖅᑲᖅᑐᑦ ᒪᓕᑦᑎᐊᕆᐊᖃᖅᑐᑦ ᑕᒪᒃᑯᓂᖓ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐸᕐᓇᐅᑎᓂᒃ. ᐅᓂᒃᑳᓕᐅᕐᓂᖅ ᐊᒻᒪ ᑎᑎᖅᑭᓇᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᔪᓇᐊᓖᑦ ᑕᒪᒃᑯᓄᖓ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐸᕐᓇᐅᑎᓂᒃ, ᑮᓇᐅᔭᓂᒃ ᖃᐅᔨᓴᕈᑎᓂᒃ, ᐊᒻᒪᓗ ᐊᐅᓚᑦᑎᓂᕐᒥᒃ ᕿᒥᕐᕈᓂᕐᒥᒃ ᐊᒻᒪ ᐋᖅᑭᒋᐊᕈᑎᓂᒃ ᓇᓗᓇᐃᔭᑦᑎᐊᖅᓯᒪᕗᖅ ᐊᕙᑎᓕᕆᓂᕐᒥ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐊᐅᑦᑎᔾᔪᑎᖓᓂᒃ ᐊᑐᐃᓐᓇᐅᑎᑦᑎᓂᐊᖅᑐᖅ ᓈᒻᒪᒃᑐᓂᒃ ᐋᖅᑭᒍᓐᓇᐅᑎᓂᒃ ᖃᐅᔨᓴᖅᑕᐅᔭᓂᙱᖅᑐᓂᒃ ᑐᓂᓯᑲᐅᑎᒋᔭᖅᑐᑎᒃ ᑕᐃᒫᒃ ᓈᓚᙱᑦᑐᒃᑯᓗᐃᕐᑕᐅᓂᐊᕐᒪᑕ ᓄᓇᒥᙶᖅᑐᑦ ᐅᕝᕙᓘᓐᓃᑦ ᐃᓅᓯᓕᕆᓂᕐᒧᑦ-ᑮᓇᐅᔾᔭᐅᔪᓐᓂᑦ ᐊᕙᑎᖏᓐᓄᑦ.

Unipkaahak Naililaakhimayuk

Tamna Hanningayumiittuk Havaahak (Havaahak) gold-mik pakitiyumayut nanminigiyauyuk ukunannga Sabina Gold-mik unalu Silva Koapaliisi-kunnit (taiyauyuk Sabina-mik) ittuk Kitikmeot Uataani Nunavutmi. Ungahiktilaanga 400 kilamiitauyuk Ikaluktutiap kivaliani, pingangnaanilu, 95 kilamiitauyuklu Kingaumit, taununga pingangnaani, kivalianilu ittuni, imaalu ungahiktilaakakhuni 520 kilamiitanik Yalunaimit, Nunatiami.

Tamna havaahak aviktukhimayuk malguuyut nayugat paagutiyumayait apkutit ukiumi atuktuhat: Goose Nayugaa, Mariin Liitaun Nayugaa, unalu maliktaa takyup hinaa kivataani Kingaup. Sabina titigaktuk Nunapta Avatinganik Kimilguktaunik Taiguahak naunaiyagiami ihivgiugiamilu hapkuat Avatinganik inuknutlu ayughautipkaiyut piyut hapkuninnga Havaahak paakhimayaa piyakhangit naunaikhimayuk uumani Nunavunmi Nunataagutit Angigutinga unalu Nunavut Ayughautiyuk Ihivgiuknik Katimayiit Maliktakhait Upalungaiyakninganut uuma Avatinganik Ayughautiyuk Taiguahak uumunnga Hanningayup Havaahaanut (NIGB Naunaitkutinga Nampa 12MN036; NIGB 2013).

Sabina hanayumayut uyagakhiuvikmik kayangnaittumik, Avatinganut munagiyuk, ikayuutauniaktuklu tamainnut ilauyunut. Sabina aatjikutaliugniaktaat nakuuyumik munaktiuyumik nakuungiktailigiami inuit aaniaktailininnganut avatinganiklu ihagiagiyumik maniliuknikmut. Tamna Havaahak pipkaitjutiniaktuk ihagiagiyauyunik ayuikhaknik havaakhanginniklu, angikliyuumiktumiklu maniliuknik havaanginni, inuknut Kitikmeonmi Nunavunmullu tamainnut. Uyagakhiuktinnagit Naunaiyainik, iniktikhimayuk Juun 2015-mi, nakuuyumik ilittugiyut maniliukninnga uyagakhiukvikhaalu Hanningayup Havaahaa.

<u>Uyagakhiuknikmut Maliktutihaa</u>

Tamna uyagakhiuknikmut ihumaliukhimayaat naunaipkaiyut itkukhimayuk kulinik ukiunik uyagakhiukviuniaktuk piniataagungnakhiyut nutaamit ilihimayunit, atauttimut ore-havikaktuk uyagakmik uyagakhiukvikhak 19.8 milian tonnes-nik avaliittumut atauhiitlugu talvani Goose Uyagakhiukvingani. Kinikhiahimaniaktut pinniaguknakhiyuk uyagakhiukvikhaanik. Angikliyuumikhimayut havaahamut pipkaitjutiniaktuk kakugu Avatinganik Ihivgiuktaukpat.

Tamna Havaahak ilaliutihimayuk kaffiuyut uyakkanik pinahuaktamiknik: Umwelt, Llama, Eako, unalu Goose Uyagakhiukvingani ittut. Uyagak havikaktuk uyagakhiuktauniaktuk nunamit pualgikhuklugu nunap kanganit, angmaniaktuk hilamut imaalu ilanga nunap ataanit uhagakhiukniaktut talvanga akhaluutikkut akyakniaktut uyagakhiukviup mikhilaakvikmut autlagiangita upalugaiyakvianni. Uyakkat piumangitait tutkuktauniaktut tutkukviknut naunaiyagiikhimayunut kangani nunap imaaluuniin haulugit uyagakhiugiikhimaningmi. Immak puisikhimayuk atuknikmut uyakkat aviktuktautilugit havik unguvaktiktautitlugu tutkuktauniaktuk naunaiyakhimavikmi ikakuukviini talvani uyagakhiukvikmi, talvangatauk nuutaulutik haulugit uyagakhiukviugaluakvikmi.

Auyak tammaat iniktauniaktuk atuklu tulakvikhak takyup hinaani, Kingaukmiituk, unalu apkutit ukiumi atuktauniaktut pulaakattagiangita uyagakhiukvit.

<u>Havaahak Atuktakhangit</u>

Uyagakhiukninga Hanningayukmi Havaktautaaktuk 27-nik ukiunik. Ihumagiyauyuk uyagakhiukviup upalungaiyagninga hulilukaagningalu pilihaalikniaktuk atulihaalikkat 2016 (tautuklugu kiukut 1). Uyagakhiuknia naanniagungnakhiyaa kulit ukiut, maliguptigu titikkat naunaiyakhimayavut. Sabina kinnikhianiakmiyuk taamna uyagakhiukvik umiktinnagu Imai umikvia takhiyuumiklugu Pakittigumik.

Kiukut 1. Uyagakhiuknik

Atiit	Hulukaakniit	Kaffini havaktuhat	Ukiunga
Upalungaiyaknik ikluliunik	Upalungaiyaknik, nuna havaklugu, iklukpat, hanalgutit, uyagakhiukvik upalungaiyaklugu	Hitamani ukiuni	-4 to -1
Uyagakhiuknik	Uyagakhiuknik, upalugaiyakvialu hanalugu, umiktikmut nuna utiknahuaklugu tikitkakhimayutut	Kulit (10) ukiut	1 to 10
Nuna utiknahuaknia tikitkaakhimayutut umiktiliklutik	Iklukpat unguvaktiklugit, umiktiliklutik, nuns utiknahuaklugu, WRSA umiktiknik, imak immiktaaliklugu kimaktahak	Talimat, Pingahutlu 8 - naatlugit*	10 - 18
Umihimahaakkat Munaginik	Munaginia imap niukaknia, nun tautuknia, nuna imaklu kanugikpat	Tallimani (5) ukini*	18 - 23

**ukiut naaluangittut iinut.*

Pikaktut gold uyagaliughimayut kakugu taimaaktauniaktuk, talvuuna uyagakhiukvinga umikniaktuk ihuakhakninnganut. Una ihuakhaininnga, ihumagiyauyuk 8 ukiut naaniaktut, uyagakhiukninnga, hanalgutait, ukuatlu iglukpait, tuniyauniaktut ahinut ukuatlu Uyagakhiukvingalu utiffaaklugu uyagakhiukvitinnagu ayukhautikangittumik avatinganut. Umingningani munaginiaktut kakugugaaluk taimaa naunaigiami nayugaa hunavaluittumik nakuuyumiklu piluni.

Himmautikhangit

Himmautikhangit Havaahakmiklu naunaiyaghimayut piplugu hapkununga maliktakhanut: ayuknaktunut pittaakninga; akingit; pittaakninga ayuikhautigiyauyut nunapta hilataanut; ihuakhakninganut utikninganutlu uyagakhiuguigumik. Hivumuuktitluta ihumagiyahagiyavut, allamiluak hivumuugutihamik ihumayuhauyugut nunalaat ihuagiyaihaita imaaluuniin kanuk piluakniagiahapta ihumavat pittaagninga ihuahigiami nakuuyumik inuunikmut maniliugutininga pipkaitjutingit.

Malguuk himmautikhat naunaiktitauyut. Nayuganga 1-mi himmautikhangit naunaiktitaa kitut pilluakgumayangit aatlatkiinut piyukhat pipkaitjutigiami havaahak, una uuktuutigilugu nunap kangani angmayuk uyagakhiuvik uvunga nunap ataanit uyagakhiuknikmut. Talvanga ihumaliugumik tahapkununga angitkiyauyut himmautikhangit, tuklia nayuganga himmautikhangit ihumagiyauniaktut pinahuaklugit ihuaghigiami havaak. Hapkuat himmautikhangit ihumaginiaktait aatlatkiinguyut kanuktut piyaamingni tamakmik pilluakhimayuk himmiklugitlu ihivgiukningit piniaktaik pigiami nakuutkiyauyuk atuktauyaangani. Havaknikmut hivumuuknik himmautikhangit ihuakhaktitauniaktuk ihivgiuktaklugulu aatlanguktitauniaktaa kingullikpaanga havaahak ihumaliugut.

Maniliunik Aulapkaitjutingalu Hilatiptingni

Tamna havaahak naunaiktitaa akhuugutauyuk inuknut maniliunikmut ikayuutauniaktuk. Uyakkat havaktaungitpatta, tamna pittaagninga ulapikutautjutit ihumagiyangitlu maniit pipkaiyaulimaittut. Atauttimut GDP (Nunakput Kanatami maniliugaangami inuit ihumagiplugit ukalikpaktut tahapkuanguuk ikayuktauniaktut Imaa) Tamatkikguptigi manic tikinniaktuk nanaptingnut $500 milliat taala Iklukpaliuktitlugit. Havaahak ikayuutauniaktuk Nunavutmiunut naaniagungnahiyu $44 miliat taalamut ukiuni malgukni. Iklukpaliuknik havaktitiniaktut 4,300 inuit naatlugit tugaakhimalugit ukiuk atauhikmi, tugaakhimaitumiklu inuk kihimi niuvaaviitlu atuklugit havaakhaliukhimayutlu tamainni Kaanatami ikayuktauniaktut.

Atauttimut Kaanatami GDP Ayuikhautigiyauyut Havaahakmi itkukhimayut $2.5 miliat taalamik 10 ukiunik angmaumagumi. Atauttimut inkam taksi akiliktuhak naavyakniaktaa $400 miliat taala, pikaktuk $200 miliat kaanatamut akiliktuhak unalu $200 Nunavutmi/aviktukhimayumi taaksiliukninganut maniliukutikhangit. Havaahak amihumik ikayuutiniaktaa Nunavut tunilunilu $380 miliat taalamik GDP-mik Nunavutmi aulapkaininganut. Havaahak ihumagiyaatlu tamna atauttimut ihumaliugumik, ihumaliungittumikluuniit havaakhaliukhimayuklu Kaanatami havaahaliukniaktut 28,000 naalugu havaktiuyukhanik taimaa kullit ukiuni.

Hivitutilaangani havakviup, Sabina kinikniaktut havaktihanik ayungitunik ihumayunik imaa ilihimayunga uyagahiunikmu imaalu aaniktailinikmutlu ayungitunga havaat hivulikmi nunavutmiutanut uuktuktitkaaklugit.

Nuutinik, Nayugakhanginnik havakhakhiuktiuyut hanalgutinginniklu pipkaitjutauyut

Upautiyaagani ungahiktuk nuna atukluaguyaat tingminik aullaagut ukiuk tamaat; malguuk angmaumayut takyukut akyakvikhak Kingaukmut; unalu ukiumi apkutikhak atayuk nayuganginit. Tulaktukvihak pikagniaktuk tamaat ukiuk tamaat milvik talvani Goose Nayugangit uyagakhiuktitlugit. Talvanittauk tulaktukvihami Kingaukmi milvikakniaktuk hikumi ukiumi imaalu auyamittauk imakmut milutik. Havaktut havakattaktut Goose Uyagakhiukviani ikayuktauniaktut tingmitikut havaktingit tingmitjutauniaktut Inmittinmit, Yalonaimit, Ikaluktutiamit uvangalu Kugluktumit. Tatja atugninga halikaaptat ikayugiami uyagakhiuktimut Havaktut pihimmaakniaktut mikhaanut Sabina uyagakhiukhimmaagninga unalu avatinganik munaginik akhuugnik uyagakhiuktillugit iklukpaliuknik unalu aulapkaininga.

Tamayahat tikitpakniaktut auyami umiakkut. Tamayahat tingmivakniaktut ukuninga umiat tulakviinit: Ukuat Bécancour, Quebecmi kivaliptingni, ukuatlu Vancouvamit, British Calampiami uallinikmi. Tulakviik atuktauniaktuk humungauniinut tamayat imaalu nunat ausaimi, Kanatamiingittut atuktauniagungnakhiyut. Tamayat Bécancourmi aullakniaktut umiakkut ukuaklu kalitauhimayukut imaalu tamayat Vancouvami umiakkut aulakniaktut. Umiat ukuatlu akyautikyuat umiat inmingnik uhiiyakpakniaktut. Ukitkiyat umiat atuktauiaktut uhiiyagiamingnik umiamit talvunga tulakvikmut.

Ukhukyuaktauk ukhukyuakakviit umiakkut nuutiktaulutik takyukut nuutlugutauk tukhuakkut tutkuumavinganut ukhukakvini talvani tulakvingmi. Umiakyuat Tulakvikhaat utakkitillugu nuutiktikhangit ukununnga havaahak uyagakhiukvingit ukiumi apkutikhak utakkigumiluuniit ihuaktumik umiak akyakgiamingni ausaimut.

Ukiumi apkutit hanayauniaktut taafuma havaahap attuktahaanik uuma Hanningayuk Havaavikhaani. Goose-Tulakvikhak Ukiumi Apkutikhak 160 kila-miitauyuk ungahiktilaanga. Tamna George Ukiumi Apkutikhak kiklinga apkutikhak atayuk George-mit uumunga Goose-Tulakvikhamit Ukiumi Apkutikhak 13 kila-miitauyuk ungahiktilaanga. Una ihumagiyaat imayukniaktuk mikhaagut apkut uuktugumyauyuk Kingaugup umianut Tulakvianit ukuatlu Apkutihainut titigaktauhimayagiiktuk una apkut ukiugaaluk auyamilu atuktuhhak. Hapkua apkutihat uuktukuyauyut ikayugianita Nunami aviktukhimayuni uyagakhiugumayuni ihuakhiyuumikgiami imaalu angikliyuumikgiangita uyagahiuktut Nunami aulaagutit uyagahiutut kinimhiayutlu apkutait ukiuk, auyak tamaat atuktaaktut. Hapkoa apkutit ikaakpak to ikkattunuanik kugalaanik auyaligaangat, auyami panikpaktut. Hapkua tukhualiktauniaktut apkutiliuligumik.

Havaahap Iklukpahait

Tamangmik havakvihat inmik iklukpaliukniaktut hapkua ilauyut: hiniktagviit, titikkikinik, Umiat Tulakviani, tutkuumavingit, ukhukyuaktuktuk pauwakuut janugiita, akhaluutinik ihuakhaivik, tamayautit, imak anakuniklu munaginikmut halummakhaivik.

Tamna Goose Uyagakhiukvinga Havaahamut uyaganut mikhilaagutikaktut aulagiangita upalugaiyakvik, ukik amaat atukpaktuhamik milvikaktuk, hitamauyut angmaumayut-uyagakhiugviuyut, hitamat nunap ataani uyagahiukvit, havakvik nayugautaaktut 465 havaktinik iklukpaliugumik (imaaluuniin 611 katitpata kinikhiayut uyagahiukvikhamik) iklukpaliunikmi ivanilu aullalikkata. Ukhukyuakakvik aktilaanga tatatkumi ukiuk atauhikmi naaniaktuk pingahuuyut kattakyuit 15 ML aktilangit. 40,000 metrik malguiktuklugu hanayauyuk tungavikhak tamayat tikitpata. Talvani AN Iklukpaani ukuatlu kagaktautit tutkukviit, aktilanga atuktautaaktuk tutkugumagumik 3,900 tonnes Amoniat Naitriit ukuatlu 3 tonnes kagaktautinik.

Tamna Umiakyuat Tulakvikhaat Kingaukmi ittuk 130 km tunungani-tunungavyaani uataani Goose Uyagakhiukvinganit. Hivullikpaami havaanga Nayugaa hanalgutinut, hunavaluit ikkakungit, ukhukyuak tamayangitlu ihagiagiyuk iklukpiliukninganut aulapkaininganutlu havaakvik. Tamna Umiakyuat Tulakvikhaat piliukhimayuk umianik kalikatagiami, ukuatlu tamayakakvik/hanavikhamiklu. Ulhukyuakakvingalu pikagniaktuk ukhukyuak hitamanik 15 ML tauyut ukhukyuakagvihat. Tamna havakvikhak iklukaktitiniaktuk 75 nut havaktinut iklukpaliuligumik uvanilu aulaligumik.

Ungahiknia uyagahiukiup ihumagiyahakkut ukununga inuuhivut, aaniktailinikmutlu ukuatlu ihuaktumik munaginahuaktahakkut akhalutit ukuatlu iklukpait munagitiaklugit. Hanalgutit ihuakhakhimaaklugit imaalu aaniktailinip tugaanganut titigait atutiaklugit ungahikmat ikayuktuhat. Taima, aaniktukakkat uvaptingnik munagiyahavut iklukpakakluni aaniktut upaktahaanut.

Pualgikhuknit Uyagakhiukviuyut ukuatlu Uyagat Akyakviit

Angmalihaaktitlugu uyagakhiukvik atukniaktait uyagak pualgikhuktaktik mikhilaaktiklugu ukuatlu uyakkat talvaniittut atugunaittut hanayaini ukiuk tamaat atuktahat apkutit, tulakvikhamutlu atuklugitlu, milviit takhilaaklugit, imaalu ikayuklugit hanayut ukuatlu ihuakhainik talvani. Sabina havakniaktut pualgikhukhimayunik/uyagaktakvikhanik atuktahatik kakugu uyagailiuligumik uyagakhiukviup uyagait nungulikkata. Talvanitauk umiat tulakvikhaani, mikiyut pualgikhukhimayut ukuatlu uyagaktakvikhanik hanahunguyait tahamna ihuakhagiangani. Humilikaak atukniaktut uyakkanik pualgikhukhimayait haufaaklugit humilikaak.

Uyakikinik Uyagakhiukniklu

Gold iluaniitpaktut uyagakni utukakauyuni 4-pillianik ukiukaktuni taimaittut uyakkat pakitauhimayut Kanatap uyakakniit, tailikpagait Kaniitian Siiltmik. Sulfait ittuk (una sulfait kaivaktuk uyagak mahakkaakluni, puyua uyagangukhimayuk) sulfait-ngukhuni. Uyakkat havikaktut sulfaikakniaktut 0 talvunga 5%. Silvatauk pakitauvaktut uyagakni havikaktuni. Silva haja ihumagingitakkut akilivalaakmatta kihimi uyagakhiukniaktakkut kinikhiatitluta goldmik. Gold pinnikhuni nauvaktuk goldngupluni, ilaani takunaktut iikkut. Taamna uyagakhiugumayakkut Hannigayami naattaaktut 19,792 kt (atauhik tausit tonnes) talvani 5.70 grams/per tonne (g/t) piyaamingni goldmik 3,628 koz (k=1-tausit × 3,628 aunsis) ilalugu tamna pakitaktik.

Tamna uyagak havikaktuk tamainni angmaumayuni uyagakhiukviit (Umwelt, Llama uvanilu Goose-Havakviluangata) uyagakhiuktauniaktut atuklugit akhaluutit ukuatlu pualgutit uyagakhiukvikmi nunap kangani. Tamaita hitamat uyagahiuktahat attaaniimata nunap angmaklugu uyagakhiuktahak. Ititilaanga angmaunayuk uyagakhiukvik ittilaakangniaktuk 150 miitamik nunap ataani. Tamaita hitamat uyagakhiukvihat naunaiktauyut maniliugutiginiaktait uyagakhiugiami nunap ataani. Aalatkiit uyagakhiukniit uuktukuyauvaktut nunap ataani hunaungmanaat nalvaaktahaktit. Umwelt uyagahiuktauniaktuk nunap kanganit, Llama unalu Goose uyagakhiuktauniaktut nunap ataanit atuklugit hannigayumik pualgikhuliklutik, unalu Echo nunap ataanit uyagahiukniaktut atuklugit nunap ataani uyagakhiukniit.

Uyagak havikaktuk Goose-mit havaanganit tutkuumaniaktaat kiklinga 400 kt (ukumailitaa kilograms per tonnes) ukuat uyakkat akitunikhat, 750 kt akitunikhaa kitkaniituk, 2,000 kt akikitkiyauyuk uyagahak.

Uyagakhiugnik ilitagiyauyuk kaffinik kakugunnuak tikiutiniaktangit uumani Havaahak Nayugaa. Sabina kinikhimmaakniaktuk hapkuat pitillugu Uyagakhiukvinga ihuaghaitillugit aulapkaininnga piniaguknakhiuk uuminnga hiamitipkaiplugu uyagakhiugvikhanganik avataani nutaak ihumagiyanginnik. Kitut ilakunginnit uyagakhiugniaktaik saatalaingit uuminga nutaak ihumaliuktauyuk aulapkaininnga pikmat Goose-mi taimaa piliugiami iluittumik atukninga atuktauyunit aulapkaitjutikhat.

Ikkakut Uyakkat ukuatlu Ikkakungit Kuviviit Munaginiit

Tamna Kuvigakviup Tutkuumavia ittuk Goose tunungani-tunungavyaani uataani uyagakhiukviup. Piinagianiaktuk 4 Mt kuvigakniit uyagakhiuknip ikkakungit havaktamiknit tutkukhimayut uyagakhiugvikhangani malguk katitikhimayullu ikkakungit pualgikhimanikmi tutkuhimayut. Nunangalu kuviyuk kuukkamut tahikmutluuniit kiklingalu iliugahimaniaktuk angiyumik hiliktuk polyethylene-mik (HDPE) tahiyuaktumik puukangniaktut iliugaihimayuklu hukatlugu iliyauniaktut kitkani geotextile-mik ahiguktautailiyaangani.

Goose Uyagakhiukvinga atuktut pingahunik ilakut uyakkat tamayakagvikhainik matuhimayaangini ikkakut aasit nautaakmata anilaiyakhimalugu imaalu ukuat ikkakut anilaiyakhimalugit. Taamna ikkakuukvik tatatpat uyakkanik, hauyauhunguyuk uyakkanik atugunaitunik. Uyagahiukviup hivitutilangani, naanniaktavut 77 Mt uyakkannik atugunaitaptingnik, ilauplugit avatkujutit. Talvanga, 38 Mt aasitmit havaktaaktuk uyagak, 33 Mt aasiliugunaitut, imaalu 6 Mt avatkutauniaktuk.

Nuna utiknahuaklugu havagalitpakhunguyaat uyagahiuktitlugit, matutiklugit tamaita ikkaguukviit uyakkat aaniknaktut ukuatlu aasiliuktaaktut atuklugit 5-m aasiliulimaitumik palaastik munagiyaangani kikimit uvangalu matuhimanikmit.

Uyakkanik Havaknik

Aulapkaitillugit, tamaita Uyagak havikaktuk havaktauniaktuk atukluni atuktaunginnaktumit akhuugutauyumit hakugikninganik unalu saiyanaitiisin-mik[i] atuklutik. Tamna havakviuyuk tigumitaaktuk naavyakhugu 6,000 tonnes-nik upluk tammaat havakhugit uyakkat havikaktut. Pingahuuyut aatlatkiit iklukpat nayugaginiaktaa: uyakkanik ahiguktivik; hiukkanguktunik Uyagak havikaktuk nayugakhaa ilauplunilu pipkaitjutigiyumik piffaagutingalu; unalu havakvilluagiyauyuk. Tamna havaak pikagniaktuk uyakkanik ahiguktigutimik (Hivulikpaamik, imaalu Tukliuyuhanik), kaimmallugittumit pilugyaktigvikmi ahiguktigut, akhuugutauyumik hakugikninganut, saiyanaitiisin-mik atuklutik kaapin-mi kuvilaitkutimut piplugu gold-miklu piplutik kaapin-kakluakhimayumit. Gold Uyagak havikaktu-mik kikkagiktuk pilliuktauniaktuk uyagakhiukvikmi angivallaangittumik mikivallaangittumiklu akinga uuminga 350,000 ounces-mik atauhikmut ukiumi. Talvanga uyagaktaminik agyaktauniaktuk tingmitikkut uyagakhiukviilgumi gold unguvaktiktaufaaktuhak.

Avatinganik Munaginik

Sabinaup Avatinganik Munaginikmut Pipkaitjutininga pihimayuk Makpigaangani 10, naunaiyakhimayaat tungavikhak uumunga Avatinganik inuknut maniliugningalu munagiyanik atuliktitauyukhak iniktitauyukhak uyagakhiuktillugit. Pipkaitjutininga ilaliutiyuk maligangit havaktuk atuknaktuk aatlatkiini munaginikmut, kayangnakninga maliganga nungulaittuklu pivallianik. Uumani tungavingani, avaliittut munaginikmut ihumaliugutauyutlu piliukhimayut ihuakhigiami tamaita pitjutingit uuminga havakviup hulilukaagniit pihimalugulu naunaiyakhimayuk mikhipkakhimayut aktikkulaagutingit munaginikmullu pinahuagutit atuliktitauyakhak atuktillugu uuminga Havaahak piigiami ikikliyuumigiamilu nakuungittumik pipkaitjutiyaanik. Pipkaitjutininga naunaiktaalu aulapkaitjutingit havaangit piyut maligatigut piyakhak havauhikhamut, kanugiliugningitlu piliughimayuk talvani Havauhikhat angigutingit ukuatlu piyakhangit piyut ihuaktut maligakhat, maligutingit unalu laisikhat pipkaitjutauyut. Tamaita Havaahak havaktut kaantgaktiuyutlu ihagiagiyauyut maligiami hapkuat munaginikmut ihumaliugutauyuk. Naunaipkainik titikkikiniklu ihagiagiyauyut hapkuat munaginikmut ihumaliugutauyuk, ihivgiuknik, havaaklu uuminnga munaginikmut ihivgiuknik ihuaghainiklu naunaikhimayuk uumani Avatinganik Munaginikmut Pipkaitjutininga. Avatinganik Munaginikmut Pipkaitjutininga tuniniaktuk ihuaknik kiugiami munaginikmut kanugitaakhaanik tuulikhimaittumik ikikliyuumigiami piigiamiluuniit pittaakninga nakuungittut ikkakungit pipkaitjutauyut atuktaunginnaktumut inuknut maniliukninganik avatingani.

Imanganik Munaginik

Tungavilluanga atuktahakkut imak atuktaufaakhunguyuk imak kaangani ilakuuyut atayumit atukfaaktahak uyakkat uyagakhiukniani. Atufaakninga puplaktukvinga ittuk uumani atukfaaktahak uyakkat uyagakhiuknianut Tutkuumaviani Nayugaata pikagniaktuk kuvigakvikhamik tungavimik uunakutikhaklu atufaagutihamik insuliitikhimayumiklu nunap kaanganut palaastikmik tukhuakakluni. Aatlanik imaliuknik ihagiaginiaktuk takyuungittumik piyut pitillugit pikalluangittumik atufaaknik.

Unalu, takyukangittumik ihagiagiyauyut ikayugiami imakmit havakhimayumitlu imanga ihagiagiyauyuk Goose Uyagakhiukvingani, uumanilu Umiat Tulakvikhaani. Tamna Goose uyagakhiuvingit piniaktut tahikmit atilik Goose Tahik imiktaktaaklutiklu Angiyuk Tahikmit. Imakmik takyuiyakvikhamik pipkaitjutiniaktut niukkaguminaktumik imakmik tamainni uyagakhiukvingni piyaangini talvanga Kingaukmit. Takyuiyakhimayuk immak atuktauniaktuk tamainit uyagakhiukviknit.

Nuna tamainni uyagakhiuvingit natignanguyuk huittumik pihimayuk, ungahiktuliaktumik, ukiuk tamaat kuutigunga kuvipluni. Kihimi, tamaat pipkaitjutinga Uyagakhiukvingani imak munaginik ahinut pipkaitjutigilugu imanga haniani uyagakhiukviup havaangit aulapkaitjutikhangit ikikliyuumiktigiami ayukhautinginik. Tamna Goose-tahiani ittuk Uyagakhiukvinga ihagiagiyauyuk mikkakmik kuutigunganik ahianut piyukhak ihumaliugutlu Goose milvinga angikliyuumiktukhak ihumaliughimayuk ahinnungaugiami kuutigut tatja ingilgayuk angikliyuumiutiviani. Tamagmik hapkuat kuugalaat ingilgayut Goose Lake-mut aktilaangitlu aatlangughimainniaktuk, kihimi nayugaa anivinga tahikmut aatlangugniaktuk.

Goose Uyagakhiukvingani Piinagialakiyaami uyaganginnik, ilangit tamaatluuniit imaiyaktauniaktuk tahit. Llama Tahik imaiyaktakhak piinagialakiyaami Llamap uyagakhiuktahait unalu Umwelt Uyagakhiukvingani imaiyakyauniaktuk atugiangani Kaaniit imakakvikhaa imiktakvikhak. Tahapkua imaiyaktahavut titigaktauniaktut imaalu piliktinata angiktuhauyut imalikiyit. Tamna Goose nayugaluanga tukhuaktut hanaluta nunamik imak uataagut kuviyaangani kahaktaililugu tugaklugu talvunga Goose Tahianut.

Tamaita angmaumayut uyagakhiukviit ittut kikinikmi nunangani kihimi Llama ilauyuk Talik Tahiani ilaukmat Llama Tahianut. Imakaluagunaituk huna nunap ataanit. Kuukat apunmit mahaktunit unalu auyami nipalluanga ihuaghiniaktuk pupliktugumitku tahigakmut kuvigiami avatinganut. Imaiyagumitku uuminga nunap ataanit Uyagakhiukvinga piniaktuk atugumik aatlatkiinik imakmi nalayuniklu pupliktuutit ittut tamainni havaktuni, pupliktuktut ukunuuna kaffiuyunik kiviktiutinik. Goose Uyagakhiukvingani, tamaita imanga himmautiniaktuk Ilakunganit Tutkuumaviani imanga piniaktuk imaup munagivinganut.

Ikkakunik Munaginik

Ikkakunik hunavalungit katitiktauniaktuk munagivingani talvaniluuniin Uyagakhiukvingani Hunavaluknit ikkakungit ikikliyuumiktitauniaktut atufaaklugit imaaluuniin hunamik aalanguklugu atufagiangani. Tamna Goose Uyagakhiukvik atuliktitauniaktuk hauhimayunik ikkakulgilit kayangnaittunut angiktauhimayut hunavaluknit ikkakungit. Aatlat hunavaluit atuktangit talvannga kayagittumik tutkukniaktait akyakakvikagumik angikhimayunik uyagakhiukvikmi atuktauffaaliklugit ikkakukvinganiluuniit. Tamaita uyagakhiukviit innikvikakniaktuk ikkakunik ikualaaktigiami kayangnaittunik ikualaaktaaktuniklu ikkakunik uumingalu kayangnaktut ikkakunik tutkuumavikhaanik. Anakuit kiknagivyaktuklu imangit uyagakhiukvikmit hanaviiknitlu halummaktauniaktut atukhimayumi imak halummaktikvingani (himmautigiiktunik pipkaitjutiyuk alguyaktuktumit). Halummakhimayut anakuit iliugainiaktaat nayugakhaanut angiktauhimayumutlu nayugakhaani nunami, tahapkua Ilakut Ittuhat, unaluuniit imaklunik munaginik. Kuvigakkat piliukhimayuk ikikliyumigiami ahiguknikkat hukhaungikkatluuniin uuminnga kikinikmit.

Umingninga unalu Nuna Utiknia Uyagahiuktinagit

Sabina havaaginiaktaa nuna munagihimmaaklugu, utiknahuaklugu uyagahiutinatik. Iklukpakakviit pipkaiffaakhimaniaktuk iklut piiktaulutik uumani nunguvinga atuktauninganilu. Piluni utiknik imat akhuuktumiklu hakugikninga ihumagilluaktauniaktuk kingullikpaami Uyagakhiukviup uuyagakhiuknikninga. Una puuktuilutik matutigilutiklu umigiami uyagakhiukviup ikkakutik (Acid-liuktumik ikkakut uyakkat) atuklugit uyakkat nautilaitut aasitmik ukuatlu uyagakhiukvit tatatiklugit imakmik, havauhiklugitlu immat niukaktaaligiami. Ikikliyuumigiami imak halummakvinga, tamna angmaumayut uyagakhiukviit immikniaktait tahiup imanganik ikikliyuumigiangita piliugninga asit-nganik kuviyuniklu havigaliit. Uyagakhiukviup umiknia iit ukiut naaniaktaa imaalu malguk umiknit atuklugit (Haja unalu umiktagiiknik) atuklugulu talimat ukiut munaginik, nutkaktilugit takukattaakhimalugu. Taapkua malguk ukiut takuniaktaat nutkaktingnik iklukpaknik umiktiginik. Siksit ukiuttaut atuklugittauk immak uuktukattaaknia imaalu kingulikpaat utiknahuaknik imaalu nutkaktiknik hunalikaak talvaniituk.

Uyagakhiukniup maligait atuktauniaktut umiktigilugapta. Kayangnaktut hunavaluit atuktangit katititauniaktut uyagakhiukviilgumi ikkakugvingani ukuatlu kayangnaktut hunavalukutingit akhaluutinit hanalgutinitlu ahinut ikkakuutahat. Hanalgutit piiktauyuk ukunanga kayangnaktut hunavalukutingit igitauniaktuk angmaumayumi Uyagakhiukvinganut uumunngaluuniit umikhimayumut hauhimayunik ikkakulgilik piliukhimayut atauhikmi ikkakut uyakkat tutkuumaviini. Iklupait umiktitauniaktait naviktiklugit hauniaktait. Tukhuat unguvaktauniaktut apkutinit kuugalaat ihuaghiffaaklugit, kihimi apkutit ahiguktaulimaittut.

Talvani umiat tulakvikhaani, nunap kanganiittut ahiguktauniaktut, hauyaulutiklu; kihimi hauyahat umiakut akyaktauniaktut tahamunga Goose nayugaani uvaniluuniin haniani umiakakviup. Tahapkuat tamangmik, iklukpat ukuatlu hanalgutit unguvaktaukpata, nayugait (uyagaukpat imaaluuniin uyagaliak) kuvittalakiniaktait humutlikaak.

Ukuat havauhiit ilivaktait tahapkua ikayuknahuakhugu nuna munagiplugu imaalu pinahuaklugit havaknik nakuuyuk ikayugiangita ikihinahuaklugit aanniknaktut nunaptingnut imaalu unguvaklugit aanniknakniaktut nunaptingnut imaalu inuknut havaahakhiuniinut.

Preamble – Structure of Volume 2

Sabina
GOLD & SILVER CORP.

Preamble – Structure of Volume 2

Sabina's Back River Project is located in a remote region of central Nunavut. Current access is by air transportation only.

The Project consists of the development of mining deposits at the Goose Property which also requires the development of access infrastructure to these sites. This access infrastructure consists of the:

- expansion of the airstrip at the Goose Property;
- establishment of the Marine Laydown Area (MLA) located on Bathurst Inlet;
- development of a winter ice road to link the MLA to the Goose Property; and
- development of a winter ice road connection to link the George Exploration Cap with the MLA and the Goose Property.

The establishment of access infrastructure is a large component of the Back River Project. This infrastructure will be established at the onset of the project development and will remain in use for the life of the Project.

Section 1 provides information on the Proponent, Project location, land tenure and current exploration activities at the Goose and George properties.

Section 2 presents an overview of the Project design considerations, development phases, duration and permitting requirements.

Section 3 discusses the potential for ongoing and future development at the Goose and George Property Areas.

Section 4 presents the alternatives considered for the development of the Back River Project.

Section 5 discusses the economic operating environment as per the requirements of section 6.5 of the NIRB guidelines for the development of the EIS.

Sections 6, 7, and 8 describe the Back River Project as it is intended to be developed by Sabina. As directed by the NIRB, the project description has been structured to "present an overall development plan describing the Project development phases (site preparation, construction, operation, maintenance, any potential modifications, temporary closure, final closure, and post-closure), relevant timeframes, works and undertakings associated with each of these phases" (NIRB Guidelines 6.2). In accordance with this directive, Section 6 presents the description of all project components and infrastructure that will be constructed at the onset of the project development and remain operational for the life of the Project. This includes:

- Section 6.4: The Marine Laydown Area;
- Section 6.5: The Winter Ice Roads; and
- Section 6.6: Mining support infrastructure at the Goose Property which is the main Project site.

Section 7 focuses on the operation phase of the mine sites:

- Section 7.1 provides an overview of the resources and the baseline geological, mineralogy and hydrogeological conditions at the Goose and George properties.
- Sections 7.2 and 7.3 provide an overview of the mine plan and the associated infrastructure and equipment.
- Sections 7.4 to 7.9 present a description of the processing activities and the associated infrastructure at both MLA and Googe Property in use for the Operation Phase of the Project.
- Section 7.10 presents the water management strategy for the Operation Phase.

Section 8 presents the preliminary reclamation and closure plan for all Project components and properties as well as discussions of temporary closure for the possibility that operations are unexpectedly suspended.

Finally, Section 9 of this volume presents an overview of “associated monitoring and/or mitigation plans to be implemented in each of the development phases to eliminate or minimize adverse effects that might occur at various project stages for each Project element.” These management plans are based on the ISO principle of continuous improvement and adaptive management. These are living documents that evolve over the life of the Project and shall be updated as often as required. A more detailed description of Sabina’s Environmental Management System and content of the management plans is provided in Volume 10 of the FEIS.

The appendices include:

- Appendices V2-4A, -4B, and -4C which present alternative assessments for mining waste (waste rock and tailings), location of the MLA, and summary results of select ones, respectively;
- Appendix V2-6A presents a memo describing the basis and designs for Project logistics and transportation;
- Appendix V2-7A and -7B present Project hydrogeological and hydrology reports, respectively;
- Appendix V2-7C, -7D, and -7E present the Project geotechnical, geochemical, and waste rock storage area reports, respectively;
- Appendix V2-7F describes the background and design features for mineral processing;
- Appendix V2-7G presents the tailings management system;
- Appendix V2-7H and -7I present the Project water and load balance and water management system reports, respectively; and
- Appendix V2-7J includes the figures referred to in Volume 2.

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BACK RIVER PROJECT
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Project Description and Alternatives

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Acronyms and Abbreviations

Acronyms 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)
ABA	Acid-base Accounting
AP	Acid Potential
CCME	Canadian Council of Ministers of the Environment
CDA	Canadian Dam Association
DEIS	Draft Environmental Impact Statement
DFO	Fisheries and Oceans Canada
DWT	Dead Weight Tonnage
EMS	Environmental Management System
FEIS	Final Environmental Impact Statement
GDP	Gross Domestic Product
GN	Government of Nunavut
GNWT	Government of Northwest Territories
IDF	Inflow Design Flood
INAC	Indian and Northern Affairs Canada (now AANDC)
IOL	Inuit Owned Land
KIA	Kitikmeot Inuit Association
MCRP	Mine Closure and Reclamation Plan
MLA	Marine Laydown Area
ML/ARD	Metal leaching/acid rock drainage
NIRB	Nunavut Impact Review Board
NLCA	Nunavut Land Claims Agreement
NP	Neutralization Potential
NPC	Nunavut Planning Commission
NPAG	Non-potentially acid generating
NRC	National Research Council
NRCan	Natural Resources Canada
NTI	Nunavut Tunngavik Incorporated
NWB	Nunavut Water Board

NWT	Northwest Territories
OPEP	Oil Pollution Emergency Plan
PAD	Permanent Alteration to, or Destruction of, Fish Habitat
PAG	potentially acid generating
PDA	Potential Development Area
PPC&F	post pillar cut-and-fill
RCMP	Royal Canadian Mounted Police
SNP	Surveillance Network Program
TF	Tailings Facility
TSF	Tailings Storage Facility
TK	Traditional Knowledge
US EPA	US Environmental Protection Agency
VEC	Valued Ecosystem Components
VSEC	Valued Socio-economic Components
WRSA	Waste Rock Storage Area

1. Introduction

1. Introduction

1.1 PROPONENT INFORMATION

Sabina Gold & Silver Corp. (Sabina) is a public Canadian mining company (SBB: TSX) that is focused on development of its 100% -owned Back River Project (the Project). Company contact details are as follows:

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Sabina has been actively completing mineral exploration in the Kitikmeot Region since 2004; initially at the Hackett River Project and at the Back River Project since it was acquired in 2009. Through these continued programs, Sabina has developed a more robust corporate structure and workforce to support advanced exploration and continues to build toward project development and operations. In addition, as the exploration program has grown (initially with a camp of 25), Sabina has expanded its program to include camps that operate with approximately 200 people (between two sites) involved in exploration, engineering and environmental programs. Project advancement has also meant increased and more complex associated logistical support and resupply using overland winter road and all-weather road transport as well as air access using ice and all-weather airstrips.

These programs are completed under various authorizations and Sabina has complied with all terms and conditions of authorizations to date. In addition, Sabina updates and submits management plans to the appropriate regulatory authorities each year as well as maintaining a series of internal operating procedures to improve safety and environmental protection. Sabina has been very forthcoming with all levels of government during all aspects of project development and have developed a good relationship with community residents based on mutual respect and open communication. In 2007, Sabina was awarded Kitikmeot Inuit Association's (KIA's) environmental award for our camp operations and we continue to work with and support various community events and programs.

Although environmental incidents have occurred since Sabina acquired the Back River Project, none were significant and there are no known residual environmental liabilities. Sabina has an exemplary local employment and safety record over the ten years of exploration in Canada's Arctic. The Back River Project site is inspected on an annual basis by the permitting agencies and regulators. To date, no orders have been issued and Sabina has been in compliance with all terms and conditions. Over the past two operating years (2014 & 2015) five inspections were conducted by eternal parties with no non-conformances identified.

In 2009, at the time of the acquisition of the Property, a letter of credit (LOC) was provide to the KIA under the terms and conditions of the transferred land use licences. This LOC is held to meet site closure requirements. The LOC has been reviewed annually and has been increased numerous times as site enhancements have occurred.

Sabina intends to build a mine with integrity—one that is safe, environmentally responsible, and beneficial to all parties involved. Sabina intends to balance good stewardship in the protection of human health and the natural environment with the need for economic growth.

1.2 REGIONAL CONTEXT

The Back River Project is an advanced gold exploration project located in the West Kitikmeot region of Nunavut, as shown in Figure 1.2-1, at approximately 65° to 66° north latitude, and 106° to 107° west longitude. The Project includes the Goose Property Area and a Marine Laydown Area (MLA) in southern Bathurst Inlet, to be connected by winter ice road. The George Property will remain as a focus of ongoing advanced exploration and will have seasonal land-based access via winter ice road which may extend to connect with the proposed BIPR road corridor.

The closest communities to the Project are Kingaok, located approximately 160 km to the north of the Goose Property, and Omingmaktok, located approximately 250 km to the northeast of the Goose Property. The communities of Kugluktuk and Cambridge Bay are the closest major regional settlements. Kugluktuk and Cambridge Bay are likely sources of workers and contractors. Communities of the Eastern Kitikmeot region (Gjoa Haven, Kugaaruk and Taloyoak) are also likely sources of workers and contractors. Yellowknife, Northwest Territories (NWT) and other southern locations will also serve as a source for workers, goods, and services.

1.3 LAND TENURE

The Property comprises 45 federal mineral leases and 19 federal mining claims covering approximately 54,042 hectares. The Project is divided into the Goose Property and five exploration prospects: George, Boot, Boulder, Del, and Bath. All of the tenure is in good standing and a description of the tenure type, size, and ownership of each property is listed in Table 1.3-1. This table includes the six additional claims (10,730 hectares) that Sabina staked for the Boulder prospect in 2012.

1.4 MINERAL TENURE

There are six claim groups included in the Back River Property. These are a mix of federal mining leases and federal mining claims as can be seen in Table 1.3-1 and Figure 1.4-1. These cover approximately 54,042 ha. The mining leases have been surveyed by a registered Canadian land surveyor and do not require filing of annual assessment work; however, an annual fee of Cdn$1/ acre is required to maintain the leases in good standing. The mining claims have been surveyed and are marked with pickets along claim boundaries and claim posts at the corners of the claims.

All leases and claims are 100% owned by Sabina, and are currently in good standing. Annual reports are delivered to the KIA, Aboriginal Affairs and Northern Development Canada (AANDC), the Nunavut Impact Review Board (NIRB), and the Nunavut Water Board (NWB) as per the terms and conditions of authorizations issued for work done on the properties.

Figure 1.4-1 shows Sabina's claim and lease map of the Back River Property.

1.5 PERMITS, LICENCES, AND AUTHORIZATIONS

Table 1.5-1 presents the current authorizations and permits that are in place for the mineral exploration activities and baseline data collection activities that are occurring on the Project and other exploration interests held in the area.

1.6 PROJECT OVERVIEW

The Back River Project includes the Goose Property Area, the Marine Laydown Area situated in the southern portion of Bathurst Inlet, and interconnecting winter roads and associated spur winter roads (Figures 1.6-1 to 1.6-4). The mine plan for the Project is an estimated ten year operating mine life based on currently known resources, with a total ore feed to a single process plant at the Goose Property Area of 19.8 million tonnes. Continued exploration may extend projected mine life.

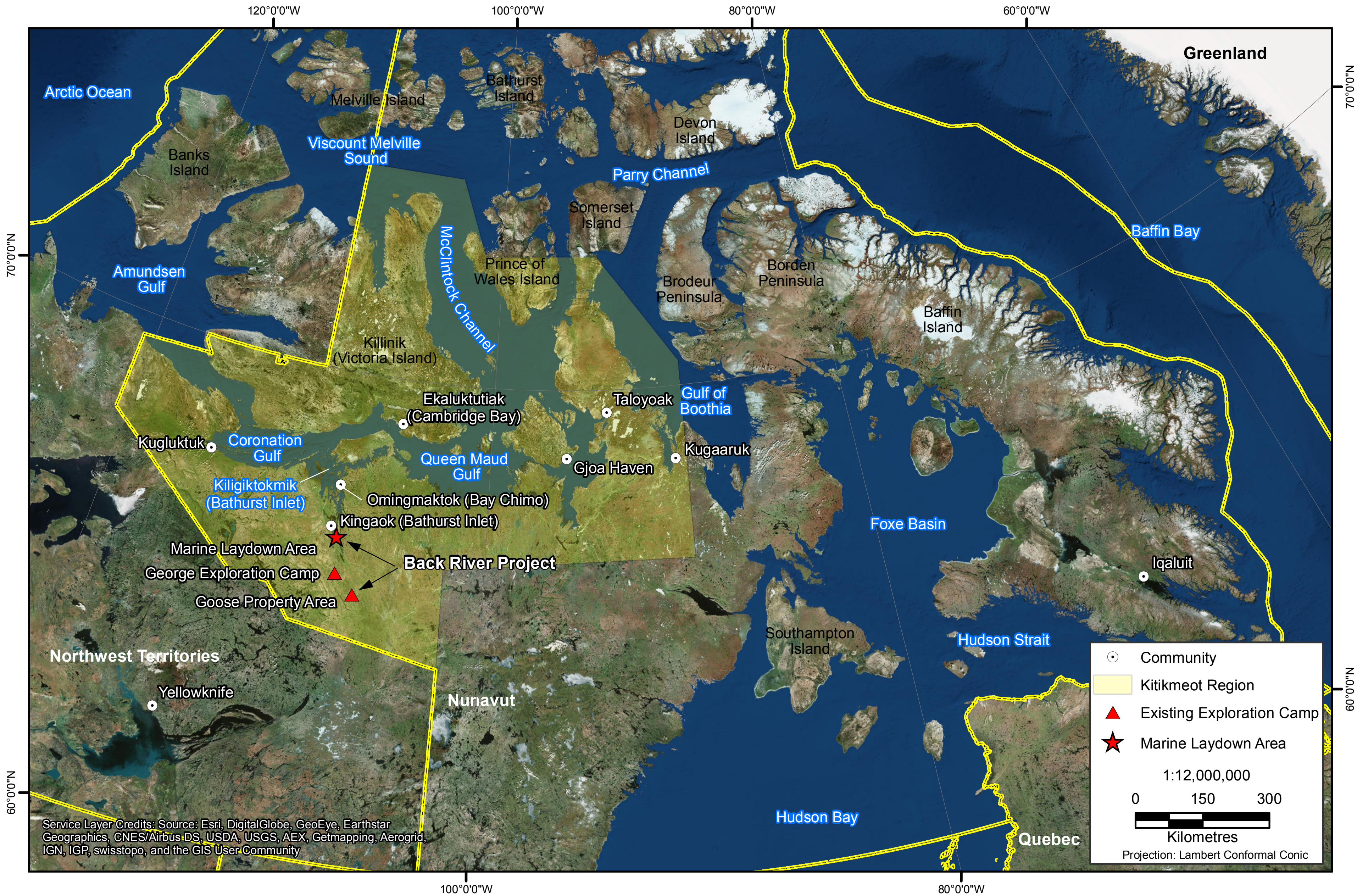

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Figure 1.2-1

Back River Project Location and Kitikmeot Communities

Table 1.3-1. Mineral Tenure Status (as of September 23, 2015)

Project/ Prospects	Tenure Name	Hectares (ha)	Tenure Type	Registered Ownership as of September 23, 2015	Expiry/ Renewal Date
Goose	3694	417.92	Federal Mining Leases (7)	100% in good standing	16-Oct-2016
	3695	410.27			16-Oct-2016
	3696	1,077.71			16-Oct-2016
	3697	1,101.80			16-Oct-2016
	3698	1,073.66			16-Oct-2016
	3699	1,004.00			16-Oct-2016
	3700	1,084.59			16-Oct-2016
	K12025	920.36	Federal Mineral Claims (3)	100% in good standing	19-May-2017
	K12026	662.42			19-May-2017
	F94558	800.69			9-Sep-2016
George	3562	69.48	Federal Mining Leases (19)	100% in good standing	9-Nov-2015
	3598	394.16			28-Dec-2015
	3599	821.11			28-Dec-2015
	3600	1,008.88			28-Dec-2015
	3601	1,097.91			28-Dec-2015
	3602	1,027.90			28-Dec-2015
	3603	1,078.08			28-Dec-2015
	3604	450.01			28-Dec-2015
	3605	1,036.81			19-Dec-2015
	3606	1,074.04			19-Dec-2015
	3607	1,033.97			19-Dec-2015
	3608	1,057.61			19-Dec-2015
	3649	1,046.92			19-Dec-2015
	3650	200.08			28-Dec-2015
	3651	1,042.07			28-Dec-2015
	3653	1,074.85			19-Dec-2015
	3677	536.53			16-Oct-2016
	3729	111.01			16-Oct-2016
	3730	749.88			16-Oct-2016
	F98491	998.04	Federal Mineral Claims (2)	100%in good standing	25-Nov-2015
	F98492	888.29			25-Nov-2015
Boot	3552	1,029.92	Federal Mining Leases (10)	100% in good standing	30-Dec-2015
	3553	1,036.80			30-Dec-2015
	3554	1,093.50			30-Dec-2015
	3555	1,015.17			30-Dec-2015
	3609	1,082.16			30-Dec-2015
	3612	1,080.54			30-Dec-2015
	3613	1,025.06			30-Dec-2015
	3678	1,061.51			16-Oct-2016
	3679	1,002.38			16-Oct-2016
	3724	541.89			16-Oct-2016

(continued)

Table 1.3-1. Mineral Tenure Status (as of September 23, 2015; completed)

Project/ Prospects	Tenure Name	Hectares (ha)	Tenure Type	Registered Ownership as of September 23, 2015	Expiry/ Renewal Date
Boulder	3466	300.51	Federal Mining Leases (8)	100% in good standing	18-Nov-2015
	3557	1,012.91			30-Dec-2015
	3558	1,052.19			30-Dec-2015
	3559	1,049.36			30-Dec-2015
	3560	1,100.39			30-Dec-2015
	3691	260.01			16-Oct-2016
	3692	456.84			16-Oct-2016
	3693	671.09			16-Oct-2016
	K12027	903.96	Federal Mineral Claims (6)	100% in good standing	4-Oct-2022
	K12028	1,008.86			4-Oct-2022
	K12029	949.73			4-Oct-2022
	K12030	938.79			4-Oct-2022
	K12033	290.79			4-Oct-2022
	K12034	734.27			4-Oct-2022
Bath	5152	983.1375	Federal Mining Lease (1)	100% in good standing	10-Mar-2016
	F94554	650	Federal Mineral Claims (2)	100% in good standing	9-Sep-2016
	F94555	550			9-Sep-2016
Del	K10862	966.74	Federal Mineral Claims (6)	100% in good standing	12-Sep-2018
	K10863	966.74			12-Sep-2018
	K10866	966.74			12-Sep-2018
	K10867	966.74			12-Sep-2018
	K10869	965.52			12-Sep-2018
	K10870	976.46			12-Sep-2018

Within the Goose Property Area there are several mineral targets as shown on Figure 1-6-2 (Goose Property Area). A combination of open pit and underground mining methods will be used for mineral extraction. The Marine Laydown Area is shown in Figure 1.6-3.

Ore will be mined and trucked using conventional open pit and underground methods and processed using standard gravity and leach recovery processes at a process plant located at the Goose Property. Waste rock will be stored in designated storage areas on surface or backfilled in mine workings on the property. Tailings from the process plant will be stored in a Tailings Storage Facility (TSF) in the vicinity of the process plant along with two mined out open pits. Depending on the results of ongoing exploration, the mine and mineral processing plant may operate for more than 10 years. The average annual payroll is estimated to be 833 on-site people across the Project during the Operation Phase. Only about half of the employees would be on site at one time because of the fly in/fly out rotational schedule.

Sabina is currently conducting exploration at the Goose Property, George Property and the Wishbone-Malley Property. Activities include the following:

- regional mineral prospecting, sampling, and mapping;

- potential test-pitting (manual and mechanical) for geotechnical and exploration programs;
- diamond drilling;
- regional geophysical programs;
- aggregate crushing operations;
- progressive reclamation activities;
- environmental baseline and compliance sampling;
- technical tours and inspections; and
- associated water use to support drill program and camp operations.

1.7 CURRENT ACTIVITIES

As Project development advances it is anticipated that these activities will continue across the currently properties identified, and any future, mineral occurrences.

These activities in the Kitikmeot Region are supported by two camps – one at the Goose Property Area and one at George Property Area. Sabina is also authorized to establish temporary seasonal camps, including Bathurst Inlet area, to support exploration and environmental baseline programs.

The Goose Property Area currently contains a 135 person all-season camp consisting of sleeping units, dry/kitchen/dining facilities, offices, core processing facility, heavy equipment storage, a maintenance shop, a fuel tank farm (13 × 75,000-L dual walled enviro tanks) and additional drummed fuel storage. The camp is powered by a 433 kW diesel-powered generator with backup. The camp is operated on a seasonal basis and is generally closed annually from early October to late January.

The George Property Area currently contains an 80-person all-season camp consisting of sleeping units, dry/kitchen/dining facilities, core process facility, a machine storage garage, and a fuel tank farm (2 × 75,000-L dual walled enviro-type tanks) and additional drummed fuel storage. A diesel generator (225 kW), with an identical backup, provides power to the site.

During the winter months, January to May, a 2,000 m (6,564 ft) ice runway can be established at Goose and a 1,597 m (5,240 ft) at George camp on adjacent large lakes. The Goose Property has a 914-m all-weather gravel airstrip that can be used year-round and is suitable for small DASH-sized turboprop aircraft. A 530-m-long dirt airstrip is located on the George Property for use by small aircraft, such as Twin Otters. During the ice-free months float-equipped aircraft may land on lakes in the area.

Bulk goods and fuel are typically flown into the Properties by aircraft or hauled by Cat-train from a supply barge located at Bathurst Inlet. No significant roads exist at site; only local dirt trails are present around the existing exploration camps at the Goose and George Properties.

These activities are conducted under permits, licences and authorizations as identified in Table 1.5-1. Not included in the list of authorizations is the compliance with Fisheries and Oceans Canada (DFO) Measures to Avoid Causing Harm to Fish and Fish Habitat.

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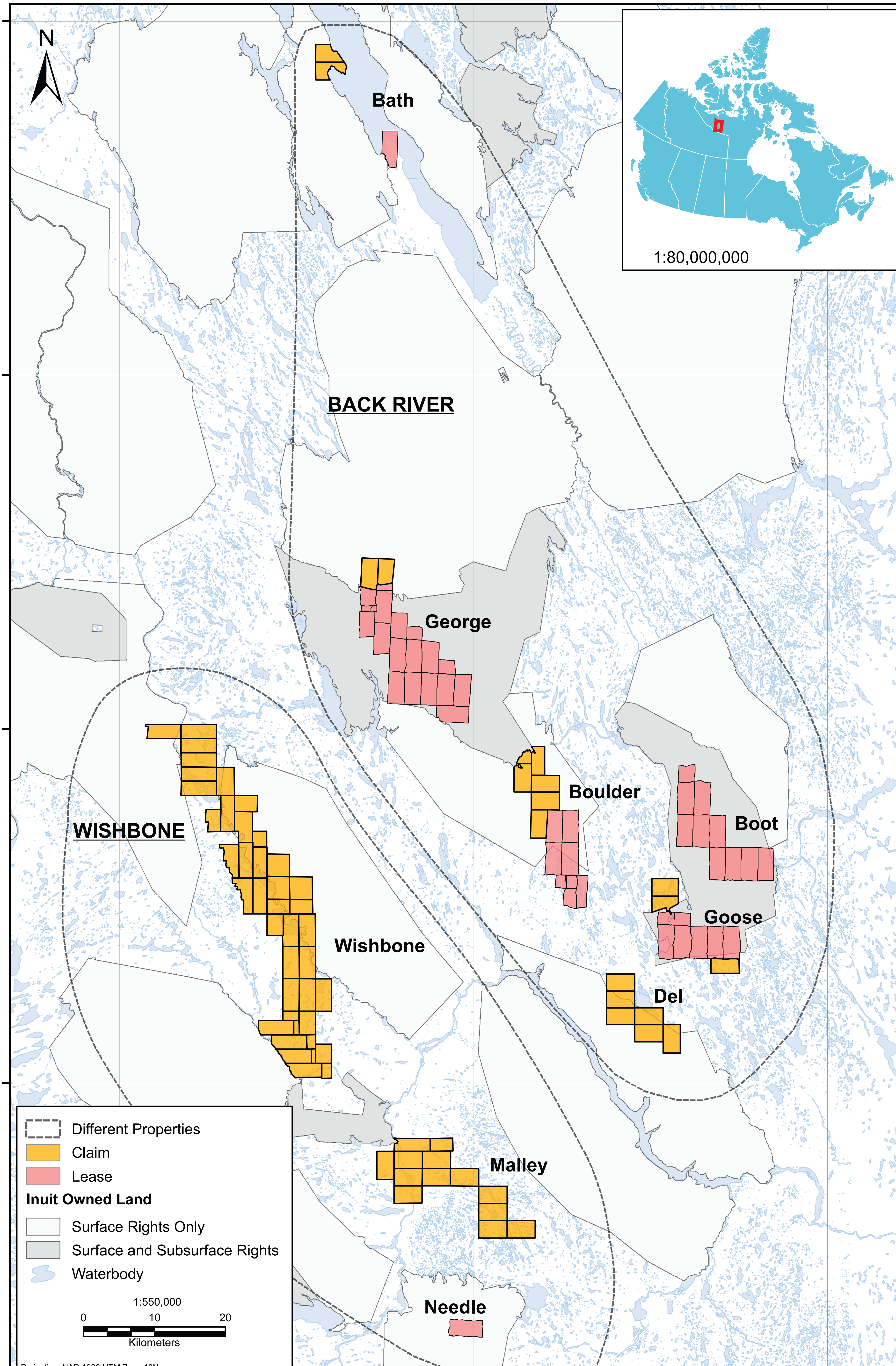

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Figure 1.4-1

Back River Mineral Tenure Map

Figure 1.6-1

Back River Project Location

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Table 1.5-1. Current Authorizations and Permits (as of January 19, 2015)

Permit	Expiry (year-mo-day)	Agency	Description
KTL204C012- Amended	2015-12-13	KIA	Boulder: Staking/prospecting, exploration (ground/air geophysics), geophysical survey, gridding and drilling.
KTL204C020- Amended	2015-12-13	KIA	Boot: Exploration (air/ground geophysics), staking, prospecting, fly/survival camp and drilling.
KTL304C017- Amended	2015-12-13	KIA	Goose: Staking/prospecting, exploration (ground/air geophysics), drilling, bulk sampling, bulk fuel storage, camp, winter road, all-weather airstrip and connecting road.
KTL304C018 - Amended	2015-12-13	KIA	George: Staking/prospecting, exploration (ground/air geophysics), drilling, bulk sampling, bulk fuel storage, camp, winter road, all-weather airstrip.
KTL304F049 - Amended	2015-12-13	KIA	Winter road connecting Bathurst Inlet - Goose and George.
KTP11Q001	2015-12-13	KIA	Goose rock quarry.
KTP12Q001	2015-12-13	KIA	Goose airstrip borrow area.
KTP12Q002	2015-12-13	KIA	George borrow quarry.
N2011F0029	2015-12-13	AANDC	Winter Road connecting George-Goose.
N2010F0017	2015-09-16	AANDC	Winter Road connecting Bathurst Inlet - Back River Project.
N2010C0016	2015-10-31	AANDC	Exploration activities.
2BEGOO1520	2020-02-18	NWB	Goose water license.
2BEGEO1520	2020-05-29	NWB	George water license.

1.8 ANALYSIS OF NEED AND PURPOSE OF THE PROJECT

The purpose of the Back River Project is to mine and process ore from five deposits (Goose Main, Llama, Umwelt, and Echo) and ship gold doré to world markets so there is an economic return on investment while protecting the environment and maximizing the socio-economic benefits to the region.

The need for this project is:

1. To provide a return on investment to the Company's shareholders.
2. To provide additional northern employment and business opportunities.
3. To supply gold to the international marketplace. The reasonably foreseeable international demand for gold has created market conditions that Sabina believes are favourable for operating mines at the Back River Project.
4. To support the Nunavut Planning Commission Broad Planning Principles, Policies and Goals (NPC 2007).
5. To contribute to the development of infrastructure, skills training, employment, and business opportunities in Nunavut, as outlined in the Nunavut Exploration and Mining Strategy (Government of Nunavut 2007). This will help build healthy communities and strengthen partnerships between Sabina and stakeholders and institutions.
6. To contribute to Canada's northern strategy to strengthen Canada's sovereignty, protect the country's environmental heritage, promote economic and social development and improve Northern governance. (INAC 2009).

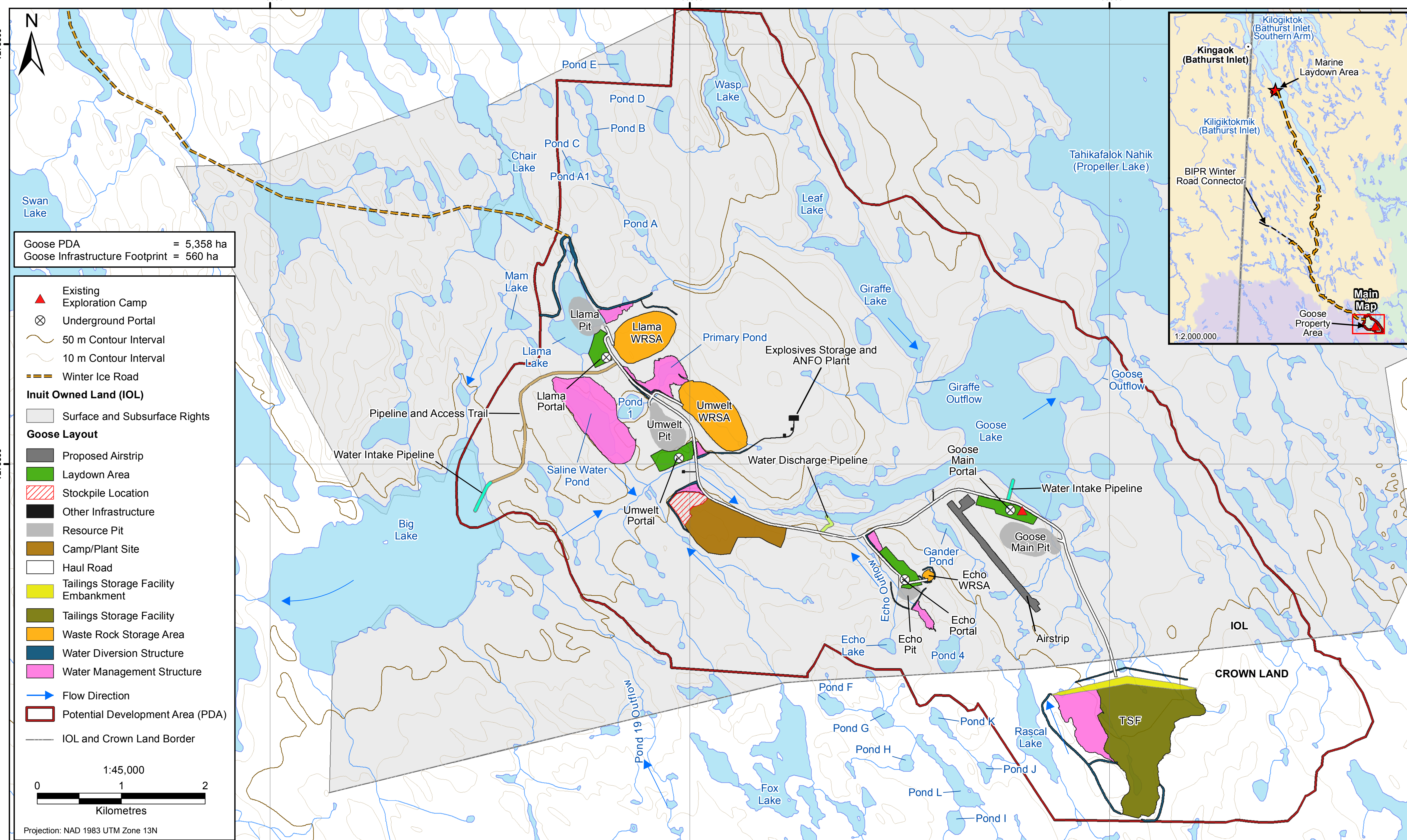

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Figure 1.6-2

Potential Development Area and Layout
Goose Property Area

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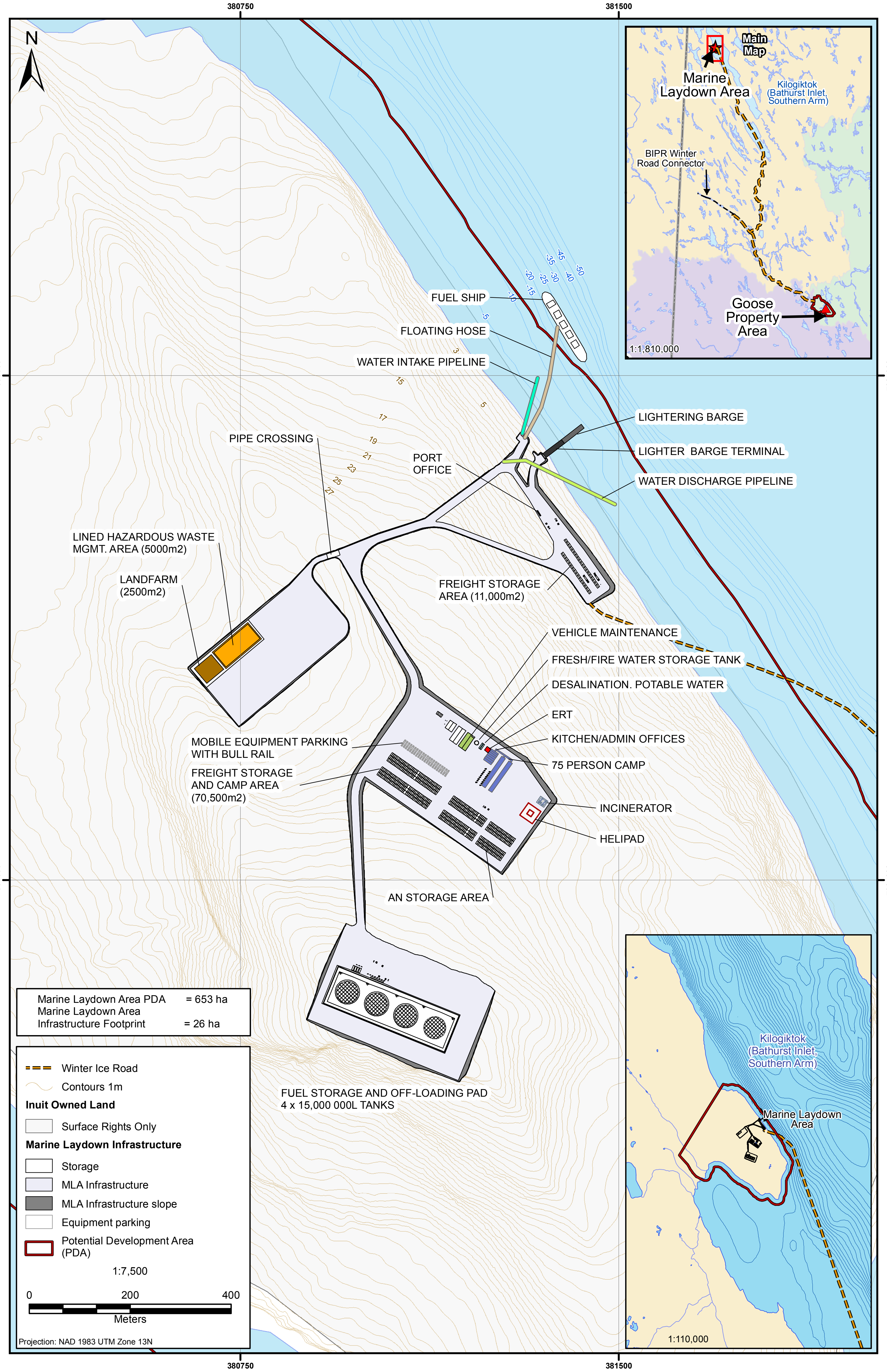

Figure 1.6-3

Marine Laydown Area
Layout and Potential Development Area

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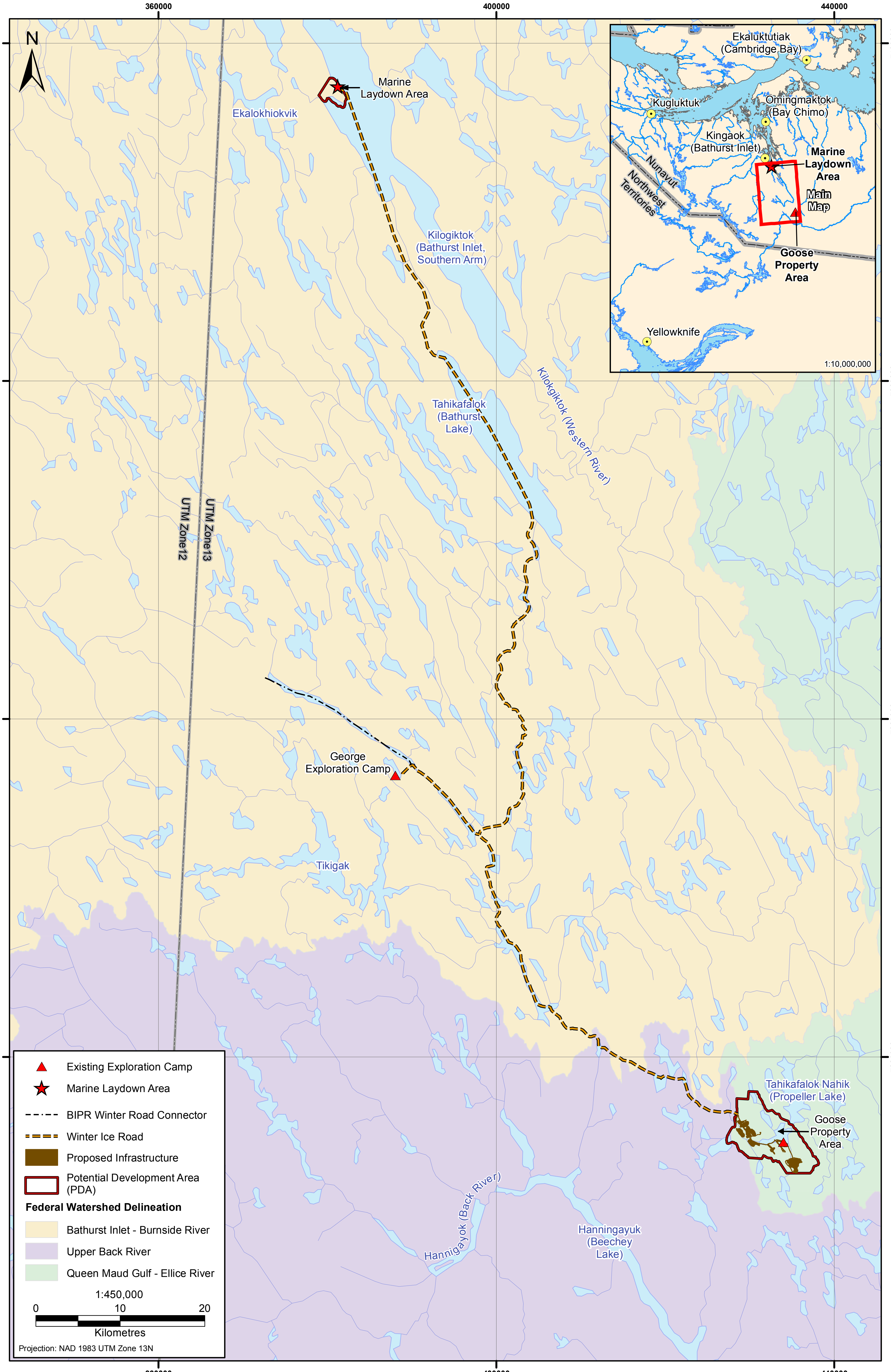

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Figure 1.6-4

Winter Ice Road Corridor Overview

Sabina believes in the economic viability and potential of the Back River Project, and that project development will bring much needed training and employment opportunities, as well as increased investment in services to the people of the Kitikmeot region and Nunavut as a whole. The Feasibility Study, completed in June 2015, identified a significant portion of the Back River resources to have suitable confidence and economic constraints to satisfy the conditions for a mineral reserve.

The economic impacts of the Project are a result of direct procurement and workforce employment. Using this data as input, the indirect and induced employment, personal income, Gross Domestic Product (GDP), and government revenue effects are predicted. Estimation of this information requires a detailed economic impact analysis, the results of which are included as part of the Environmental Impact Statement (EIS) for the Project (Volume 8).

The Back River Project is predicted to result in employment, income, GDP, and government tax revenue benefits to the Kitikmeot Region, Nunavut and Canada as a whole. Table 1.8-1 is a summary of the direct and spin-off (indirect and induced) impacts as estimated by the economic model. As is evident, such project expenditures would be a significant boost to the local, regional, and territorial economies.

Table 1.8-1. Input-output Interprovincial Model Summary Results

	Construction		Operation	
	Nunavut	**Canada**	**Nunavut**	**Canada**
Total GDP ($CDN million)	43.6	502.0	382.2	2,557.5
Total tax revenue ($CDN million)	7.6	94.5	45.0	408.8
Total direct employment (person years)	223	1,494	1,659	6,968

Source: ERM Rescan (2015)

The Back River Project is located in an isolated, remote area of Nunavut with limited access. For this reason, infrastructure such as roads and marine docking facilities are needed to access the Project as well as connect the Properties that make up the Back River Project. Sabina is open to other negotiated use and access along its road corridor; however, at this time it will be considered a private road, along with the marine facility, and closed to public use.

2. Project Components and Activities

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2. Project Components and Activities

2.1 PROJECT DESIGN CONSIDERATIONS

2.1.1 Biophysical Environment

A detailed characterization of the biophysical environment is presented in Volume 5 (Chapters 1 – Geology, Chapter 2 – Permafrost, and Chapter 3 – Landforms and Soils). The harsh Arctic climate, soil conditions, and permafrost form the prime design considerations for the viability of the Project.

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.
- To the extent possible, avoid known archaeological sites and prioritize avoidance of important (unique and/or old) sites.
- Maintain a buffer at least 31 metres from streams and waterways.
- Use of winter ice roads for access to the Goose and MLA sites.
- 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.

2.1.2 Climate Change

Sabina recognizes the importance of climate change and a discussion of climate change and its potential impact on project design is presented in volumes 4 and 9, respectively. The design incorporates measures to cope with potential effects of climate changes in addition to normal best practices that are already implemented as a matter of course during engineering design. The Procedure for Climate Change Integration for Engineering Design is a systematic four phase process which includes select elements from EARG (1998) and PIEVC (2011), two studies commissioned recently by the Government of Nunavut.

- *Vulnerability Assessment of the Mining Sector to Climate Change – Task 1 Report* (Golder 2012); and
- *Engineering Challenges for Tailings Management Facilities and associated Infrastructure with Regard to Climate Change in Nunavut* (Journeaux Assoc. 2012).

The procedure is essentially a completely new but fit-for-purpose process for design considerations and adaptive measures.

2.1.3 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 Final Environmental Impact Statement (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; and
- Volume 8 for the human environment.

Impacts to freshwater fish and fish habitat due to current and future activities includes directly removing or altering fish habitat due to drilling activities and culvert installations and potentially affecting water quality or sediment quality. For the purposes of the *Fisheries Act*, serious harm to fish includes the death of fish or any permanent alteration to, or destruction of, fish habitat (PAD). The *Fisheries Act* defines fish habitat as “spawning grounds and any other areas, including nursery, rearing, food supply, and migration areas, on which fish depend directly or indirectly in order to carry out their life processes.” The term “fish” includes parts of fish; shellfish, crustaceans, marine animals, and any parts of shellfish, crustaceans, or marine animals; and the eggs, sperm, larvae, spat, and juvenile stages of fish, shellfish, crustaceans, and marine animals. The main mitigation measure employed for a PAD to fish habitat will be avoidance. A range of specific and generally accepted techniques for sediment control, riparian care, site isolation, timing/sequencing, reclamation, and rehabilitation will be used to avoid a PAD, prevent the introduction of deleterious substances to watercourses, and to minimize adverse effects of disturbances to fish habitat. Effects associated with work in or around water will be minimized through adherence to Best Management Practices as outlined in Sabina’s current Site Water Monitoring and Management Plan, Aquatic Effects Management Plan, Closure and Reclamation Plan, DFO’s Measures to Avoid Causing Harm to Fish and Fish Habitat and the DFO Under-ice Water Withdrawal Protocol.

In addition to these measures, Sabina’s Environmental Management System (EMS) is presented in Volume 10, Chapter 1. The EMS and associated 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 and in a spirit of continuous improvement.

2.1.4 Application of the 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 Approach throughout the design and assessment of the Project. This approach forms the basis for project design criteria, the effects assessment volumes of the FEIS, the alternatives assessment (herein, Section 4) and the management practices which are detailed in the Environmental Management System, Volume 10.

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.

Sabina promotes responsibility and accountability of managers, employees and contractors to protect the environment and make environmental performance an essential part of the management/contractor review process, as well as promoting the development and implementation of systems and technologies to reduce environmental risks.

Formal monitoring and compliance reviews by environmental professionals are enhanced by a culture of encouraging all employees, contractors or stakeholders to report to management any known or suspected departures from this policy or its related procedures.

The Project will contribute to the economic development of Nunavut through the creation of sustainable private sector employment, and the long term legacy of the Project transportation infrastructure. Ongoing consultation, adaptive management and the application of the precautionary approach in decision making is aimed at protecting the health of the local population, as well as minimizing any impact of the Project on the environment and local ecosystems.

2.1.5 Occupational Health and Safety Policy

The people who work for Sabina Gold & Silver Corp. are the key to our company's success and we are committed to the health, safety and well-being of our entire workforce. To achieve this commitment Sabina will:

- Make zero harm the primary goal in all our places of work.
- Incorporate safety as a core value of our business and integrate safety considerations into all that we do.
- Comply, or strive, to exceed the requirements of all applicable health and safety laws, regulations and industry standards.
- Ensure that all persons associated with the company, including managers, supervisors, employees and contractors take every reasonable measure and precaution to protect the health and safety of all employees and contractors.
- Provide the necessary resources, information, training, and leadership to protect our workforce against injury, illness and hazards.

- Assign employee responsibility and develop accountability mechanisms for health and safety performance within the company.
- Use best practices and management systems to identify, assess and report on potential hazards to eliminate, minimize and manage risks in the workplace.
- Develop company-wide readiness to anticipate and respond to potential incidents.
- Develop and regularly update emergency response plans and procedures for all our operations.
- Through frequent communication, ensure that all of Sabina's employees and contractors understand the Company's health and safety policy and the related management systems.
- Empower and encourage employees, contractors and stakeholders to actively raise any health and safety issues, without repercussion.
- Continuously review and improve our health and safety record.
- Regularly set targets, monitor performance and report on outcomes in order to identify and correct any deficiencies.

Every employee has the right to work in a safe and healthy environment. Zero harm is Sabina's number one objective. We expect a strong commitment to health and safety from all employees and contractors to achieve this goal.

2.1.6 Wildlife

The Project area has a broad range of wildlife species. Sabina discourages any unnecessary disturbance to wildlife from its activities through the following measures:

- It is prohibited to feed wildlife thus, Sabina has implemented a comprehensive waste management plan that separates all waste at the source and ensures proper handling, storage and disposal.
- It is prohibited to harass or interfere with all wildlife species. This includes chasing animals with any motorized vehicle including aircraft. Air traffic shall be directed to avoid migrating caribou, denning animals or nesting waterfowl.
- Hunting is strictly prohibited in the Project area by employees, visitors or contractors. The only exception is individuals authorized to have registered Company firearms for predator protection.
- Wildlife encounters will be recorded in the wildlife log.

Information related to existing caribou trails and other terrestrial wildlife and mitigation measures adopted to minimize potential effects are presented in Volume 5.

2.1.7 Socio-economic Conditions

Sabina is committed to environmentally responsible and socially acceptable exploration and mining practices. We are dedicated to creating and maintaining a safe environment for both the land we occupy and the people that drive its success. The company's philosophy is to conduct its operations to protect not only the environment, but the health and safety of its employees and the public as well.

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, our responsibility is to limit negative environmental and social impacts and to enhance positive impacts.

To achieve these goals, Sabina is committed to:

- leadership in the mining community by integrating responsible environmental management as an essential component of all business decisions;
- complying with all applicable laws, regulations and standards; upholding the spirit of the law and where laws do not adequately protect the environment, applying standards that minimize any adverse environmental impacts resulting from its operations;
- communicating openly with employees, the regulatory community and the public on environmental issues and addressing concerns pertaining to potential hazards and impacts;
- assessing the potential effects of operations and integrating protective measures into the planning process to prevent or reduce impacts to the environment and on public health and safety;
- applying appropriate corrective actions should unexpected environmental impacts occur. This will also include taking appropriate action to prevent reoccurrence of these impacts;
- providing adequate resources, personnel and training so that all employees are aware of and able to support implementation of the environmental and social policy;
- conducting and supporting research and programs that improve understanding of the local environment to conserve resources, minimize waste, improve processes, and protect the environment;
- working with the appropriate local regulators and agencies, maximize benefits to the affected communities and residents; and
- balancing all decisions with best management practices, scientific principles and traditional knowledge.

2.1.8 Archaeological and Cultural Sites

Archaeological sites provide a strong link to the people who lived and hunted on this land in the past. It is important to protect these resources by maintaining the integrity of any known and newly discovered sites and/or artifacts. Archaeological sites in the area may include:

- tent rings, stone flakes, tool making or using, and other evidence of people living in the area;
- caches and cairns; and
- Inuksuik and other trail markers.

Sabina has incorporated archaeological programs as part of the ongoing baseline data collection and implemented a Standard Operating Procedure for all employees, contactors and visitors. If an archaeological artifact is found, it is not removed or disturbed and the location is reported to the appropriate regulatory bodies.

2.1.9 Consideration of Current Land Use Activities

There are no other commercial land users in the area near the Goose Property Area, such as tourism operators or harvesters; however, there are other mineral exploration projects and tourism in the region of the MLA. Sabina is committed to open communication with its industry neighbours and where possible to implement joint programs and share information.

2.1.10 Public Consultation and 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 2013). Volume 3, Chapter 3 summarizes the efforts undertaken by Sabina to incorporate TK into the Project development.

2.1.11 Future Development

Consideration for future development is an integral part of the Project development. Refer to Section 3 of this volume.

2.1.12 Other Considerations

The remoteness of the site is a prime consideration for the Project development. The Back River Project area has no pre-existing transportation infrastructure. While the logistics involved in site capture will minimize effects on the receiving environment, they present major challenges. Thus Sabina is proposing the construction of winter ice road to access the site. Site access is discussed in further detail in Section 6.2 below.

2.2 PROJECT PHASES

The life of the Back River Project is 27 years (including closure and post-closure) as indicated in Table 2.2-1. It is expected that construction activities will begin in 2016 with the staging of materials at the MLA, followed by three years of construction of the Goose Property infrastructure. For the purpose of this assessment, the first year of production is termed "Year 1." Production will carry on for 10 years followed by the period of reclamation and closure activities (up to 6 years). Sabina expects to follow up with post-closure monitoring of the site for approximately five years. However, post-closure monitoring will carry on until closure objectives have been achieved.

Table 2.2-1. Life of Project

Activities	Duration	Section of this Volume
Mobilization and Construction	4 years (Year -4 to -1)	Section 6
Operation (for the purpose of the environmental assessment)	10 years (Year 1 to 10)	Section 7
Reclamation and Closure	8 years (Year 10 to 18)	Section 8
Post-closure Monitoring	5 years (Year 18 to 23)	Section 8

It should be noted that the operational phase may be extended beyond 10 years should additional mineral deposits become economical to developed (discussed in Section 3). As most of the mineral deposits targeted have a short recovery life (one to five years), Sabina will adopt a progressive reclamation approach.

2.3 PROJECT PERMITTING

The development of the Back River Project will require a Project Certificate to be issued by the Nunavut Impact Review Board. This is issued after the completion of the environmental impact review process and after it has been determined that the Project should proceed.

The Project will require a Type A Water Licence from the NWB, which can only be issued after a Project Certificate is obtained. Sabina intends to apply for a Type A Water Licence from the NWB either in conjunction with or after receiving the Project Certificate.

A Fisheries Authorization may be required from the DFO for some Project activities and components. It is planned that Sabina will work with the DFO such that the authorization process will occur concurrently with the environmental review process.

The Project may require a Schedule 2 Amendment to the Metal Mining Effluent Regulations, depending on the plans for tailings containment and management, and water management. Environment Canada is responsible for these regulations. If required, it is understood that the final process for obtaining a Schedule 2 Amendment cannot commence until a final Fisheries Authorization is issued by DFO.

The Project will require land use authorizations from the KIA for development on Inuit Owned Land. The Project will also require land use authorizations from AANDC for infrastructure located on Crown land.

2.3.1 NIRB Exception from Review

There are currently no plans to request additional Exemptions from Review other than those for ongoing exploration and camp operations.

3. Future Developments

3. Future Development

The Back River Project includes the development of the following mineral deposits at Goose Property as open pit and underground mines:

- Llama;
- Umwelt;
- Echo; and
- Goose Main.

3.1 FORESEEABLE EXPANSION OF THE PROJECT

As mentioned in Section 1.6, exploration activities are ongoing and mineral resources have the potential of being expanded. The inclusion of additional reserves in the mine plan may extend the operations period of the mine life.

The infrastructure at the Goose Property and the MLA is designed to enable ongoing use and expansion beyond the currently defined operating mine life. Additional infrastructure would be required to mine deposits at the George Property. If Sabina opts to advance the George Property or other resource in the future, an additional regulatory process may be required.

Four mineral deposits are currently identified at the George Property; these are LCP South, LCP North, Locale 1, and Locale 2. Both open pit and underground mining methods would be employed and would use a combination of equipment mostly relocated from Goose Property with some purchased new. As all processing of ore is likely to be done at Goose Site, only mining and activities in support of mining are planned for George Property. Run of mine ore would likely be crushed, stockpiled, and then transported seasonally to Goose Property using dedicated ore haulers.

The George Property would operate independently from Goose Property and MLA and hence, requires dedicated infrastructure. Waste rock storage areas (WRSAs), bulk fuel storage tanks, a diesel power plant, laydown yards, a maintenance shop, an accommodations camp, water and domestic waste management facilities, and satellite communications are all required. The accommodation complex will be portable, modular units constructed off-site.

An all-weather airstrip would provide access for personnel and select materials and consumables. Equipment and materials for construction and operations would be transported from MLA via a winter ice road. A winter ice road connection with Goose Property would allow transfers of personnel, equipment, and materials as well as the ore destined for processing. All-weather roads allow for year-round access on site.

The Property is located within the permafrost region; therefore, infrastructure that is particularly sensitive to differential settlement, such as the fuel storage tanks, will be built on competent bedrock. Less sensitive structures and linear surface elements, such as roads, pipelines, and airstrips, will be built on overburden soils and include an appropriate thermal protection layer.

3.2 POTENTIAL DEVELOPMENT OF ADDITIONAL ORE MATERIAL

As stated in Section 2.2, the operational phase of the Project may be extended beyond 10 years should the existing deposits be expanded upon or additional mineral deposits become economical and developed.

As exploration is a Life of Project activity, it is likely that the existing deposits will increase at depth and laterally and additional deposits will be delineated and become economical to develop over the life of the Project. The current environmental assessment which includes cumulative assessment focusses on mining activities within the Potential Development Area of each site. Should additional deposits be located outside of the PDAs as defined in this EIS, Sabina will submit an application for an amendment to its Project Certificate.

4. Alternatives

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4. Alternatives

4.1 METHOD OF ASSESSING ALTERNATIVES WITHIN THE PROJECT

Alternatives within the Project have been evaluated according to the following key criteria:

- technical feasibility;
- economic viability;
- potential impacts to the environment;
- amenability to reclamation;
- community acceptability or preference; and
- socio-economic effects.

For each Project alternative, once an option is judged “technically feasible” and “economically feasible”, key criteria can be qualitatively evaluated on the basis of professional judgement, previous experience with similar projects or situations, and community consultation. Criteria are meaningful attributes that are essential for Project success, and the ranking of these provides the basis for distinguishing between various options.

The Project has considered numerous alternatives; the summary results of select alternative assessments are presented in Appendix V2-4C. Details expanding on alternatives assessment for select alternatives are presented in section 4.2 and 4.3 of this report. A Multiple Accounts Analysis report (MAA) has be completed for mining waste (waste rock and tailings) management. The results of the MAA are summarized in 4.2.5 and 4.2.6 and presented in detail in Volume 2, Appendix V2-4A.

4.1.1 Technical Feasibility

Technical feasibility relates to the appropriateness of an alternative from an engineering or operational perspective and incorporates aspects of known performance, reliability, and operational ease for the Project.

Given both the cold climate and relative remoteness of the Project, an important consideration in evaluating technical applicability includes proven northern performance.

4.1.2 Economic Viability

Cost implication relates to the overall Project costs including capital, operating and maintenance, and closure/reclamation costs of an alternative.

4.1.3 Environmental Acceptability

Each alternative under evaluation may have the potential to have adverse effects on the environment given the vulnerability of the arctic ecosystem.

This criteria, along with Amenability to Reclamation, is used to evaluate alternatives considering both the potential concern for the short-term (during Construction and Operations) and long-term (after Closure and Post-Closure), physical/chemical stability and environmental impacts of the Project.

The "environment" in this context refers to both the natural and socio-economic environment, focusing on Valued Ecosystem Components (VECs) and valued socio-economic components (VSECs) identified in the impact assessment (Volume 2).

4.1.4 Ease of Reclamation and Closure

Amenability to reclamation is also taken into consideration. This objective relates to the decommissioning or reclamation of various aspects at eventual Project closure. It is relevant to those aspects of the Project that alter the landscape (i.e., roads and stockpiles) and/or require dismantling and either removal from site or disposal on site (e.g., buildings).

4.1.5 Social Acceptability

Alternatives are also evaluated in terms of community acceptability or preference. This criterion is by nature subjective, both in terms of the community perspectives that have been expressed as well as the interpretation and weighing of those perspectives. However, effort has been given to synthesizing and incorporating viewpoints and desires expressed to Sabina thus far through its consultation efforts.

Sabina is required to consider public opinions and preferences as a criterion in the assessment for Project alternatives (NIRB 2013: 19). Likewise, Sabina must discuss how public consultation has influenced Project design and planning, and how public preferences have been considered by Sabina in determining the preferred Project alternatives.

Sabina has been conducting community engagement and consultation activities for the Back River 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, HTOs, youth, and other stakeholder groups. Numerous questions, issues, and suggestions have been raised by local residents. Sabina has documented this information in meeting minutes and a comprehensive community engagement database, the results of which are presented in Volume 3 (Public Consultation, Government Engagement, and Traditional Knowledge) of the FEIS. Likewise, Sabina has discussed potential Project configurations and alternatives with local communities, and has incorporated their feedback into various aspects of Project design and management.

For example, alternatives assessment analyses and conclusions (i.e., for major alternatives) were presented in each Kitikmeot community and Yellowknife in June 2015 for public review and comment. Alternatives were discussed during public and stakeholder meetings, and presented on descriptive posters that were placed in public meeting halls. No major issues were raised by community stakeholders at this time in regards to the alternatives assessment presented by Sabina. Copies of all public meeting presentations made by Sabina can be found on www.backriverproject.com under the 'Additional Resources' tab, while copies of public and stakeholder meeting minutes can be found in Appendix V3-1C of the FEIS.

Regardless, public opinions and preferences have resulted in a number of specific measures being taken by Sabina. Over the course of Sabina's public consultation program, for example, communities have 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 caribou, fish, other wildlife resources, water quality, and from mine tailings and contaminants. As such, Sabina has gone through extensive effort to select alternatives that minimize potential negative socio-economic and environmental effects in these areas. A comprehensive environmental management and monitoring program has also 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.

Alternatives pertaining to the location of the Tailings Storage Facility (TSF) and the management of mine tailings have strongly considered public opinions and preferences. At the request of the Kitikmeot Inuit Association (KIA), for example, the TSF was moved off of Inuit Owned Land (IOL) and on to Crown land even though this was economically less favourable to Sabina. Tailings will also be deposited sequentially in the TSF, followed by the Umwelt Tailings Facility (TF), and Goose Main TF. The TSF will thus have a smaller disturbed footprint and progressive reclamation of tailings can occur; an alternative which addresses public concerns pertaining to the management of mine tailings.

Public opinions and preferences have also informed Sabina's alternatives assessment in a more general way. For example, Sabina's decision to proceed with the Project has been at least partly supported by the desire local residents have expressed for new economic development opportunities in the Kitikmeot Region. Sabina's decision to advance open pit and underground mines at the four Goose Property mineral deposits (and not currently advance the George Property mineral deposits) was also at least partly supported by the simplicity of this alternative from a public and permitting perspective.

4.1.6 Socio-economic Effects

With respect to enhancing socio-economic effects, it is recognized that some alternatives may provide tangible and intangible benefits to local communities and the region. Since this objective is focused on enhancement of positive benefits and negative socio-economic effects are addressed in the preceding objective, there is no unacceptable rating.

4.2 DISCUSSION OF MAJOR (TIER ONE) ALTERNATIVES WITHIN THE PROJECT

The alternatives that shaped the overall development of the Back River Project include:

1. Project Go/No-Go decision;
2. Access and transportation alternatives for the movement of freight and personnel;
3. Mineral reserves and mining operations;
4. Ore processing and gold recovery;
5. Alternatives for tailings storage location;
6. Alternatives for waste rock management;
7. Location of the main Goose Plant Site infrastructure;
8. Location of the Marine Laydown Area;
9. Water management;
10. Power generation; and
11. Site reclamation and closure.

Decisions were made based on the selection criteria presented in Section 4.1.

4.2.1 Project "Go/No-Go" Decision

Economic analysis enables Sabina to evaluate the environmental, social and financial risks associated with the development of the "Back River Project." On the basis of this ongoing assessment, Sabina has three possible decisions regarding for the development of the Project:

- proceed with mine development in the near term, as proposed herein or on a decelerated timeline;
- delay the Project until circumstances are more favourable; or
- abandon the Project.

Recognizing that long term economic viability is highly sensitive to current and expected long term gold and fuel prices, Sabina released preliminary economic assessment results (SRK 2012) and opted to proceed with the Project and submitted a Project Description to initiate environmental assessment and permitting. Continued feasibility studies (Pre-feasibility in October 2013 and separate Feasibilities in June and September 2015) indicate that the Project remains technically and economically feasible and Sabina will continue to progress environmental assessment and permitting for the Project.

If the Project does not proceed, the mineral resource will not be developed, and the potential effects and benefits predicted in this EIS will not be realized. The expected socio-economic trends in the absence of the Project are described in Volume 8. The Project is expected to bring a multitude of benefits to local communities supporting both traditional pursuits and the generational shift that is occurring within the Inuit community as youth show an interest in participating in the wage-based lifestyle.

4.2.2 Access and Transportation Alternatives

4.2.2.1 Access and Transportation to the Project Site

There are three options for the transportation of supplies, equipment and material to the Project site used individually or in various combinations over the Project life. They are:

- air transportation;
- marine transportation; and
- overland access via all-weather and/or winter ice roads by:
  - establishing a connection between Goose and the Marine Laydown Area; and
  - establishing a marine receiving and staging area on Bathurst Inlet with a link to the Goose property.

A detailed logistics and transportation study was undertaken as part of the Project Feasibility Study. This and past studies indicate that a combination of all three options is optimal at different stages of the Project to access the site. Given the remote location of the Project, transportation represents a significant contributor to capital and operating costs. As such, reasonable opportunity will be taken to reduce costs while not incurring unnecessary risks. The following factors were accounted for in execution planning and cost estimating related to logistics and transportation. These will evolve as the project proceeds through detailed engineering and procurement.

- Permissible windows for navigating the various zones according to the Arctic Ice Regime Shipping System (AIRSS);
- Total and dimensional capacities of transport craft, whether fixed wing, ocean barges, ships, tankers, flat deck trailers, etc. available and permissible to use particular routes;

- Origin of the freight; North America, Europe, and Asia are regions that may supply equipment, materials, and consumables:
  - Countries of origin may dictate whether shipment of freight directly to Bathurst Inlet is possible and feasible; and
  - The most cost-effective marshalling port may not be the one closest to the manufacturing location or point of origin.
- Marshalling port; other ports in addition to Vancouver and Becancour, e.g., European and Asian, were investigated:
  - Unit costs for re-handling, storage; and
  - Unionized workplaces may present restrictions to allowable hours worked, availability during weekends, etc.
- Weights and dimensions of dry freight and their optimum modes of transport:
  - Roll-on / roll-off (RORO) – typically mobile mining and auxiliary equipment;
  - Containerized – material the can be containerized in standard 20ft ISO containers;
  - Modular – large modular components that cannot be containerized (e.g., camp modules);
  - Rack – typically steel and piping; and
  - Airfreight.
- Availability and all-inclusive, lowest-cost supply of diesel fuel;
- Sensitivity of the freight to possible shipping delays including spoilage, criticality of need, etc.; and
- Costs and risks associated with the construction, operation, and maintenance of the winter ice road network:
  - Numbers of trailer and tanker trips will trade off against the costs for maintaining the roads given the amount of freight requiring

A detailed discussion of transportations options is presented in Section 6 and in Appendix V2-6A.

4.2.2.2 Air Transportation

Due to the remoteness and isolation of each Property, air transportation is an essential component of the Project development.

The air transportation alternatives considered for access to each Property include:

- ice airstrips and open water float access using nearby lakes; and
- all-weather airstrips up to 1,524 m to support year round access with up to Hercules, or equivalent sized, aircraft.

Both the existing Goose and George exploration camps have all-weather airstrips and ice airstrips are constructed and operated on nearby lakes for delivery of equipment and material during the winter months and float access is used in the open water season. This practice will continue through the Project life.

Because of the seasonal nature of use at the Marine Laydown Area and exploration camps, air access will involve the construction and operation of ice airstrips able to accommodate up to Boeing 737, or equivalent, aircraft and serviced by float planes during the open water season. An all-weather airstrip at MLA was not deemed to be cost beneficial. As such, the MLA would be serviced from Yellowknife and the Goose Property. The need for, and amenability of, upgrading and using an all-weather road at the MLA as a temporary gravel airstrip is considered.

The Goose Property is the main Project site and includes the more significant infrastructure and workforce. In assessing air access needs, four locations were considered for the location of an all-weather airstrip up to 1,524 m in length to provide year-round access. These locations included extending the currently existing 915 m all-weather airstrip. The airstrip would accommodate up to Hercules, or equivalent aircraft, and support ongoing exploration and project development early in the Project life.Based on the technical and cost considerations, the preferred options are:

- Seasonal airstrips using ice and open water at Goose Property and the Marine Laydown Area, and similar seasonal access for George exploration camp throughout Project life;
- Continue using the existing airstrip at George Property as part of exploration and to support construction, operations, and closure at MLA and Goose Property as required; and
- Keep the existing 915 m airstrip at Goose Property or extend it to 1,524 m using ROQ and gravel surface material for all-weather use as part of construction and use throughout operations and closure.

4.2.2.3 Marine Transportation

The marine shipping alternatives considered to provide access to the Project area includes:

- shipping via ocean-going freighters, tankers, and barges;
- shipping channel/routes from the east;
- shipping channel/route from the west; and
- shipping channel option within Bathurst Inlet.

<u>Shipping Season</u>

Marine shipping is a proven transportation method in the Arctic servicing communities and other projects; however, the open water shipping season in this area of the Arctic is limited to a maximum of three months depending on the ship type and route.

Associated with marine shipping is the consideration of the need for ice breaking. In this case, the alternatives include:

- open-water shipping only (up to 3 months);
- ice breaking of early season ice only (to extend open water to 4 months); and
- ice breaking all year (to extend shipping window up to 12 months).

For this assessment only open water shipping (and no ice breaking) has been considered. Sabina will limit their shipping period to the annual open water season ending October 15. For safety reasons and under unforeseen and exceptional events, icebreakers may be used and vessels may be overwintered.

<u>Shipping Route</u>

The preferred route from ports on the eastern coast of North America follows the established Northwest Passage shipping route used for resupplying Cambridge Bay and veers south towards the community of Kingoak on Bathurst Inlet. The preferred route from west coast ports similarly follows the Northwest Passage around Alaska, south of Victoria Island, veers south towards Kingoak. These routes are preferred based on the technical feasibility of established shipping routes for equipment, supplies, and materials sourced from the North American coast, Europe, or Asia. Canadian Hydrographic Services (CHS) deemed our proposed shipping routes as good and does not require additional hydrographic work.

The portion of the shipping corridor from the community of Kingoak to the Marine Laydown Area was selected based on the MLA site, local bathymetry, foreshore slope, navigational requirements, space for maneuverability, avoidance of sensitive landscape, and proximity to sensitive environmental and cultural areas. The quality of survey in Bathurst Inlet was categorized as good by CHS.

4.2.2.4 Overland Transportation and Access

The overland transportation options include all-weather and winter ice road corridors between the following Project areas:

- Marine Laydown Area to Goose Property;
- George Exploration Camp to MLA to Goose Property road; and
- George Exploration Camp to proposed BIPR road.

The overland transportation alternatives assessment also considered each Project phase and required access over the mine life. A road connection between the Marine Laydown Area and the principal properties will be used throughout the mine life to provide ongoing support and resupply for all Project phases. This will be used primarily to transport large equipment and bulk materials that cannot be cost-effectively or readily delivered by aircraft.

In 2012 as part of preliminary economic studies, a high level study was completed to determine whether an all-weather road or a seasonal winter ice road link between Goose and George properties should be considered (SRK 2012). Based on technical feasibility and cost considerations, seasonal winter ice roads were determined to be the preferred connection between the two mineralized areas.

The same results extended to the Marine Laydown Area and the Goose Property connection. The evaluation considered the seasonal nature of marine shipping, the technical feasibility and cost considerations.

The design basis for the preferred corridors is to maximize routing over ice on suitable water source lakes, and minimize use of terrestrial components including undulating topography, steep slopes, and avoid culturally and environmentally sensitive areas.

The Project may utilize three winter ice road corridors over the Project life, based on technical and cost considerations:

- corridor between the Goose Property and MLA;
- linkage of the George Property to the MLA and Goose Property; and
- connection to the proposed BIPR road.

The winter ice road to the George Property also connects to already screened and/or approved winter ice roads connected to Glenore Canada's proposed Hackett River Project. This may serve as a future link between the Projects should operational conditions warrant.

At this time, cost considerations suggest that 100% Sabina ownership and control is necessary for the Project to proceed at this time winter roads, along with the MLA, will be considered private and closed to public use.

4.2.2.5 Access and Transportation within the Project Locations

Sabina has considered two main options for transportation within each site. They are:

- all-weather roads; and
- winter ice roads.

The transportation study conducted in the Project Feasibility Study indicates that year round access will be required within the Goose Property for technical and cost reasons. The preferred on-site transportation method was determined to be a network of all-weather roads. A detailed discussion on the preferred all-weather road network is presented in Section 6.

Transport methods, equipment and staging may also vary depending on mine schedule and resupply needs. For the FEIS, the information on anticipated freight frequency and volumes is presented in Section 6. As additional engineering studies are conducted, revised equipment and transport management options may be considered based on technical feasibility, cost and environmental considerations.

Local air transportation for the exploration program was facilitated using helicopters and it is anticipated that these machines will continue to be used throughout all phases of the Project.

4.2.3 Mining and Quarry Operations

4.2.3.1 Open Pit and Underground Mine Operations

Several mineralized zones have been identified across the Back River Project at both Goose and George properties since exploration started in the area. Exploration activities have focussed on economic evaluation of some of the more promising areas and have identified economically feasible reserves.

The four deposits located at the Goose Property are Umwelt, Llama, Goose Main, and Echo. The geometry of these ore bodies is suitable for open pit mining based on the proximity to ground surface and economic assessment. The proven method for extracting ore from deposits with such a geological configuration is open pit mining using shovels and trucks and it is the mining method selected for the Project. Most of the deposits extend from surface to sufficient depth to consider a combination of open pit and underground mining methods. Crossover analyses were performed on all four deposits to determine the elevation at which the change from open pit to underground mining is optimal. Underground mines were deemed viable for all four deposits. Post pillar cut-and-fill was the selected method for the Umwelt underground mine, drift and fill for Llama and Goose Main, and longhole open stoping for Echo.

Overburden will be removed by blasting and will be placed in Waste Rock Storage Areas (WRSAs). Suitable waste rock is also planned to be used for road construction, laydown areas, and construction of the TSF dam. The open pit will then be excavated using a conventional bench configuration with access via ramps, using conventional open pit mining equipment. Blast holes will be drilled, an explosives truck will deliver and dispense explosives into the holes, blast sequences will be established, the open pit cleared of all personnel, and the blasts detonated.

Underground mining alternatives include access and mining methods. Access to the mineralized zones could be via shaft, decline or some combination of the two. Given the geometry of the deposits, depth and location of mineralized zones, proposed mining method, and mine life, the preferred access method for underground operations will be by decline.

Underground mining methods other than those already selected, or combinations of methods, may be used to safely and efficiently extract resources taking into consideration geometry, dip angle, continuity and grade distribution, rock mass strength and competency, in-situ value of mineralized material. In addition to providing access to mineralized zones, development will provide ventilation, communications and other mine services, and emergency egress.

4.2.3.2 Options for Ore Management

Although minimizing the double handling of ore offers the benefits of reduced simplistic operating costs, stockpiling offers flexibility and other economic benefits. Direct feeding mined material to the crushing plant, without the use of a stockpile, can result in a critical bottleneck and does not optimize the Project finances.

Ore material will be stored in stockpiles adjacent to the process plant area at Goose Property. Mine plans and schedules have been developed to determine the volume of material and grade available to the process plant throughout the life of the mine. Ore management options are determined by technical considerations including mine planning, ore grade, mineralogy, and economic considerations. An objective of the scheduling is to be able to feed the processing plant with as much high grade ore as economically feasible early in the mine life. This will result in the shortest payback duration. The proposed high-, medium-, and low-grade stockpiles may vary for their cut-off criteria as well as sizes. As additional exploration and mine planning work progresses, ore management will continue to be optimized. The potential to improve grade using sorting techniques to segregate low grade and waste may be investigated further.

4.2.4 Ore Processing and Gold Recovery

4.2.4.1 Options for Production Rate Changes

The proposed ore milling rate is 6,000 tonnes per day, which results in a 10 year mine life based on current ore reserves. This alternative provides an acceptable return on investment and is environmentally and technically the most practical alternative given the information to date.

On the basis of the capacity of the equipment and infrastructure required, a lower processing rate may not provide as favourable return on investment given a base fixed cost. However, financing the 6,000 tonnes per day Project under current market conditions may be challenging for Sabina. As such, lower processing rates have been investigated conceptually at 2,000 tonnes per day and as a feasibility study at 3,000 tonnes per day as alternatives. The latter study yielded favourable economics with a substantially smaller initial capital investment.

A higher ore production rate may provide a higher rate of return based on increased economies of scale but this would require additional ore bodies to be mined. Similarly, the infrastructure and processing plant would likely need to be expanded to accommodate increased mining and processing activities. While geological drilling on other occurrences in the area to date is encouraging, insufficient drilling has been carried out to confirm the amount and grade of the ore bodies to a level sufficient for investment. Sabina will consider increasing the production rate at some time in the future if ore resources and reserves justify this.

4.2.4.2 Options for Processing the Ore and Gold Recovery

Options for Comminution

Based on available information and testing done to date, the basis flowsheet includes primary and secondary crushing followed by further size reduction using a 4.1 MW, 5.5 m diameter by 7.5 m long ball mill and a 3.0 MW fine grinding mill. Further review of the design of the comminution circuit will be done to study options of using tertiary crushing, semi-autogenous grinding or high-pressure grinding rolling ahead of ball milling as well as variations to achieve fine grinding.

Options for Processing

For the feasibility studies, metallurgical test work was completed and included work to determine the ore properties, processes to recover gold and silver (including gravity, flotation and cyanide leaching) and cyanide detoxification.

Processing test work indicated that gravity concentration cannot be used as the only process to extract gold due to the lower recovery. However gravity processing may be used in conjunction with other processes to either improve performance or reduce costs. Conventional rougher flotation and direct cyanide leaching was successful in maximizing gold recovery; however, the cyanide consumption and possible loss of gold with the flotation tailings, and associated costs using direct cyanide leaching are higher.

Three various flowsheet configurations were considered that included combinations of gravity and/or flotation and cyanide processing methods. With this understanding of the success of processing options, an overall process flowsheet was developed. The preferred flowsheet is described in Section 7.8 and includes gravity separation followed by intensive leaching in a parallel process stream with cyanide leaching of the remaining whole ore. Although a commonly employed process of leaching followed by cyanide-in-pulp is the design basis, another viable alternative, cyanide-in-leach, will be investigated further.

Options for Cyanide Use

Cyanide leaching is considered to be a much safer alternative to extraction with liquid mercury, which was previously the main method of removing gold from ore. Cyanide leaching has been the dominant gold extraction technology since the 1970s and in Canada, more than 90% of mined gold is extracted from ore using cyanide.

Although cyanide can be safely used, the mining industry continues to research alternatives to cyanide and improve the techniques for managing the cyanide it does use. In some cases it may be possible to concentrate gold using only gravity separation. However, this is not economical or feasible with the currently identified Back River Project mineral deposits.

More efficient utilization of cyanide is achieved in the process flowsheet by grinding in cyanide. Process water containing cyanide from the tailings thickener will be added to the ball mill circuit. Grinding will occur in a low concentration cyanide solution thereby assisting the leaching process. This and other possible process changes and optimizations provide opportunities to reduce overall cyanide consumption.

4.2.4.3 Tailings Disposal Alternatives

The current state of technology for tailings disposal indicates the most commonly used disposal options are conventional slurry tailings, thickened tailings, paste tailings, and filtered tailings. An earlier study completed as part of the PFS (included within Appendix V2-4A) provides detailed descriptions of these tailings disposal technologies and an in-depth analysis of each technology, a summary of which is copied below. These options were reassessed as part of the Appendix V2-4A: Waste Management Multiple Accounts Analysis Report to include updates to the water and waste management strategy and process grind size.

The current alternatives analysis concluded conventional slurry tailings is the most appropriate method for the Project, with a solids content of about 50%.

Filtered (i.e., dry stack) tailings was not considered in this analysis because the process grind size is 50 microns, making it impractical to filter the tailings. Thickened and paste tailings were excluded due to the higher complexity associated with water management and challenges of such complex water management in the Arctic environment.

Conventional Slurry Tailings

Tailings produced by most conventional milling and flotation processes generate a slurry with a solids content ranging from approximately 30 to 50%. Conventional slurry tailings are transported via pipeline to the TSF and discharged into the TSF either sub-aqueously or sub-aerially. Sub-aerial deposition is often from the tailings embankments where beach development acts as an additional seepage control measure. The supernatant water, along with any additional water reporting to the TSF from direct precipitation and runoff, is recycled to the mill for use in processing.

Thickened Tailings

Thickened tailings have been used in the mining industry for decades. The tailings are dewatered using thickeners, often with the addition of flocculants, to approximately 50 to 60% solids. At this solids content the tailings have a higher viscosity that conventional slurry tailings.

Paste Tailings

Paste tailings are typically characterised as highly thickened, non-segregating slurries with high solids contents. The dewatering process normally consists of two-stages; in the first stage, tailings are thickened (as described above) and may be filtered to dewater the tailings and produce a wet-cake material. In the second stage, water is added as necessary to achieve the desired rheology. Additives may be mixed with the tailings to aid in dewatering and transportation.

Filtered Tailings

The moisture content of filtered tailings is typically reduced by mechanical dewatering of the tailings slurry to about 20 to 30% of the dry solids weight. At these low moisture contents, the tailings no longer exhibit flow characteristics of a slurry or paste and form a moist “dry cake” material. This can usually be handled using conventional earth moving equipment and transported by truck or conveyor system.

4.2.5 Alternatives for Tailings Storage Locations

As part of the Final Environmental Impact Statement (FEIS) for the Back River Project (the Project), SRK Consulting (Canada) Inc. was retained by Sabina Gold and Silver Corp. to carry out a comprehensive Waste Management Multiple Accounts Analysis Report (MAA) of the mine waste rock and tailings disposal alternatives.

The results and methodology of this analysis are summarized in this section. The detailed report is included as an appendix to this volume (Appendix V2-4A). A description of the methodology used in the assessment is provided, with tables comprising the detailed assessment given in the appendix. Findings related to waste rock and tailings are discussed in separate sections both within the MAA and within this chapter.

4.2.5.1 Methodology of Assessment

Typically, an MAA is a four step process. The first step entails documenting a comprehensive list of sub-accounts (or criteria) organized by accounts (or general categories) pertinent to the evaluation of each alternative. Typically, for MAAs related to waste alternatives, the four accounts are: engineering and operations, environmental, project economics, and socio-economic. Using these accounts and sub-accounts, the alternatives are then presented in the form of summary tables to allow the reader to readily compare the alternatives.

The second step entails a pre-screening assessment that allows any alternatives identified as potentially "fatally flawed" to be rejected from further detailed assessment.

The third step entails a detailed evaluation of the alternatives based on key criteria. Data to support each sub-account is collected, processed, and summarized, as well as engineering calculations are completed.

In step four, the alternatives are ranked on the total score basis, with the highest score usually being the preferred alternative. For this MAA, relative importance ratings were not applied to remove any unintentional potential bias.

There have been serval studies conducted at each level of project planning include an MAA at the Prefeasibility Study Phase. Due to these scope changes, a direct comparison between the various alternatives spanning the three phases of planning (i.e., PEA, PFS, and FS) is difficult. The MAA was therefore completed considering the latest Project requirements as the basis for the comparison.

4.2.5.2 Tailings Alternatives Analysis Design Basis

The current state of technology for tailings disposal indicates the most commonly used disposal options are conventional slurry tailings, thickened tailings, paste tailings, and filtered tailings. The current alternatives analysis concluded conventional slurry tailings is the most appropriate method for the Project, with a solids content of about 50%.

Filtered (i.e., dry stack) tailings was not considered in this analysis because the tailings grind is less than 50 microns, making it impractical to filter the tailings. Thickened and paste tailings were excluded due to the higher complexity associated with water management and challenges of such complex water management in the Arctic environment.

The design basis of tailings alternatives for the MAA included:

- Required tailings storage capacity is in the order of 15.8 Mm^3.
- Disposal of tailings in mined-out open pit(s) and a purpose built TSF.
- Location constraints respecting the wishes of the KIA to avoid subaerial tailings deposition on Inuit Owned Land (IOL).
- Consideration for subaqueous tailings deposition in a natural or man-made lake as a result of KIA preference.
- All tailings management structures to be located within the Potential Development Area (PDA) as defined in the 2013 Draft EIS and approved by the Nunavut Water Board.

The current analysis includes all alternatives considered in the previous analyses and evaluates them against a set of criteria determined based on the current mine plan. This resulted in a total of 43 alternatives being considered (slurry tailings disposal only).

4.2.5.3 Pre-screening Assessment Methodology and Results

A pre-screening assessment was completed on the total number of 43 alternatives. The number of alternatives was reduced from 43 to 9 by applying a series of criteria that would qualify as “fatal flaws” with respect to the TSF parameters. A brief description of the reasons for eliminating each of the 34 alternatives is provided in the MAA report.

The pre-screening criteria included the following:

- minimum storage capacity;
- distance from mill;
- design complexity;
- location - must be located within the PDA;
- flexibility to handle reasonable upset conditions;
- acceptable risk of failure of the engineered containment.
- the TSF is not sited within any waterways and therefore does not have the potential to affect navigation;
- climate change considerations were incorporated into the design of the Project, including the TSF and TFs (Appendix V2-7A and Appendix V2-7G); and
- other climate change impacts such as increased hydrology are not expected to meaningfully impact the TSF or the TF in the Post-closure Phase.

4.2.5.4 Detailed Analysis Methodology and Results

An MAA requires selection of the most important criteria (sub-accounts) under the four different accounts that would allow for a relative comparison between the tailings disposal alternatives and the potential effects. These four main evaluation criteria (accounts) are:

- Technical / Operational;
- Project Economics;
- Environmental; and
- Socio-economics.

Alternatives pertaining to the location of the Tailings Storage Facility (TSF) and the management of mine tailings have strongly considered public opinions and preferences in each of the four main evaluation criteria. For example, at the request of the Kitikmeot Inuit Association (KIA), the TSF design location was moved to off of Inuit Owned Land (IOL) and on to Crown land.

The criteria were selected to avoid “double accounting” of components within each of the four accounts. For example, although distance from the mill site can be a criterion for the environment (land disturbance) and engineering categories (fill quantity), it was evaluated under the Technical/ Operational account only. In addition, the sub-accounts within each account were selected to provide a balanced assessment of each category. For example, sub-accounts within the Environmental account were selected to evaluate terrestrial and aquatic considerations equally.

For each of these sub-accounts, the alternatives were given a relative score that differentiates between the most and the least effective alternatives in that sub-account category. For example, when considering the relative distance between the tailings storage location and the mill, the closer site would score higher than the more distant site. This was because the more distant site would have an increased risk of pipeline failure, land disturbance, potential effects on wildlife, etc. Table 4.2-1 summarizes the accounts and sub-accounts selected for the Project tailings disposal alternatives assessment. The detailed descriptions of each sub-account for each of the 9 alternative locations are provided in Tables 4 through 8 of Appendix V2-4A.

Table 4.2-1. Summary of Tailings MAA Evaluation Criteria

Account	Sub-account
Technical/Operational	Distance from mill site
	Dam details
	Footprint size (excluding lakes) of impoundment, dam, and access road
	Size and volume of impacted lakes
	Dam, access road, and closure construction quarry volume requirements
	Potential for increased tailings deposition capacity
	Ability to recycle tailings supernatant water
	Flexibility with regard to technical, operational, and environmental uncertainties
	Precedent
	Catchment boundaries
	Technical feasibility and risks
	Operational risks/uncertainties
	Closure risks/uncertainties
	Post-closure land use
	Within potential development area (Community preference)
	Outside of IOL (Community preference)
Economic	Total costs (excluding taxes and royalties)
	Economic risks
	Construction risks
Environmental	Acid rock drainage and/or metal leaching (ml) potential
	Topographical issues
	Geotechnical and seismic issues
	Hydrology issues (relative effect of water quality and flow)
	Hydrogeology issues
	Atmospheric issues (i.e., potential for dust generation)
	Water quality issues
	Climate Change
	Effects on Lake Trout
	Effects on Whitefish
	Effects on Arctic Grayling
	Effects on Ninespine Stickleback
	Effects on Slimy Sculpin
	Effects on Burbot
	Effects on Caribou
	Effects on Muskox

(continued)

Table 4.2-1. Summary of Tailings MAA Evaluation Criteria (completed)

Account	Sub-account
Environmental (*cont'd*)	Effects on Wolverine
	Effects on Grizzly Bear
	Effects on Upland Breeding Birds
	Effects on Waterfowl
	Effects on Raptors
Socio-Economic	Archaeological sites
	Employment opportunities
	Training opportunities
	Regional economics
	Community Services, infrastructure, health and well being
	Maintenance of traditional lifestyle
	Spiritual well being
	Perceived community response
	Landowner opinion
	Overall perceived socio-economic consequence and relative preferences
	Archaeological sites

Table 4.2-2 presents the MAA results for the Project TSF location alternatives. For any given criterion (sub-account) in the table, the maximum score that an alternative can achieve is 5 (a score of 5 implies that the alternative is considered to perform the best in that given category).

Table 4.2-2. TSF Locations Alternatives Ranking

		Alternatives								
		#28	**#29**	**#30**	**#32**	**#35**	**#36**	**#37**	**#40**	**#41**
Summed Score per Account	Technical / Operational	55	52	53	49	55	50	38	60	53
	Economic	5	5	5	6	11	10	12	11	11
	Environmental	58	57	57	41	45	45	57	60	60
	Socio-economic	19	14	19	19	15	15	12	21	16
Score Ratios	Technical / Operational	0.69	0.65	0.66	0.61	0.69	0.63	0.48	0.75	0.66
	Economic	0.33	0.33	0.33	0.40	0.73	0.67	0.80	0.73	0.73
	Environmental	0.55	0.54	0.54	0.39	0.43	0.43	0.54	0.57	0.57
	Socio-economic	0.48	0.28	0.38	0.38	0.30	0.30	0.24	0.42	0.32
Total Score		**2.05**	**1.81**	**1.92**	**1.78**	**2.15**	**2.02**	**2.06**	**2.47**	**2.29**
Ranking by Account	Technical / Operational	2	6	4	8	2	7	9	1	4
	Economic	7	7	7	6	2	5	1	2	2
	Environmental	3	4	4	9	7	7	4	1	1
	Socio-economic	1	8	3	3	6	6	9	2	5
Overall Rank		5	8	7	9	3	6	4	1	2

Subaerial disposal in TSF C (Alternative #40), coupled with in-pit disposal in Umwelt TF and Goose Main TF, is the preferred tailings disposal alternative for the Project. Not only does it rank as the most desirable overall alternative, but it also ranks on or near the top of each of the four accounts individually.

4.2.5.5 In-pit Disposal of Tailings and Waste Rock

A mine waste management plan designed around in-pit disposal allows the TSF to have a smaller disturbed footprint, smaller containment capacity, and shorter operating life. It also enables progressive reclamation of tailings to occur. It is an alternative which addresses public concerns pertaining to the management of mine tailings.

The proposed plan tailings management plan includes depositing tailings (and potentially waste rock) sequentially starting in the TSF, followed by the Umwelt Tailings Facility (TF), and Goose Main TF. In addition to Umwelt and Goose Main, Llama and Echo are also candidate pits for the disposal of tailings and waste rock. With Llama already considered for use as a temporary saline water holding pond, and Llama connected to the already effected Umwelt pit, Sabina may opt to also use Llama for tailings or waste rock management in the future. If this was the case the MMA and the mitigation and management plans presented in the FEIS (including water discharge criteria) remain appropriate.

4.2.6 Alternatives for Waste Rock Management

As part of the Final Environmental Impact Statement (FEIS) for the Back River Project (the Project), SRK Consulting (Canada) Inc. was retained by Sabina Gold and Silver Corp. to carry out a comprehensive Waste Management Multiple Accounts Analysis Report (MAA) of the mine waste rock and tailings disposal alternatives.

The results and methodology of this analysis are summarized in this section. The detailed report is included as an appendix to this volume (Appendix V2-4A). A description of the methodology used in the assessment is provided, with tables comprising the detailed assessment given in the appendix. Findings related to waste rock and tailings are discussed in separate sections both within the MAA and within this chapter.

4.2.6.1 Methodology of Assessment

Typically, an MAA is a four step process. The first step entails documenting a comprehensive list of sub-accounts (or criteria) organized by accounts (or general categories) pertinent to the evaluation of each alternative. Typically, for MAAs related to waste alternatives, the four accounts are: engineering and operations, environmental, project economics, and socio-economic. Using these accounts and sub-accounts, the alternatives are then presented in the form of summary tables to allow the reader to readily compare the alternatives.

The second step entails a pre-screening assessment that allows any alternatives identified as potentially "fatally flawed" to be rejected from further detailed assessment.

The third step entails a detailed evaluation of the alternatives based on key criteria. Data to support each sub-account is collected, processed, and summarized, as well as engineering calculations are completed.

In step four, the alternatives are ranked on the total score basis, with the highest score usually being the preferred alternative. For this MAA, relative importance ratings were not applied to remove any unintentional potential bias.

Because the in-lake disposal was excluded as a viable option (Appendix V2-4A) and leachate from the WRSAs can readily be collected and managed, the environmental effects are essentially identical for all alternatives. The socio-economic sub-accounts would not differ significantly among the various alternatives barring any fatal flaw scenarios in these criteria. Due to these considerations, a complex MAA analysis would not yield any additional value to the classic alternatives analysis performed as part of the technical studies in the FS stage.

4.2.6.2 Waste Rock Storage Alternatives Analysis Design Basis

Technical considerations for locating the WRSAs included capacity, proximity to mine workings, elevation changes, footprints, and associated costs. Further evaluation using environmental (such as distance to local waterways and fisheries impact potential) and cultural (such as local land use and archaeological sites) considerations have refined the boundaries of these storage areas as well reduced the waste rock storage locations.

Geochemical characterization of samples from the Project resulted in grouping the rock into four categories, based on the acid rock drainage generating potential: PAG, NPAG, uncertain, and low sulphur. For the scope of this study, the uncertain waste rock was identified as PAG and the low sulfur as NPAG, resulting in two categories only being reported from hereon.

The geochemical study (Appendix V2-7D) concluded that 65% of the waste rock in-situ is NPAG; however, due to operational recovery estimates and conservative waste segregation practices, 58% will be identified as PAG with the remainder (42%) being NPAG.

Preliminary calculations indicate acidic conditions are not expected to develop in >95% of the waste rock during the freeze back period. Although acidic conditions could occur more rapidly in some of the waste rock, average pH conditions in seepage and runoff would be expected to remain buffered until complete freeze-back of the WRSAs.

The geochemical study confirmed that blending of the PAG and NPAG waste rock to take advantage of the buffering offered by the NPAG, and thereby neutralize the PAG, would not be viable.

4.2.6.3 Waste Rock Alternatives Analysis Assessment Results

The assessment of alternative methods for managing potentially acid-generating/metal leaching mine waste material considered:

- freeze back with a thermal NPAG cover;
- low permeability covers;
- co-disposal and co-mixing of mine waste material; and
- subaqueous disposal.

Sub-aqueous disposal can include disposal in an engineered structure, in a natural waterbody, in a mined out open pit, or underground development. Construction of a permanent, water retaining, engineered structure was ruled out since it would not be considered best practice. Deposition in a natural waterbody was also ruled out as the lakes around the Property are either shallow, thus offering limited confinement or are larger, thus providing good aquatic habitat.

The underground mining methods employed on the Project require a portion of material from surface as mine backfill. As such, this backfill material would be composed, as much as practical, of PAG waste rock, either sourced locally from underground development or backhauled from surface development. Consideration was given to storing PAG rock in mined-out open pits; however, the mine scheduling and the need to use the pits for tailings management and water management made this a less desirable option.

For the remaining PAG waste rock on the surface, consideration was given to low permeability covers. Generally, the use of low permeability covers would be the most cost effective; however, no suitable natural materials are generated by Project activities and as such, this would not be a cost effective option. Therefore, the only viable low infiltration cover would be geosynthetic liners. The initial capital costs and long-term replacement costs of these liners make them an undesirable option.

The assessment considered technical, environmental, socio-economic, and economic perspectives, and determined that encapsulation of PAG waste rock with the placement of a NPAG thermal cover is the preferred methodology. During progressive reclamation and in Closure, the PAG waste rock would be surrounded and capped by a coarse (high permeability) cover of NPAG material to protect the underlying waste rock from seasonal thawing and would ensure long-term freezing. The approach to mine waste management is described in more detail in Volume 2, Section 7.2.7.

The assessment also considered alternative storage locations at Goose Property for waste rock. The preferred locations are as follows:

- Umwelt WRSA - located about 600 m east of Umwelt pit;
- Llama WRSA - located about 700 m southeast of Llama pit;
- TSF WRSA - located on the TSF, about 2 km south of Goose Main pit; and
- Echo WRSA - located about 300 m northeast of Echo pit.

4.2.7 Alternatives for Goose Plant Site Location

The PDAs have identified areas that may be affected by Project components and activities over all phases of the mine life. Four alternate plant site locations within the Goose PDA were evaluated; these locations were chosen as the topographic highs of the region and presumed to have the best foundation conditions. The general selection criteria were a large and stable area to accommodate the required infrastructure that had the least negative technical, environmental, and social impacts. At the time of this evaluation, the geotechnical investigations were limited to visual assessments but suitability was confirmed in subsequent field investigations. The assessment optimized ore haul distances and elevation differences between the open pits, underground mines, and the Plant Site. Distances for tailing disposal to the TSF and the Umwelt, Llama, and Goose Main deposits were also considered.

The assessment provided cost comparisons between the four alternate locations. From this analysis, it was determined that the Goose Plant Site located as shown in Figure 1.6.2, would be the most economic and efficient. The 2015 field program (see Appendix V2-7C) confirmed the geotechnical conditions at the preferred location were suitable for founding the critical infrastructure.

4.2.8 Site Selection for the Marine Laydown Area

Four options were considered for the MLA and are described in a trade-off study (Appendix V2-4B). These locations were assessed by considering: navigation and vessel maneuverability, bathymetry and foreshore slope, topography of the upland area, road access, airstrip, metocean conditions, berth face orientation, geotechnical conditions and ice conditions as well as environmental acceptability, socio-economic and community preferences.

Based on these criteria, the preferred location of the Marine Laydown Area has been identified and indicated on Figure 1.6-1. Appendix V2-4B presents the outcome of the site selection study for the MLA.

4.2.8.1 BIPR Alternatives

Although the long term preferred option for the development and operation of the Back River Project was a link to the proposed BIPR Project infrastructure (NIRB File No. 03UN114), its suspension has precipitated the alternative to proceed with designing a project specific Marine Laydown Area on the shores of Bathurst Inlet (as discussed in Section 4.2.1). This will enable Sabina to proceed with the Project and maintain the current schedule.

Sabina proposes to construct its own winter ice road from the Goose Property to receive supplies from the MLA. Should the BIPR Project be reactivated and constructed sometime during the life of the Back River Project, Sabina will revaluate the benefits of switching to this location.

4.2.9 Water Management

Water management at Back River mine operations includes options for surface water control and groundwater control. In both situations, water can either be diverted/excluded or collected and pumped to treatment if needed, disposed or put to beneficial use on site.

4.2.9.1 Groundwater

Underground development is planned to a depth of approximately 650 m below ground surface (mbgs). At this depth, planned mine workings will be approximately 250 m below the permafrost. As such, groundwater mine inflows are likely to be variable during development of the underground mines. Ground temperature data confirms that Umwelt, Llama, and Goose Main underground mines will intercept talik zones, however Echo underground is located completely within permafrost. The Llama open pit is also is believed to intersect a talik zone and is therefore expected to accumulate groundwater saline groundwater as well.

Potential groundwater controls include either physical barriers to cut off inflow or an array of pumps and sumps to dewater. Due to technical and cost considerations, physical barriers will not be used to cut off groundwater inflow as current environmental data suggests that permafrost and ground conditions will limit the volume of inflow. Adaptive management measures, such as grouting ahead of underground mine development, will be used if required to mitigate higher than expected groundwater pore pressures and flowrates.

Options to discharge the groundwater flow include to the environment or to an on-site disposal facility. For technical, economic, and environmental considerations, saline groundwater will be temporarily stored at a constructed Saline Water Pond during operations and pumped back underground during the progressive reclamation of each underground mine.

4.2.9.2 Surface Water

Surface water management in the open pit operations and infrastructure at Goose Property will include a network of diversion channels to direct surface water flow away from the Project footprint as well as a network of collection channels and sumps to collect contact water. Contact water will include water from open pit mine workings and surface water flow/stormwater from the individual project areas.

Options to manage the surface water at Goose include discharge to the environment or directing to a disposal area. Due to operational water requirements at the process plant site, surface contact water will be directed to the TSF for use in the plant site.

At the MLA, options for water management are limited to diverting and collecting water using best management practises. Infrastructure will be designed such that its footprint is minimized to limit the changes to local drainage patterns. All roads and surfaces will be constructed using geochemically suitable material. Roads and pads will be designed to have runoff disperse as sheet flow to minimize channelized flow. Non-contact water will be diverted around infrastructure, as much as is feasible, and directed to natural downstream drainage networks to maintain local drainage patterns. Clean water and snow will be managed to restrict contribution to potentially poor quality water and will be diverted to maintain natural drainage networks as much as possible.

These preferred options of diversion and collection of water are proven water management options in Arctic conditions.

4.2.9.3 Lake Dewatering

Lake dewatering to access mineral resources will be determined in conjunction with ongoing economic considerations for the Project over the project life. A lake dewatering plan would be developed and approved for each freshwater lake removed and/or impinged by mine operations. These plans would include consideration of a completing a catch-per-unit-effort/recapture phase of the Fish-out Program (typically between August and September) and engineered structures to manage the dewatering program. Experience from other properties in Arctic conditions will provide an indication of best design and management options to complete lake dewatering in addition to Traditional Knowledge and community consultation.

Detailed engineering design will investigate retention and perimeter dikes as part of the lake dewatering scheme. Options will consider use of available mine waste material and various alternatives for seepage control such as glacial till, geosynthetic clay liners and slurry or sheet-pile cut-off walls or some combination of seepage control measures.

Water removed from the lake will be incorporated into overall site water management plan.

4.2.9.4 Contact Water

At the Back River Project, surface water can be grouped into two categories, contact and non-contact water. Contact water is defined as any water that may have been physically or chemically affected by mining activities. Contact water includes:

- surface runoff from the mining and milling areas;
- groundwater seepage into open pits;
- surface runoff and shallow drainage from rock storage areas;
- surface runoff and shallow drainage from tailings storage area;
- transport water from tailings;
- water generated from consolidation of tailings (bleed water); and
- flushing water from tailings distribution lines.

All contact water will be intercepted, contained, analyzed, treated if required, and discharged to the receiving environment when water quality meets the discharge criteria.

Non-contact water is limited to runoff originating from areas unaffected by mining activity that does not come into contact with developed areas. Non-contact water will be intercepted and directed away from developed areas by means of natural or man-made diversion channels and allowed to flow to the neighbouring lakes untreated.

4.2.9.5 Cyanide Detoxification in Process Water

Cyanide is toxic in large doses and is strictly regulated in most jurisdictions worldwide to protect people, animals, and the aquatic environment.

Many jurisdictions, including Canada and Australia, recommend that mines that use cyanide do so in a manner consistent with the International Cyanide Management Code, which involves minimizing the amount of cyanide used; designing measures to protect surface and groundwater; designing and operating systems that reduce cyanide levels in effluent; and preventing spills.

In Canada, cyanide is considered to be a hazardous substance, and provincial and federal legislation requires it to be transported, handled, and disposed of by fully trained personnel in certified storage containers. Its disposal and discharge into the environment at mine sites is regulated provincially through the use of permits and licences. In addition, the cyanide concentration of effluent leaving a metal mining operation must be below the maximum allowable as prescribed by the Metal Mining Effluent Regulations under the federal *Fisheries Act* (1985).

Cyanide will only be used at the Goose Property to recover gold and the processing plant will incorporate cyanide detoxification prior to release to the active Tailings Facility or Tailings Storage Facility. Active treatment methods include:

- Alkaline Chlorination;
- Hydrogen Peroxide; and
- Sulphur Dioxide.

Test work presented in Appendix V2-7F: Mineral Processing Memo indicates that the preferred treatment option to reduce cyanide levels in the tailings uses sulphur dioxide methods.

4.2.10 Power Generation

The Back River Project has an estimated operating life of 10 years. For such a short project life cycle and having several development sites, diesel power generation offers the most flexibility and is the only economically viable alternative. Diesel generated power supply will provide the required capacity to meet power demands of the Project at the lowest cost. This source of supply is also the most reliable in arctic conditions. Several alternates have been assessed.

Hydroelectric power generation is not economically and perhaps not environmentally feasible due to the significant distance to the nearest possible generation site. Geothermal energy is not feasible due to the depth of permafrost.

The technical and economic feasibility of liquefied natural gas (LNG) power generation facility remains to be assessed as the technology for safely and economically transport it to remote sites is still developing. LNG could be a viable system in the near future for both power generation and powering vehicles.

Solar power is not yet proven technology for large commercial or industrial use in the Arctic as challenged by the northern latitude and extreme weather conditions. There are advantages of longer days in summer (offset by less to no sunlight in winter) and increased efficiency of photovoltaic modules in low temperatures and snow reflection. Solar cannot be the primary power source but it is a possible supplemental supply.

Wind power generation may be technically feasible when including designs tailored to the environmental conditions but the Project requires a reliable and constant power supply. Both wind and solar power are intermittent energy sources which mean that all available output must be harnessed when available and transmitted for immediate use or stored for later use. They would also need transmission lines from the generation site to Project sites and would require diesel backup at sites in likely periods of inadequate wind or solar energy. Storage and power management technologies are being utilized in systems around the world and continue to develop so Back River could be a candidate for supplemental deployment.

As none of the alternatives are viable as the sole energy source, the infrastructure for and generation using diesel must first be established. As wind, solar, and LNG technologies become more mature for the Arctic, they may be economical supplements to diesel-generated power.

4.2.11 Closure and Reclamation Options

4.2.11.1 Abandonment and Reclamation of Project

Site closure and reclamation alternatives are dependent on the site configuration retained and how the site is developed over the life of the Project. For the Project as defined in this assessment, closure alternatives are discussed in Section 8 of this volume.

Under the terms of the KIA Land Use Licences and the NWB Water Use Licences, Sabina is obligated to rehabilitate the areas used to its previous standard of human utilization and natural productivity. In accordance with regulations, Sabina is planning for the closure of the facilities at the end of the mine life. The current approach considers decommissioning of facilities, removal off-site of materials and equipment that can be reused or recycled, and on-site disposal of remaining materials. Hazardous materials will also be removed off site for processing at licensed facilities. Reclamation and closure of project components that will remain in place (such as tailings facilities and waste rock storage areas) will ensure physical and geochemical stability, while being both environmentally and technically feasible.

Another option at the end of Project life is for part, or all, of the infrastructure to remain in place for other use. Sabina will consider transferring the facilities to a third party should there be such interest.

Changes to regulatory requirements and consultation with communities or stakeholders throughout the life of the Project could be reflected in subsequent updates to the Mine Closure and Reclamation Plan, if required.

4.2.11.2 Care and Maintenance Closure of Project

Care and maintenance refers to conditions at the Property where there is potential to recommence operations at a later point in time. During a care and maintenance phase, production is stopped but the site is managed to ensure it remains in a safe and stable condition. The reasons for taking a Project to care and maintenance are varied, but may include:

- it is considered to be temporarily unviable due to current economic conditions, including unfavourable resource prices, which are expected to improve at a later date;
- declining ore grades;
- change in company and/or Project management or ownership.

It is challenging to assess alternatives to care and maintenance closure options, as a care and maintenance program will be needed to manage environmental risks associated with plant/process plant facilities, equipment, tailings storage, waste rock storage areas, hazardous materials, and mine operations specific to the Project and the current conditions. Public health and safety considerations, and emergency response plans, continue during the care and maintenance phase. Section 8 outlines the current approach to care and maintenance closure.

4.3 DISCUSSION OF ALTERNATIVES (TIER TWO) WITHIN THE PROJECT

Once decisions have been made on the major alternatives shaping the Project, a second tier of alternatives for executing components of the Project are evaluated during the preliminary and detailed design phases. The following are described in the followings:

1. Detailed Site Layouts
2. Options for Quarry Sites
3. Emergency Shelters, Seasonal/Temporary Exploration Camps
4. Goose Property Infrastructure
5. Marine Laydown Area Infrastructure
6. Domestic Waste Management
7. Options for Equipment
8. Options for Future Development of Other Mineral Deposits
9. Bulk Fuel Storage Alternatives
10. On-site Accommodations and Worker-related Alternatives

4.3.1 Detailed Site Layouts

Alternatives for site layouts at the Goose Property and Marine Laydown Area are presented at a high level in Sections 4.2.7 and 4.2.8, respectively. Detailed site layouts as currently designed (see Figures 1.6-2 and 1.6-3) represent one each of innumerable possible layouts. Optimizations for capital and operating costs, operability and maintainability, and safety will continue with ongoing engineering and could result in changing specifications, relocating, or resizing of certain facilities.

4.3.2 Options for Quarry Sites

At the Goose Property and MLA, quarry material will be needed for the early development of roads, airstrips, or laydown areas. Quarry material will also be needed for the construction, operation, and maintenance of infrastructure needed for the Project life.

Options for quarry material include:

- local eskers;
- local bedrock locations – new areas; and
- local bedrock locations – within current mine operations footprint (i.e., waste rock).

For environmental reasons, Sabina is currently focused on avoiding extraction of esker material where possible and have considered new bedrock locations only. Suitable material locations need to be physically and geochemically stable, aim to minimize transport distances, and avoid culturally and environmentally sensitive areas. These bedrock locations can be new areas outside the proposed mine workings, or be areas that are accessed during regular mining operations with the waste rock directed to construction efforts rather than being placed in waste rock storage areas.

An assessment of quarry material needs for construction has currently identified three areas at the Goose Property that may be suitable sources for aggregate; note that further analysis could provide additional options that meet the above criteria. Two of these areas are currently authorized quarry areas accessing bedrock material and surface aggregate. The third area is using suitable waste rock from with open pit boundaries at Umwelt open pit.

At the Marine Laydown Area, quarry material is needed to build infrastructure. In order to develop this area, cutting into the slope will be needed to level the ground surface and provide a suitable foundation for the MLA Fuel Tank Farm. This cut material will be crushed and graded to be used in construction.

4.3.3 Emergency Shelters, Seasonal/Temporary Exploration Camps

Small, temporary camps for up to 25 people may be needed to support early season resupply activities, emergency, and/or exploration target areas located 20 km or more from the main Goose, George , or Marine laydown. They would be established for safety, environmental and economic reasons. The intent is not to establish a network of camps across the exploration area, but to have the opportunity and flexibility to establish these temporary camps as needed. The locations of these camps are currently undetermined, however,they are currently permitted under existing land use and water authorizations. Their locations are dependent on operational needs, environmental and cultural conditions and are nominally 50 m away from local waterways (during open water and frozen conditions). Sabina has committed to providing 45 days notice before establishing these camps.

Infrastructure at the seasonal camps would include kitchen, camp dry, sleepers and office tents/ weatherhavens to accommodate up to 25 people. These seasonal camps would also involve fuel, materials and supplies storage and handling to support local exploration and resupply activities. Water would be provided by local sources to supply water to the camp facilities (showers, kitchen, laundry) and ice airstrip construction and maintenance as needed.

Emergency shelter infrastructure would be associated principally with the winter ice road corridors with a station mid-distance along the route. This shelter would be either permanently installed for the Project life on a constructed pad or temporarily placed on pullouts built as part of the winter ice road. Shelters would be equipped with survival and communications equipment as required by weather conditions and occupational health and safety needs.

4.3.4 Goose Property Infrastructure

Various locations were assessed at the Goose Property Area for the processing plant complex. The current location was finally selected based on the following factors: proximity to the deposits, proximity to Tailings Storage Facility, relatively large area of flat and elevated terrain, competent rock or close to surface for good foundation conditions, remote from culturally sensitive areas. The selected site also offers the best opportunity for water management and spill containment and reduces overall site footprint and land disturbance.

The location of the fuel tank farms is dictated by the site development and the logistics of accessing the Goose Property. This is discussed in Section 6.6.5.

4.3.4.1 Goose Property Freshwater Sources

For the Goose Property, minimizing use of freshwater is an important design criterion for camp and processing plant operations. For this reason, the water balance for the Goose Project incorporates maximizing recycling water from the tailings facility for use in the process plant while maintaining an adequate water cover on the tailings. Even with recycling, the processing plant will still require additional freshwater for operations. This fresh make-up water will be sourced from Goose Lake principally with Big Lake being the most likely other source to provide additional water resources during low flow conditions during operations and/or for closure activities. Alternative water sources for all water supply throughout the Project life (including operations and closure) will be based on technical feasibility, costs, proximity to infrastructure and environmental considerations. Camp water supply will also require freshwater throughout all phases of the Project life.

The proximity to the point of water source is the primary selection criteria. However, the source must be sufficient to satisfy the Project needs while respecting drawdown criteria established by DFO guidelines. Goose Lake is currently used as a water supply source to support exploration camp and drilling activities. In determining water needs for the Goose operations, freshwater needs were addressed in water balance calculations and it was determined that Goose Lake has sufficient capacity to supply freshwater during site preparation, construction and operation in conjunction with water recycling efforts. At closure, additional freshwater may be needed to reach closure objectives.

4.3.4.2 Other Goose Property Infrastructure

Once the plant location, waste rock storage areas, and Tailings Storage Facility were determined, other infrastructure (such as the airstrip) were located based on the following factors: proximity to the plant site, suitable ground conditions for good foundation conditions, minimizing project footprint, and remote from culturally and environmentally sensitive areas.

4.3.5 Marine Laydown Area Infrastructure

The infrastructure needed at the MLA was based on the consideration of vessel and the associated shipping logistics, offloading requirements for receiving fuel and cargo, and workforce requirements. While a preferred site for the MLA has been identified, this was based on the limited information available at the time. Ongoing assessment will include field and design reviews.

Options to transport fuel to the MLA include:

- by tankers that will anchor offshore and fuel will be offload fuel through a floating hose that will convey the fuel from the tanker to a shore manifold and through a pipeline that transfers the fuel to the on-land fuel storage tanks;
- by tankers that will anchor offshore and fuel will be transferred to barges for offloading and transfer into on-land storage tanks; and
- solely by towed barges and transfer to on-land storage or remain on barge for transfer to trucks and delivery to site during winter season. Note that floating line transfer is not possible from barges.

A trade-off study of these options indicate that the shipping season during operations is too short to support fuel deliver by barges and the preferred option is delivery by tankers and transfer to fuel storage at the MLA using a floating line. With this decision, the location and size of the storage tanks is determined by minimizing the floating hose length, topography and elevation of area, tanker size and pumping capacity, avoidance of environmental and cultural sensitive areas.

Options for cargo delivery during operations include ships, barges, or a combination of both. An assessment of the number and size of vessels and barges required determined that cargo be transported to the site using both ships and barges over the mine life. This is based on technical and costing considerations to deliver the annual resupply in the relatively short two month, open water shipping window. With this preferred option determined, the dock and related in-water structures will be determined by the ship and barge requirements incorporating costing and technical considerations with avoidance of environmental and culturally sensitive areas, and minimizing impact to foreshore marine environment and fisheries/fish habitat. Cargo can be offloaded directly from the ships if there is sufficient water depth at the dock or can be carried out by lightering.

Temporary offloading during construction may also be required. The preferred option in this case would be for temporary cargo offloading by beach landing of barges with skid bow and bow ramp. The barges use their open anchoring system to moor and tugs hold the barge on the beach and push on them as they lighten up with cargo offloading. The cargo is typically offloaded using front end loaders. This is a proven approach for cargo delivery in Arctic conditions.

Temporary storage of fuel during construction may also be required as permanent storage tanks are under construction and being prepared for operation. In this case, temporary storage may include bladders and/or smaller portable fuel storage tanks. These bulk fuel storage methods and containment are currently used at the Back River exploration project and are a proven approach to fuel storage and handling in Arctic conditions.

Water for the camp operations at the Marine Laydown Area will be drawn from Bathurst Inlet and a desalination facility will be constructed as part of the Project.

With the decision on preferred options for fuel and cargo delivery, offloading requirements and on-site storage requirements, the camp infrastructure was developed based on costing and technical considerations, minimizing footprint, avoiding environmental and culturally sensitive areas, and the seasonal use of the facilities.

4.3.6 Domestic Waste Management

4.3.6.1 Greywater and Blackwater Treatment

Alternatives for treating greywater and blackwater (sewage) are limited in Arctic conditions due to technical feasibility, operational needs, costs and environmental considerations. Over the Project life, and at each Project site, various options may be used independently or in combination with each other. These alternatives include:

- use of Pacto units with incineration of the waste and appropriate disposal of the resultant ash;
- direct discharge of untreated water to an approved sump;
- mixing untreated waste water with other effluent prior to discharge to meet discharge objectives; and
- treat using a membrane bioreactor or similar biological process.

While options remain possibilities, the use of a biological reactor is the preferred option for Goose Main during operations. This is was chosen, despite being less economic than other options identified, due to environmental and community considerations.

The seasonal nature and smaller camp size of the MLA make a membrane bioreactor or similar process less preferred. There will be no direct discharge of treated sewage effluent or camp greywater to the marine environment. During all project phases, the MLA camp will employ Pacto or incinerating toilets to avoid the need for a sewage treatment plant. Greywater will be settled and separated of oils and grease before being discharged through a designated pipeline to the tundra to the north of the Construction Laydown Area (see Figure 7.10-2) and will ultimately runoff into Bathurst Inlet. It is expected to attenuate before contacting the marine receiving environment due to the following:

- o Greywater will be discharged in an area of low slope to minimize velocities, encourage sheet flow, and minimize channelization;
- o The discharge will be directed towards gravel beds or rock to reduce water velocities as appropriate; and
- o To maximize attenuation, the expected flow path to the nearest receiving environment is greater than 1.5 km, due to the gently sloping topography extending to the west and south of the discharge location.

Greywater will meet the ocean disposal criteria.

4.3.7 Options for Equipment

The only practical method for excavating the ore released by blasting for the Project is mechanical shovels. Diesel-hydraulic face shovels will be used, backed up by front-end loaders to load mine haul trucks to transport ore to the primary crusher or run-of-mine stockpile and waste rock to the waste rock stockpiles. Movement of vehicles within the pits will be monitored by a central dispatching system to ensure worker health and safety and operational efficiency.

Backhoe excavators will be utilized for general earthworks, snow removal, and limited mining activity where the larger equipment may have limited access. Wheel and track bulldozers will be used for cleanup around mining activities and for control of rock on the benches. Graders and water trucks will be used for main haul road maintenance. All equipment is operated by an operator located in a heated, enclosed cabin that is an integral part of the equipment.

4.3.8 Options for Future Development of Other Mineral Deposits

Future development of other mineral deposits will depend on current economic environment, mineral resources and reserves, regulatory regime and socio-economic considerations. Although Mineral Resources for both the Goose and George properties are reported, only the Goose Property resources are considered for mining in the FEIS. Mineral Resources at the George Property will be held for future opportunities. The potential for future development, including George Property, the expansion of existing deposits, or additional mineral deposits that are deemed economical, is presented in Section 3.2 of this volume.

4.3.9 Bulk Fuel Storage Alternatives

Activities will require an initial sealift to the MLA, including bulk fuel, early during the open water season. An initial 540,000 L will be needed for fuel storage. The Back River Project does not intend to overwinter a fuel vessel as a method of storing fuel. Should overwintering be utilized all regulatory requirements would be met.

A trade-off study for the FS indicates that the shipping season is too short to support fuel delivery by barges and the preferred option is delivery by tankers and transfer to fuel storage at the MLA using a floating line. With this decision, the location and size of the storage tanks is determined by minimizing the floating hose length, topography and elevation of area, tanker size and pumping capacity, avoidance of environmental and cultural sensitive areas. Aboveground, field erected or shop fabricated hardwall tanks are the preferred bulk fuel storage method for environmental, technical feasibility and cost considerations. These facilities would include corrosion protection, secondary containment, containment sumps (if applicable) and overfill protection.

During construction at the Goose Property, fuel will be delivered by air or overland via the winter ice road link to the MLA or a combination of both. Once operation begins, fuel will be brought in by sealift and transported from the MLA to the Goose Property over the winter ice road. Same as for MLA, aboveground, field erected or shop fabricated hardwall tanks are the preferred bulk fuel storage method for environmental, technical feasibility and cost considerations. These facilities would include corrosion protection, secondary containment, containment sumps (if applicable) and overfill protection.

Temporary storage of fuel during construction may also be required as permanent storage tanks are under construction and prepared for operation. In this case, temporary storage may include bladders and/or smaller portable fuel storage tanks. These facilities include secondary/tertiary containment sized to accommodate 110% of the largest tank within the containment. These bulk fuel storage methods and containment are currently used at the Back River exploration project and are a proven approach to fuel storage and handling in Arctic conditions.

4.3.10 On-site Accommodations and Worker-related Alternatives

4.3.10.1 Work Scheduling during Operation

The options for work rotation include:

- two weeks on site and two weeks off site;
- four weeks on site and two weeks off site; and
- three weeks on site and three weeks off site.

Assessment of rotation schedules as part of logistical considerations indicates that the preferred worker rotation during operation is two weeks of site work followed by two weeks in their resident communities. While this is not the most cost-effective schedule, it has been found by decades of experience at remote mines to be the preferred work schedule in terms of worker safety, separation from family members, having a consistent workforce that shares the same rotation, and ultimately for the retention of the mine’s workforce.

4.3.10.2 Worker Sourcing (Direct Points of Hire)

It is anticipated that points of direct hire for the Project will be from the Kitikmeot communities of Kugluktuk, Cambridge Bay, Gjoa Haven, Taloyoak, and Kugaaruk and the seasonally used communities of Kingoak and Omingmaktok. Other communities in Nunavut, and other Canadian jurisdictions, will also be sources for employees. Sabina will employ the appropriate personnel over the project life to meet the operational objectives and cannot limit the points of hire to the Kitikmeot Region, or Nunavut Territory.

Although employees will come from various communities, options to transport to site are limited to the following due to the current infrastructure network of the Territory:

- central access hub in Yellowknife;
- central access hub in Cambridge Bay and Kugluktuk; and
- combination of access hubs in Yellowknife and Cambridge Bay and Kugluktuk.

Economic consideration of logistics has determined that the best approach would be a combination of employees coming through Yellowknife as well as direct flights from Cambridge Bay and Kugluktuk to the Project.

This proposed arrangement, which still allows workers from other communities to participate in the Project without direct flights, is the preferred alternative because it offers the best “effect – benefit” matching opportunities to the Project and the communities. The communities closest to the Project have traditional land ties and will be most affected by the activities of the Project. Selecting these communities as preferential points of hire optimizes benefits from the Project in view of Inuit land use constraints imposed on these communities.

4.3.10.3 Worker Accommodations

The existing facilities at Goose Exploration Camp will be used for initial construction, i.e., prior to the permanent camp being operational, and for overflow capacity during peak periods in construction or operations. The permanent accommodation facilities at both the MLA and Goose Property will be structures that are pre-fabricated off site for transport to and assembly at their temporary, if required, and final locations. A possible alternative to this arrangement that has not been fully assessed yet is the use of a floating accommodations barge for the MLA. This could be for temporary or permanent use and such a decision would be based on an economic trade-off study. Any required environmental assessments would be conducted and considered in the decision.

4.4 NON-VIABLE DEIS ALTERNATIVES

The alternatives shown in Table 4.4-1 were presented in the DEIS and have been found to not be viable after further consideration during FEIS.

Table 4.4-1. Non-viable DEIS Alternatives

Ref	Alternative Description	Reason Considered Non-viable
4.2.2.4	Connection to Tibbit to Contwoyto Winter Road (TCWR)	Technical operating considerations, un-guaranteed access, environmental impact, and concern over insufficient length of its operating season make the TCWR connecting road not viable.
4.2.10	Hydroelectric power as an alternative for power generation	Hydroelectricity is not economically and not environmentally feasible due to the significant distance to the nearest possible generation site. It is also not suitable to provide baseload for Project energy needs.

5. Economic and Operating Environment

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5. Economic and Operating Environment

5.1 PROJECT EXPENDITURES

5.1.1 Construction

The total GDP impact is estimated to be over $502 million during the Construction phase. The Project will bring revenues of approximately $49.2 million to the federal and $45.3 million to the provincial and territorial governments across Canada; this revenue will primarily come from personal income tax, indirect corporate profit tax and sales tax. The Project will substantially benefit Nunavut and will contribute as much as $44 million in GDP to Nunavut primarily during the two years of active construction.

5.1.2 Operation

Total Canadian GDP impacts of the Project are predicted at $2,557.5 million over the 10 years of production. Total tax revenue during operation is estimated at $408.8 million, consisting of $207.6 million in federal, $201.2 million in provincial/territorial tax revenue, and Nunavut mining royalties of $97 million over the life of the mine. The Project will substantially benefit Nunavut and will contribute as much as $382.2 million in GDP to Nunavut during the Operation phase.

5.2 EMPLOYMENT

5.2.1 Construction

During the Construction phase, the Project is estimated to result in a total of 4,339 person-years of direct, indirect and induced employment across Canada. In the first year of mobilization and construction, it is expected that the Project will create less than 100 person-years of employment which will increase to a peak of over 1,800 person-years in the fourth and final year. Nunavut will benefit with as much as 347 person-years of direct, indirect and induced employment including 260 person-years which will occur in the Kitikmeot region. The Kitikmeot region is estimated to benefit from a total of approximately 223 person-years of direct employment.

5.2.2 Operation

During the Operation phase of the Project it is expected that the total direct, indirect and induced employment for Canada as a whole will be 20,828 person-years. Total employment increases sharply through the first and second years of operation, peaking at 2,545 in Year 8 of production and then decreasing thereafter. Nunavut will benefit with as much as 2,928 person years of direct, indirect and induced employment with over half of that (1,938) in the Kitikmeot region. The Kitikmeot region is estimated to benefit from a total of approximately 1,659 person-years of direct employment.

5.3 ORIGIN OF WORKFORCE

Sabina has estimated projected workforce based on experiences at other similar projects in the Kivalliq and Kitikmeot regions. At Meadowbank, for example, the Inuit employment proportion has varied between 30% and 40% over the first three years of operation. Current estimates utilize 35% northern hires during the Operation phase and 25% for the Construction phase. These estimates may vary significantly depending on numerous external factors. Employment opportunities will focus on hires from the Kitikmeot communities of Cambridge Bay, Kugluktuk, Gjoa Haven, Taloyoak, and Kugaaruk. Sabina will utilize other locations such as Yellowknife and other cities in Southern Canada location as and when needed.

5.4 LABOUR INCOME

Personal income effects (direct, indirect, and induced) are expected to total $334.3 million for Nunavut with $248.6 million for the Kitikmeot region for life of mine. Direct income effects for the Kitikmeot are estimated at $218.1 million life of mine.

5.5 CONTRACTING

The Project may depend on several contract services for the Construction and Operation phases. These could include, but not be limited to:

- open pit/underground mining;
- underground infrastructure work;
- surface infrastructure work;
- mobile and fixed equipment maintenance;
- camp services: catering and accommodation management;
- logistics, transportation services, and fuel services;
- expediting/mine resupply;
- communications;
- monitoring;
- external trainers on site to conduct specialty training, e.g., safety, conflict management, cultural awareness;
- security; and
- administration.

Sabina would require contractors to utilize reasonable Northern labour from qualified local sources and provide on-the-job training program.

5.6 WORK SCHEDULE, TRANSPORTATION AND HOUSING

Production, maintenance, and technical personnel are currently planned to work 12-hour shifts on a 14-day/14-off schedule (fly-in/fly-out). Construction and certain crews during the Operation phase may work up to 28-day/14-off schedule depending on prevailing requirements. The 14-day/14-off schedule is a common schedule used by remote operations in northern Canada and will result in 2,190 scheduled hours of work per year excluding vacation time. Crew changes will take place by air and employees arriving at the airport will be transported by bus to the camp. Crew movements to the Goose Property and the MLA will be facilitated by chartered air service from Edmonton, Yellowknife, Cambridge Bay, and Kugluktuk. One or two return passenger flights per week, from the south and north, is expected for the Goose Property during Operations. The MLA, when active, will also have weekly return flights, most likely from Yellowknife. The number of personnel required on-site will depend on the types and amount of work being done. The origins of the employees, the number of passengers, and the types of passenger aircraft being flown will determine the schedule of flights, including their origins, at the time.

During the construction phase, the current exploration camp at Goose Property will be used as temporary lodging for workers while the construction camp is constructed. The construction camp will be similar to those at other remote mines.

The permanent camp will also include a reception and security area, a kitchen and dining room, laundry facilities, and an administration building including a first-aid clinic. Recreational facilities will be included as they are considered essential to recruit and retain employees.

5.7 TRAINING AND BENEFIT PROGRAMS

In order to attract, retain and develop the calibre of employees necessary to optimize operations, Sabina is committed to provide advancement and promotion opportunities to current employees wherever reasonable. Training programs will also be organized within the Kitikmeot communities to help community members train for appropriate, needed positions.

Sabina will provide employees job-specific training and instruction as part of their employment. Comprehensive testing and training programs will be implemented to ensure the safety of all employees at the mine site.

Sabina will provide for all its employees a comprehensive benefits plan coverage, which includes prescription, medical, dental, Accidental Death and Dismemberment Insurance, life insurance as well as an employee assistance program.

5.8 INUIT IMPACT AND BENEFIT AGREEMENT

Under the Nunavut Land Claims Agreement (NLCA) Section 12.5.2 the Company is required to detail the steps which it proposes to take to compensate those adversely affected by the Project. It is Sabina’s view that the only party whose interests are potentially directly adversely affected by the Project are Inuit Beneficiaries in the Kitikmeot region as the Back River Project lies primarily within Inuit Owned Lands administered by the KIA. As such, Sabina is committed to the negotiation of an Inuit Impact and Benefit Agreement with the KIA in line with the Project development timeline.

5.9 GOVERNANCE AND LEADERSHIP CONTEXT

The Back River Project is located primarily on Inuit Owned Lands (IOL) located in the Kitikmeot region. As such, surface rights for the primary mine infrastructure is managed by the KIA. Portions of the winter ice road transportation corridors are managed separately under Aboriginal Affairs and Northern Development Canada. Sub-surface mineral rights for the Project are managed by Aboriginal Affairs and Northern Development Canada and do not sit with Nunavut Tunngavik Incorporated (NTI) and hence royalties are paid directly to the Crown.

Because the Project lies on Inuit Owned Lands, it can only proceed with the consent of the Inuit as provided by the KIA. In addition, the communities of Cambridge Bay, Kugluktuk, Kingaok, Omingmaktok, Gjoa Haven, Taloyoak, and Kugaaruk, and groups within these communities play an important part in the advancement of the Project.

Three institutions of public government created under the NLCA will play a key role in deciding whether the Project can be developed and under what conditions. These include:

- The Nunavut Planning Commission (NPC) – responsibility to ensure that the proposed development meets concordance of existing land use plans.
- The Nunavut Impact Review Board (NIRB) – responsible to screen and review the environmental and socio-economic impact of the proposed Project in a public setting to determine whether a recommendation should be made to the Federal Minister of Aboriginal Affairs and Northern Development on whether the Project should proceed or not and under what conditions. If the Project is approved to proceed, the NIRB also plays a role in monitoring that the Project is

constructed, operated and ultimately closed in accordance with the commitments made and conditions applied during the review process.

- The Nunavut Water Board (NWB) – responsible for issuing the required water licences for the Project should it proceed. The water licence addresses all water use at the Project including diversions and all deposition of waste to water generated as a result of mining, including ultimate closure and reclamation.

Sabina will work with other Federal and Territorial government agencies to address their areas of focus and authorization. These include, but are not limited to, the Government of Nunavut, Canadian Northern Development Agency, AANDC, DFO, Environment Canada, Natural Resources Canada, Transport Canada, and the Government of the Northwest Territories.

Sabina will endeavor to avoid potential conflicts of interest that may arise in current governance regimes during the Project development by bringing all of the parties together in an open and transparent manner and working in a cooperative manner to seek accommodation that will avoid such conflicts.

6. Detailed Project Description - Construction

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6. Detailed Project Description – Construction

6.1 CONSTRUCTION OVERVIEW

Mobilization and construction (Year -4 through -1) takes place over a 4 year period. Most of the environmental protection measures are incorporated in the planning stage of the Project and will be implemented at the onset of construction activities and carry through for the life of the Project. This Section presents an overview of the infrastructure to be advanced during construction which have a “life of Project” use. These include:

- the construction and operation of the Marine Laydown Area (described in Section 6.4);
- the construction and maintenance of winter ice roads (described in Section 6.5);
- the construction of the mine site infrastructure such as site roads, laydowns areas, maintenance facilities, camps, administration buildings, airstrips, waste management facilities, fuel storage at the Goose Property (described in Sections 6.6); and

The focus of mobilization (Year -4 to -3) is to provide access to the Project and initiate delivery of equipment, materials and supplies for construction. Other activities that will be included are the establishment of laydown areas, communications network and improvements to camp facilities to accommodate a growing workforce.

Subsequent years (Year -3 to -1) focus on constructing processing facilities, water and waste management infrastructure, support facilities, and the tailings facilities at the Project sites. The scope of the construction activities is summarized in the following sections.

6.2 PROJECT DEVELOPMENT AREAS

The Goose Property is located in a remote area of the Kitikmeot Region, Nunavut. Currently, access is by air. For the development of the Back River Project, the site can be accessed by air or overland via winter ice road linkage to Bathurst Inlet where the Marine Laydown Area is.

The Project includes the development of the following winter ice roads (WIR):

- Winter ice road from the Marine Laydown Area to the Goose Property (MLA-Goose Winter Ice Road);
- Winter ice road connecting the George Exploration Camp with the MLA-Goose WIR (George Winter Ice Road Spur); and
- Winter ice road connecting the George Exploration Camp to the Bathurst Inlet Port and Road (BIPR) all-weather road (BIPR Winter Ice Road Connector).

6.2.1 Potential Development Area

Sabina has identified a Potential Development Area (PDA) for the Goose Property and MLA. Since the Project design is at the feasibility phase, the actual footprint of these facilities may shift within this PDA as further geotechnical investigations are undertaken and the design of the facilities is finalized. The PDA makes allowance for potential relocation of certain facilities within its boundaries. With the exception of the freshwater aspects, for the purpose of the environmental effects assessment on other aspects (landform, vegetation, wildlife), it is assumed that the entire area of the PDA is lost for the duration of the mine life. For freshwater aspects, the assessment focuses on the expected physical footprint of the facilities and their expected effects on the freshwater VECs. Table 6.2-1 summarizes the size of the PDA and the expected footprint of facilities for each site.

Table 6.2-1. Size of Potential Development Areas and Footprint of Facilities

Project Site	PDA	Footprint of Facilities	Reference Figure
Goose Property Area	5,358 ha	758 ha	Figure 1.6-2
Marine Laydown Area	653 ha	27 ha	Figure 1.6-3
George Winter Ice Road Spur (spur road from George to MLA-Goose WIR)	13 km length 200 m corridor	13 km length 30 m width - water 10 m width - land	Figure 1.6-4
BIPR Winter Ice Road Connector	20 km length 200 m corridor	20 km length 30 m width - water 10 m width - land	Figure 1.6-4
Marine Laydown Area – Goose Property Winter Ice Road	160 km length 200 m corridor	160 km length 30 m width - water 10 m width - land	Figure 1.6-4

6.3 ACCESS TO PROJECT SITES

The access routes to the Project sites are presented in Figure 1.6-4 while Table 6.3-1 presents a summary of the site access routes for the Back River Project.

Table 6.3-1. Logistics and Site Access to Goose Property

Air Access	Throughout the mine life, all-weather airstrip capable of servicing passenger and large cargo aircraft. Ice and open water airstrips may also be used.
Overland Access	By winter ice road from the MLA to the Goose Property during winter months (January to April).
Sea/Overland Access via Bathurst Inlet	Open water season (end of August to mid-October) sealift delivery (fuel, equipment, supplies and material) to Marine Laydown Area.

6.3.1 Air Access

Due to the remote location of the Project site, air transportation of manpower, goods, equipment and supplies will be a fundamental feature of the Back River Project for the life of the Project. Ice and open water airstrips and aprons will be used during construction and closure. Helicopters are and will continue to be used within the Project area to access exploration activities and support environmental work. The types and amounts of work being done, the origins of the employees, the number of passengers, and the types of passenger aircraft being flown will determine the schedule of flights at the given time, including their origins. Crew movements will be facilitated by chartered air service from Edmonton, Yellowknife, Cambridge Bay and Kugluktuk. Air freight will use Edmonton and Yellowknife as hubs. Table 6.3-2 presents an overview of the expected number of flights for the various phases of the Project.

6.3.1.1 Goose Property Airstrip

At the onset of construction activities, an all-weather airstrip and apron capable of servicing passenger and large cargo aircraft will be constructed at the Goose Property by extending and upgrading the current exploration/development gravel airstrip. This airstrip will serve as the main air access to the Property throughout the life of the Project. The all-weather airstrip will be designed to Transport Canada standard TP 312 *Aerodrome Standards and Recommended Practices* (2005). The airstrip will be up to 1,524 m long and 45 m wide. It will be equipped with lights, communications equipment, and instrumentation in accordance with appropriate Federal regulations. The airstrip will include an operations center and stand-alone power supply (generator including back-up).

Table 6.3-2. Anticipated Number and Frequency of Flights for Each Phase of the Project

Project Site	Construction	Operation	Closure	Post-closure
Project Phase	Years -4 to -1	Years 1 to 10	Years 10 to 18	Years 19 to 23
Goose Property	Up to 4 per week fixed wing	Up to 4 per week fixed wing Up to 2 per day heli	Up 3 per week fixed wing	1 per month fixed wing (summer period)
MLA (during sealift and winter ice road haulage)	Up to 4 per week fixed wing	Up to 6 per week fixed wing	Up to 2 per week fixed wing	1 per summer fixed wing (summer period)

6.3.1.2 Marine Laydown Area Airstrip

An airstrip capable of accepting small turboprop aircraft may be constructed on ice during winter (Bathurst Inlet in proximity to MLA). Access to the MLA will be by floatplanes during open water, if necessary. There will be no all-weather airstrip constructed at the MLA.

6.3.1.3 Air Transportation Security

Passengers and cargo traveling from off-site airports will be governed by the respective security procedures and policies.

Passengers departing from or commuting between the on-site airstrips will be issued boarding passes which need to be presented in order to board their plane. All luggage must be tagged to identify the owner. Upon deplaning, the passengers will board shuttles for the respective camp. Checked luggage will be unloaded by ground crews and delivered to the camp. All incoming and outgoing luggage, including carry-on, may be subject to search.

6.3.1.4 Emergency Response

Emergency response procedures for accidents, malfunctions and incidents related to air traffic are addressed in the Risk Management and Emergency Response Plan (Volume 10, Chapter 3).

6.3.2 Overland Access

Overland access to the Project is possible between January and April each year. Winter ice road corridors are shown on Figure 1.6-4 and include:

- winter ice road access from the Marine Laydown Area to the Goose Property;
- winter ice road access to the George Exploration Camp; and
- winter ice road access between the George Exploration Camp and the proposed Bathurst Inlet Port and Road (BIPR) all-weather road.

The Goose Property will be the main operational hub of the Project. During construction, equipment, material and supplies delivered by air or overland via the MLA winter ice road will be staged at the Goose Property.

The Marine Laydown Area will be constructed on southern Bathurst Inlet. Construction of the MLA is expected to begin in Year -3 to receive the first sealift and will be completed for the beginning of the

Operation phase. During construction, oversized materials and equipment will be delivered to the MLA and transported to the Goose Property over the winter ice road. During operation, equipment, material, fuel, and supplies will be delivered by annual sealifts and staged at the MLA until the following winter season. Beginning annually in early December, the winter ice road linking the MLA to the Goose Property will be constructed. Once the winter ice road is ready for traffic, then the equipment, material, fuel, and supplies staged at the MLA will be transported by trucks to the Goose Property. It is expected that the transfers will occur annually between January and April.

The construction and maintenance of the winter ice roads is described in Section 6.5.

6.3.3 Marine Access and Shipping Route

The location of the MLA and the winter ice road to the Goose Property is shown on Figure 1.6-4.

6.3.3.1 Shipping Season

Shipping of goods, equipment, material, and supplies will occur annually from approximately July 15, or as early as possible, through October 15. The eastern and western routes have different open water seasons, approximately August 25 through September 30 and July 15 through October 15, respectively. Shipping will occur during these windows, and not after October 15, unless unforeseen or emergency situations are encountered. There will be no requirement for ice breaking. Because this shipping season coincides with community resupply, Sabina will endeavor to work with local and territorial governments to minimize interference with each other's deliveries and if possible, coordinate joint resupply efforts.

6.3.3.2 Shipping

The Back River Project will include shipping from the St. Lawrence River and Vancouver, BC to Bathurst Inlet. 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 Back River Project will increase this number of vessels by three to four (2-3 barges and 1 ship), or up to 8 one-way sailings per year during the Construction and Operations phases. One fuel shipment is estimated for the Closure period. Table 6.3-3 summarizes the expected number of sealifts for each phase of the Project; fuel volumes and freight tonnage are provided in Tables 6.4-3 and 6.4-4 in Section 6.4. 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.

Table 6.3-3. Expected Number of Sealifts and Fuel Delivery for Each Project Phase

Year	Y-4 to Y-1	Y1	Y2	Y3	Y4	Y5+
Number of vessels	2 to 4 annual	3 to 4	3 to 4	3 to 4	3 to 4	3 to 4 annual
Number of tankers	1 annually	1	1	1	1	1 annually

Cargo will be transported to the MLA by ice class ocean-going barges or ships with the bulk of it in marine shipping containers (Twenty-foot Equivalent Units). Vessel type may fluctuate each year depending on availability and operational requirements, but the design cargo barge will have a DWT of 16,000 t and maximum draft of 6 m; cargo ships will have a DWT of 17,000 t and draft of 9.7 m. The vessels will be self-sufficient for off-loading cargo. Lightering barges will be used to transfer cargo from the vessel to the terminal at the barge landing area. Dry cargo such as supplies, explosives materials, and equipment will be landed by barges and then offloaded with mobile equipment after being brought to shore using beach ramps from the terminal barge. All vessels will meet Transport Canada requirements for shipping in the Arctic. Outgoing cargo, including demobilized equipment and hazardous waste, will be loaded onto the barges for the return trip to southern ports.

Blasting related products will arrive in sea cans and will be handled, transported, and stored in accordance with and federal approval under the *Explosives Act* (1985), *Transportation of Dangerous Goods Act* (1992), and the *Nunavut Mine Health and Safety Act* (1994).

Fuel will be transported to the MLA using tankers with capacities ranging from 15,000 to 60,000 m^3, and DWT of 20,000 to 30,000 t. Drafts will range from 8 to 12 m. The tankers will be self-sufficient for offshore mooring and the deployment of a floating hose.

The MLA will remain operational until closure although the last sealift will occur in Year 8 of Operations. Dry freight requirements for Year 9 and 10 are significantly reduced; therefore, all sea freight required for those final operational years will be transported to the MLA in Year 8 and the Winter Ice Road will operate as required thereafter

6.3.3.3 Navigational Aids

The need, installation and maintenance for navigational aids will be decided upon based on ongoing discussions with Coast Guard. It is anticipated that navigational aids will be needed during the Project life to help marine traffic know their location and the safe course to proceed. Aids to navigation may include:

- **buoy** - A floating marker anchored to the bottom and sometimes equipped with audible, visual and/or electronic signals. It marks out navigable channels.
- **daybeacon** - An unlighted fixed structure with a pointer, sign or "daymarker."
- **light** - A fixed aid, floating or on land, with an identification number and a light at the top.
- **ranges** - Pairs of lighted or unlighted fixed aids which indicate the centerline of a channel. One marker is closer than the other and aligning them marks the correct channel.
- **radiobeacon** - A transmitter which broadcasts a characteristic signal to aid navigating at night, in fog or between distant points beyond the range of normal visibility.
- **Electronic Navigation System** - One or more radio transmitters emitting special signals to aid in navigating in fog or when out of sight of land.

6.3.3.4 Shipping Management Plan

Sabina has provided a draft Oil Pollution Emergency Plan (OPEP) and Shipping Management Plan in Volume 10 of this EIS. The company does not own or operate any ships. Throughout the Project life, Sabina will rely on experienced shipping operators for the delivery of freight and fuel to the MLA. The Canada Shipping Act requires ship operators to have a Transport Canada reviewed Ship Oil Pollution Emergency Plan for each operating vessel.

6.4 CONSTRUCTION OF THE MARINE LAYDOWN AREA

The MLA will be developed as a staging area for equipment, material, fuel, and supplies required for the operation of the Project. Construction of the MLA will begin in Year -3 and the facility will be operational for construction. The MLA will remain operational until closure. The conceptual layout of the MLA is presented in Figure 1.6-3 and the characteristics of the facilities that will be constructed at the Marine Laydown Area are presented in Table 6.4-1.

Table 6.4-1. Characteristics of the Infrastructure Constructed at the Marine Laydown Area

Potential Development Area	653 ha Footprint of facilities within MLA PDA = 27 ha
Site Roads	All-weather roads will be constructed on the site. Construction materials will be from locally developed geochemically suitable cuts, and only rock quarries if needed. Roads will be private and not for public use.
Quarry Sites and Borrow Area	Aggregate required for construction: up to 1.3 Mt Quarry area: cut and fill in balance; local quarry as required Only geochemically suitable rock quarries will be developed if needed
Water Supply	Source: Bathurst Inlet - Desalination unit Quantity: domestic uses = 48 m^3/day; Industrial use: 24 m^3/day; potable water treatment plant/desalination unit
Fuel Storage	On land storage of 60 ML (four tanks at 15 ML) Fuel delivered by sealift during open water season. ISO containers as required (camp/shop facility)
Power Generation	Power plant at camp and maintenance facilities: 3x 500 kWe (N+1)
Laydown and Storage Area	Ammonium nitrate storage area: up to 3,900 tonnes inert AN in 207 ISO containers Explosives storage area: no packaged explosives and detonators will be received or stored at MLA during operations. Explosives magazines destined for Goose will be used to store packaged explosives for use at the MLA during construction. General laydown area for material and supplies: 4.5 ha Lined hazardous waste management area = 0.5 ha
Waste Management	*Landfarm* – for treatment of hydrocarbon contaminated soils or snow *Incinerator* – at camp for incineration of combustible waste including sewage Pacto waste *Hazardous waste*: Temporary lined hazardous waste storage area. Hazardous waste shipped off site for ultimate disposal during annual sealift season.
Airstrip	Airstrip capable of accepting small turboprop aircraft constructed on ice during winter. Access by floatplanes during open water, if necessary.
Wastewater Treatment	Oily water treatment plant - For light vehicle maintenance shops and vehicle wash facility – water treated and recycled within shop. Occasional discharges to the terrestrial environment. Oil to be collected and either burned in an approved waste-heat generator or drummed and removed from site as hazardous waste.
Sewage Treatment	Waste collected from Pacto systems will be incinerated.
Buildings	Laydown areas; Explosives magazines; Reagent storage; Warehousing facility; Emergency facilities (fire and ambulance station); General maintenance building (site services); Waste management building; 75 person camp and Administration complex (workforce with contingency) complete with kitchen, dry and recreational facilities; Administration complex; Modular desalination water treatment system; Diesel power plant; Power utility building;

(continued)

Table 6.4-1. Characteristics of the Infrastructure Constructed at the Marine Laydown Area (completed)

General site drainage	Site drainage designed to contain potentially contaminated runoff and to divert non-contact runoff water from laydown area.
In Water Construction	Grounded terminal barge that will accept lighter terminal barges. There are no permanent in-water works.

6.4.1 MLA Development Sequence

Mobilization at and construction of the MLA is intended to last for four years. During the open water season of the initial year of construction, earthwork equipment, a prefabricated camp and associated support infrastructure (power supply, water treatment, and incinerator), administrative building and foldaway type maintenance facilities will be staged at the MLA. Material to construct the first 15 ML fuel storage tank will be delivered in Year -4. This tank will be erected and ready to receive the first large fuel shipment during the open water season of Year -3. Along with the first fuel, the first sealift of mass construction equipment and materials, along with the initial mining fleet, will be received at MLA in Year -3. The MLA will be fully operational for Year -2 of construction.

6.4.2 Use of the Marine Laydown Area

At the MLA an estimated 1.3 million tonnes of aggregate will be required for construction. All of this material will be sourced from the MLA Fuel Storage foundation and will be used to fill all other infrastructure pads and roads. It is currently planned that only one quarry will be developed (MLA 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. The MLA will be initially developed for the use of Sabina in the Kitikmeot region. Should others want to use the facilities in the future, or if these are out of scope of the proposed MLA infrastructure, additional review work may be required.

6.4.3 Site Roads and Water Crossings

Construction materials are assumed to be sourced from locally developed geochemically suitable locations. The site roads within the MLA will be constructed as all-weather roads. The rock used from the fuel tank area will be used to construct the pads for the MLA infrastructure such as the camp and freight storage area and roads, with rock placed directly onto the tundra to preserve the permafrost. A layer of graded surfacing material will be placed to provide a protective trafficking layer. Roads will be constructed in accordance with mine haul road specifications, which require safety barricades. Roads will be utilized for Sabina operations and not for public use.

No infilling of lakes or stream crossing will be required for the site road construction. Speed limits will be imposed for site traffic and dusting is not expected to be problematic. Water from road surfaces will be released to the receiving environment, provided it meets the discharge water quality criteria presented in Table 6.4-2.

6.4.3.1 Public Access to Roads

Due to safety consideration, all site road networks within the MLA will be restricted to Sabina's use. Visitors (hunters arriving by snowmobile or boat) to the site will be asked to register their presence at the camp's administration centre. Sabina's community communication will emphasize this requirement.

Table 6.4-2. Proposed Road Surface Discharge Criteria

Parameter	Maximum Average Concentration (mg/L)
pH	6 – 9.5
TSS	35
Ammonia	4 mg/L average concentration; 8 mg/L max. grab concentration
Phosphorous	4 mg/L average concentration; 8 mg/L max. grab concentration
Benzene	0.370
Ethylbenzene	0.090
Toluene	0.002
Xylene	0.300
Oil and Grease	15 and no visible sheen
Arsenic	0.50
Copper	0.30
Lead	0.20
Nickel	0.50
Zinc	0.50

6.4.4 Lighter Barge Terminal

The ships and barges will be self-sufficient for offloading cargo. The marine infrastructure comprises a single grounded terminal barge that will accept lighter barges. Lightering barges will be used to transfer cargo from the vessel to the Lighter barge terminal at the MLA barge landing area. A foreshore ramp provides access from the terminal barge to the laydown area. The terminal barges will be secured in place by mooring it to onshore bollards. The bollards for the lighter barge terminal 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. 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. There are no permanent in water works associated with the dock construction.

The fuel tankers will use anchors to secure the ship offshore during off-loading. The Fuel supplier shall connect by means of a floating hose (as per the OPEP presented in Volume 10) to a shore installed connection that will allow the fuel to be pumped to the fuel storage facility.

6.4.5 Goods and Supply Received at the Marine Laydown Area

An estimated 260,000 t of freight is required to support operational activities over the life of the project through the MLA. A comprehensive load list was prepared to analyze the weights and volumes of all supplies, equipment and materials required during operations for each site. The timeline for the inbound freight to the MLA is included below in Table 6.4-3 and Table 6.4-4. Volumes of goods and material received will vary depending on the phase of the Project.

Fuel will be transported to the MLA using approved arctic tankers with the following specifications:

- Fuel capacity of 15,000 to 60,000 m^3
- Dead weight tonnage (DWT) of 20,000 to 30,000 tonne
- Draft of 8 to 12 m.

Table 6.4-3. Construction Freight/Fuel Requirements (Tonnes Freight/Litres Fuel to MLA)

	Yr -3	Yr -2	Yr -1	Total
Construction Freight (tonnes)	6,000	15,800	17,300	39,100
Construction Fuel (×1,000 Litres)	3,656	12,699	22,430	38,785

Table 6.4-4. Operations Freight/Fuel Requirements (Tonnes freight/Litres Fuel to MLA)

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Total
Operations Freight (tonnes)	19,100	23,500	23,100	22,500	25,100	26,600	29,400	25,000	17,100	5,700	217,100
Operations Fuel (×1,000 litres)	46,768	53,064	55,269	54,458	51,534	55,583	58,016	59,046	47,407	22,706	503,851

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 a maximum oil transfer rate of 450 m^3/hr 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 1,000 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 fuel supplier will provide all spill response equipment required for the classification facility as detailed in “TP-10783 – Arctic Waters Oil Transfer Guidelines”.

6.4.5.1 Laydown Area and Material Storage

During the construction phase and throughout the LOM, equipment, supplies, and fuel will be transported to the MLA by ocean going, ice-class vessels from Canadian western and eastern ports. The MLA will be connected via winter ice roads to the Goose Property during operations.

The port facility will be used to receive fuel, cargo, and consumables during construction and operation of the Project. Products will not be exported via the port, as gold doré will be transported by air from the Goose Property to southern cities.

Fuel and cargo will be received and staged at the MLA during the summer months and will be transported to the Properties by truck via the winter ice road from January to April. Outside of these periods, MLA activities will be limited to on-site storage and monitoring for loss prevention.

During periods of MLA activity, crew transport to the MLA will be facilitated by an ice airstrip during the winter months (January to April) and by float planes in the summer months (August to September). Between operational seasons, occasional personnel transport will be supported by helicopter service from the Goose Property.

Laydown and material storage areas will be developed during early construction stage. An estimated 20 hectares of laydown area will be required to store equipment, materials and supplies for the construction of the site facilities. Laydown areas will be constructed with run-of-quarry rock placed directly onto the tundra to preserve the permafrost. As per the road construction, a layer of graded surfacing material will be placed to provide a protective trafficking layer. The surface will be sloped to prevent pooling of water and runoff will be directed to the tundra.

With the exception of large preassembly and modular equipment, most material used for construction will be containerized in sea containers.

6.4.5.2 Construction Material, Equipment and Supplies

The MLA has been designed to annually handle the off-loading and storage of 60 ML of diesel and 30,000 t of consumables during operations, ramping up from 15 ML of diesel and 20,000 t of materials during initial construction.

A laydown area capable of storing 1,200 ISO sea-containers (20 ft. long) will be constructed along with four 15 ML fuel tanks. Additional laydown area is provided to accommodate additional storage requirements during construction.

The MLA will not be fully functional until Year -3, the first year of Construction. However, once mobilization begins in Year -4, some of the larger mining equipment/machinery may be delivered to the MLA for transportation to the Goose site over the winter ice road. This equipment could include part of the mining fleet (trucks, shovels) and possibly some of the larger mill equipment (ball mill, grinding mill, etc.).

During the operation phase of the Project, it is expected that most equipment, material and supplies required for the ongoing maintenance of the facilities will be delivered to the MLA. However, once the MLA is closed at the latter stages of operations, such transport will be done at Goose.

6.4.5.3 Consumables, Reagents and Explosives

During the Construction and Operations phases of the Project, consumables, reagents and explosives will be received in sea containers during the annual sealift. The containers will be stacked and stored in laydown areas until they can be transported on the winter ice road to the Goose property by flatbed truck. During the operation period (Year 1 to Year 10) up to 3,900 tonnes of ammonium nitrate will be received by the annual sealift. Actual explosives such as blasting caps and detonators will not be staged at MLA but flown directly to Goose.

6.4.5.4 Waste Transfer Station

Distinct waste storage areas will be constructed at the MLA for the storage of non-hazardous waste and hazardous waste.

All waste material will be handled, stored and transported in accordance with the Canadian and Territorial waste regulations. Copies of relevant legal documents will be kept on file at the mine site. Management and safety personnel will provide an overview of the applicable regulations to all employees as part of their initiation and ongoing training. Refer to both the Waste Management Plan and the Hazardous Materials Management Plan for more details on waste management (Volume 10).

Hazardous waste originating from the Goose Property will be packaged in appropriate containers prior to transportation to the MLA. A dedicated storage pad will be constructed at the MLA to receive and store the hazardous waste until the sealift can remove it from the site. The hazardous waste storage pad will be constructed to collect precipitation. The water will be released to the receiving environment if it complies with discharge water criteria. Otherwise, treatment will be provided.

For non-hazardous wastes, the storage pad will be constructed of crushed aggregate or borrow material and constructed to prevent pooling of water.

6.4.5.5 Loading and Offloading Procedures

Mobile equipment required for standard offloading the sealift or reloading the sealift vessels will be stationed at the MLA on a permanent basis. However, any opportunity to use equipment stationed at Goose that will not affect that operation will be seized. The typical equipment will be loaders having with forks or lifting devices for sea containers. Special machinery may be used for unloading large equipment delivered during the construction phase. The ships and barges will be self-sufficient for offloading cargo. Lightering barges will be used to transfer cargo from the vessel to the Lighter barge terminal at the MLA barge landing area. The Lightering Barge Terminal arrangements can be found in Appendix V2-7J. Freight will then be hauled to a laydown area where is will be stored until the annual winter ice road is open.

6.4.5.6 Potential Interference or Synergies with Community and Outpost Resupply (Kingaok and Cambridge Bay)

Because Sabina's shipping season coincides with community resupply, Sabina will endeavor to work with local and territorial governments to minimize interference with each other's deliveries and if possible, coordinate joint resupply efforts.

6.4.6 Fuel

6.4.6.1 Land-based Tank Farm

Sabina will construct a 60 ML land based tank farm (four tanks at 15 ML). There will be an ISO container utilized as a day tank at the MLA camp/shop facility. The fuel tank farms 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. In calculating the volume, the footprint of the smaller tanks is subtracted. 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 (GNWT 2006; refer to Section 4.6 of these 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.

Water pooling within this secondary containment will be released to the receiving environment provided it complies with discharge water quality criteria presented in Table 6.4-5. Treatment will be provided for the pooling water should the water quality exceeds those criteria.

Table 6.4-5. Proposed Bulk Fuel Storage Pooling Water Discharge Criteria

Parameter	Maximum Concentration of Any Grab Sample (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

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

Refuelling stations will be equipped with a lined and bermed area to contain minor spills or leaks during refuelling. The liner (e.g., 40 mm Hypalon liner or equivalent) will be protected by aggregate bedding. Vehicles and mobile equipment will drive onto this bedding for refuelling. Fuel transfer is done by pumps.

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

6.4.7 Spill Contingency and Emergency Response

A conceptual Spill Contingency Plan and an Emergency Response Plan have been prepared for the MLA. Refer to Volume 10. Since the MLA will contain a major fuel tank farm, the OPEP is applicable. The OPEP outlines measures to protect the marine environment and minimize impacts from potential fuel spill events. This OPEP outlines potential spill scenarios and provides specific procedures for responding to spills while minimizing potential health and safety hazards, environmental damage and clean-up costs. The OPEP provides instructions to guide all personnel in emergency spill responses, defines the roles and responsibilities of management and responders and outlines the measures taken to prevent spills, the related exercise and evaluation program, and the mechanism for regular updates to the Plan. The OPEP complements the Emergency and Spill Response Plan by providing site specific consideration to the MLA.

6.4.8 Communication System

Refer to Section 6.6.10 (discussion under Goose Property).

6.4.9 Power Generation

Power will be generated on site with the use of three 500 kW diesel generators. Power will be distributed as 600 V.

In order to maximize overall efficiency and energy conservation, this power plant will operate as a combined heat and power plant. Heat exchangers will be installed on the generator sets and the otherwise waste heat will be recovered by a hydronic system and used to heat the camp.

6.4.10 Security

Sabina will develop a Marine Security Plan in accordance with the requirements of the *Marine Transportation Security Act* (1994).

Smuggling, particularly alcohol and prohibited substances, could have negative socio-economic effects on the community. Various measures to prevent smuggling will be implemented including specifying prohibited substances and disciplinary actions including referring matters to 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.

6.4.11 Water Supply

A desalination plant will provide fresh water for both the domestic (with added treatment to make potable) and industrial use at the MLA. The water demand is expected to be 48 m^3/day for domestic use and 24 m^3/day for industrial use.

6.4.12 Site Water Management for the Marine Laydown Area

The layout of the MLA is presented in Figure 1.6-3. As described in the Side-Wide Water Management Plan and Site Water Monitoring and Management Plan, the MLA will not require a pond nor diversion infrastructures for water management purposes. Runoff from the laydown areas and site infrastructure will not be collected, as it will discharge towards 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. Non-contact water will be diverted around infrastructure, as much as is feasible, and directed to natural downstream drainage networks to maintain local drainage patterns. Clean water and snow will be managed to restrict contribution to potentially poor quality water and will be diverted to maintain natural drainage networks as much as possible.

6.4.13 Sewage and Waste Water Treatment for the Marine Laydown Area

Grey water and sewage will be kept separated at their sources and managed independently. Grey water will run through an oil-water separator before being discharged to the tundra if it complies with discharge water criteria. Non-toxic and low-sodium cleansing products will be selected to mitigate harm to the receiving environment. Sewage waste will be collected from Pactos and be incinerated. The incinerator will be selected having this functional requirement. Both of these operations will be as currently practised at the Goose Exploration Camp.

6.4.14 Waste Management for the Marine Laydown Area

The total volume of waste generated at a given time during the life of the Project will be dependent on the 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. An inventory of the estimated types and quantities of waste that will be generated during the various phases of the Back River Project is presented in Table 6.4-6.

Table 6.4-6. Estimated Waste Quantities Generated

	Annual Waste Quantities (tonnes)
Project Phase	**MLA Incinerator**
Construction (2 years)	30
Operations (10 years)	30
Active Closure (2 years)	5
Life of Project Totals (tonnes)	370

The estimated waste generation presented above is based on the following assumptions:

- kg/person/day (1.825 tonnes/year/person) total (incinerator and landfill) of solid non-hazardous waste (American Society of Civil Engineers and Canadian Society for Civil Engineering, 1996).
- Assumes that 55% of the waste is landfilled and 45% of the waste is incinerated.
- The MLA is occupied only half of each year (annual quantities are halved)
- Waste generated and not incinerated at the MLA is included in the Goose landfill quantities.
- Life of Project totals are based on 2 years of construction, 10 year operation, and 2 year active closure. Totals exclude closure quantities.
- Quantities have been rounded upward.

The estimated volume of waste generated during the Active Closure phase represents waste generated by the camp only, and excludes the volume of demolition waste that will be generated from execution of the Mine Closure and Reclamation Plan.

The incinerator will be capable of safely incinerating Class I, II, III, and IV solid wastes. This includes raw sewage. No chlorinated, hazardous and medical wastes will be fed to the incinerators. The main source of domestic type solid wastes will be from the Accommodation Complex. The solid wastes, oil soaked materials, paper, etc. will come mainly from the Maintenance Shop, Warehouse and Power Plant facilities. The design and performance of the incinerator system will comply with all applicable CSA Codes and Standards. The incinerator emissions will meet the requirements set by Canadian Council of Ministers of Environment (CCME) latest revision and other local Provincial and/or Territorial codes and standards.

A waste transfer laydown area will be developed to store solid and hazardous waste generated at MLA and transported from the Goose property over the winter ice road. During the open water season, these wastes will be backhauled by sealift to authorized waste disposal areas in southern Canada. All waste material will be handled, stored and transported in accordance with the Canadian and Territorial waste regulations. Copies of relevant legal documents will be kept on file at the mine site. Management and safety personnel will provide an overview of the applicable regulations to all employees as part of their initiation and ongoing training. Refer to the Waste Management Plan and the Hazardous Materials Management Plan for more details on waste management (Volume 10).

A landfarm will be constructed at the MLA in order to treat contaminated soil or snow that occurs as a result of accidents and malfunction of mobile equipment. The pooling water will be released to the receiving environment if it complies with discharge water criteria presented in Table 6.4-7. Otherwise, treatment will be provided.

Table 6.4-7. Proposed Landfarm Pooling Water Quality Discharge Criteria

Parameter	Maximum Average Concentration(mg/L)
pH	6 – 9
Total Suspended Solids	15
Oil and Grease	15 and no sheen
Total Lead	0.001
Benzene	0.370
Ethylbenzene	0.090
Toluene	0.002
Xylene	0.300

6.4.15 Air Access to the Marine Laydown Area

Access to the MLA will be by float planes during the summer months and turboprop planes during the winter months. A landing strip will be prepared on the Inlet for the winter months. During the shoulder seasons, the MLA will be serviced by helicopters.

6.5 GROUND TRANSPORTATION AND ASSOCIATED WATER CROSSINGS - WINTER ICE ROAD CORRIDORS

Two winter ice roads will be constructed for the Back River Project: 1) connecting the MLA and the Goose Property and 2) connecting the George Exploration Camp and extending from there to the proposed BIPR road. Refer to the Road Management Plan for maps illustrating the road network.

General design criteria are presented in Section 6.5.3.1.Freight and fuel will be transported from the MLA to the Goose Property annually on the winter ice road beginning in Year -2. Freight and fuel quantities have been estimated for the life of the mine and are shown in Table 6.5-1 below.

Table 6.5-1. Expected Annual Transport Quantities on Winter Ice Roads

Project Year	Freight (tonnes)	Fuel ('000 litres)
Year -2	15,200	10,543
Year -1	17,000	20,210
Year 1	18,800	44,415
Year 2	23,100	50,638
Year 3	22,800	52,836
Year 4	22,200	52,035
Year 5	21,400	45,275
Year 6	21,600	43,297
Year 7	21,400	43,846
Year 8	19,500	44,988
Year 9	18,600	52,854
Total LOM	**221,600**	**460,937**

The winter ice roads will be used for the duration of the Project Life. It is expected that vehicle traffic will begin in January and end in April annually. The expected number of vehicles on each road is presented in Table 6.5-2.

Table 6.5-2. Expected Annual Vehicle Traffic on Winter Ice Roads

Traffic Year	Freight Loads	Fuel Loads	Total Loads
Year -2	607	212	819
Year -1	683	406	1,089
Year 1	752	890	1,642
Year 2	927	1,014	1,941
Year 3	912	1,058	1,970
Year 4	888	1,041	1,929
Year 5	991	984	1,975
Year 6	1,051	1,065	2,116
Year 7	1,158	1,113	2,271
Year 8	987	1,133	2,120
Year 9	905	1,332	2,237
Total LOM	9,861	10,248	20,109

Cycle times were determined for freight and fuel haulage to the Goose Property based on the design criteria and road distances calculated from the MLA. The duration of a complete cycle between the MLA and the Goose Property exceeds the 12-hour maximum allowable shift. Therefore, it is anticipated that haul truck operators would work an eight-hour shift and each truck would take 16-hours to make a complete cycle. Table 6.5-3 provides details of estimated cycle times calculated for freight and fuel from the MLA to Goose Property. Table 6.5-4 provides an estimate of freight and fuel vehicles per year.

Table 6.5-3. Cycle Times

Description	Cycle Time (hours) MLA to Goose Property	
	Freight	**Fuel**
Unload / Reload Time @ MLA	1.5	1.0
Travel Time Loaded	7.3	7.3
Unload / Reload Time @ Goose/George	1.5	1.0
Travel Time Empty	5.4	5.4
Sub-Total Cycle Time Before Delays	**15.7**	**14.7**
Shift Change Delays	0.3	1.3
Total Cycle Time (hrs)	**16.0**	**16.0**

The cycle times were utilized to determine the number of trucks and trailers required for each year

Table 6.5-4. Annual Haul Truck Requirements from MLA to Goose via Winter Road*

	Freight Trucks	Fuel Trucks	Total Trucks
Year -2	9	2	11
Year -1	7	4	11
Year 1	9	9	18
Year 2	9	10	19
Year 3	9	10	19
Year 4	10	10	20
Year 5	9	9	18
Year 6	10	10	20
Year 7	11	10	21
Year 8	9	10	19
Year 9	8	11	19
Max. Required	**11**	**11**	**21**

**Includes trips averaging 25 tonnes per load. Fuel hauling will utilize standard B-train tankers with a 50,000 litre per load capacity.*

6.5.1 Public Use of Winter Ice Road Corridors

Although designed as private roads, Sabina acknowledges that once the winter ice roads are constructed, local hunters may wish to use these roads for traditional use. All reasonable efforts will be made to restrict or monitor access.

6.5.2 Design and Construction of the Winter Ice Road

The roads will be constructed yearly in December and January and be open to traffic from mid-January to the end of April. The annual construction and maintenance requirements of the ice roads will depend on operational and environmental conditions.

6.5.2.1 General Design Criteria

The winter ice roads will be designed to the following general criteria informed by expertise from other winter roads in the area including the Tibbitt-Contwoyto Winter Road. Depending on the prevailing conditions, construction will start in early December when the subgrade is sufficiently frozen to support light tracked vehicles and take approximately six weeks utilizing work fronts from each of Goose and Bathurst Inlet.

- Project Development Area: 200 m wide corridor (100 m to each side of road centerline);
- road width:
  - land: 10 m;
  - water: 30 m, typically but as required depending on ice quality, length of season, amount of snow drifting, etc.;
- maximum grade: 5%; and
- design vehicle: Super B-train - legal highway load capacity.

6.5.2.2 Design Features to Facilitate Wildlife and Human Movement

Largely constructed at grade, winter ice roads do not impose any barrier to wildlife or human movement. Speed restrictions, policies giving all wildlife given right-of-way on the roads, and reporting of aggregations of wildlife will serve to protect. Outside of the winter ice road season, the routes will return to their native state.

6.5.2.3 Goose to Marine Laydown Area

The winter ice road between MLA and Goose Property will be approximately 160 km long and travel over 42% land and 58% water. An emergency shelter will be located mid-way along the length.

6.5.2.4 George Winter Ice Road Spur

An approximately 13-km long winter spur road will connect the George Exploration Camp with the Goose to MLA winter ice road. The 20-km BIPR Winter Ice Road Connector extends the ice road network to connect George with the proposed BIPR all-weather road.

6.5.3 Spill Contingency and Emergency Response

The aspects of mitigating, responding to and otherwise managing spill incidents occurring on transportation corridors are detailed in Spill Contingency Plan in Volume 10. It addresses spills, releases, or discharges of hydrocarbon or other contaminants to land, water, ice, and snow. Depending on the type and quantity of the contaminant and relative locations of the spill, predetermined lines of responses, plans of action, and roles and responsibilities are specified. Besides the customized spill response equipment, including the mobile unit, each vehicle will be outfitted with spill kits.

In general, snow and ice will slow the movement of hydrocarbons. 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. Snow is generally a good sorbent as hydrocarbons have a tendency to be soaked up through capillary action. However, the use of snow as a sorbent material is to be limited as much as possible. Most response procedures for spills on land may be used for spills on snow and ice. The basic steps are: control the source control; control free product; protect the environment; clean up; and report.

One emergency shelter will be located mid-distance along the Goose to MLA winter ice road. The three camps connected by the roads, MLA Camp, Goose Camp, and the George Exploration Camp, will also serve to provide emergency shelters.

6.5.4 Winter Ice Roads Maintenance

Once the winter ice road is in full operations, the labour crews will be scaled back to the levels shown in Table 6.5-5 to perform road maintenance. Winter ice road maintenance will take place on a 24-hour-a-day basis with two labour crews working twelve-hour shifts, one crew based at the MLA and one crew based at Goose Property. The dayshift labour crew will consist of seven staff including project management and safety / ice profiling. The night labour crew will be made up of five staff.

Table 6.5-5. Winter Ice Road Maintenance Labour per Crew

Labour Position	Day Shift	Night Shift	Total
Project Manager (Goose)/Superintendent (MLA)	1	0	1
Supervisor	0	1	1
Safety / Ice Profiling (Dayshift only)	1	0	1
Heavy Equipment Operator – Skilled	2	2	4
Heavy Equipment Operator – Semi-skilled	1	1	2
Labourer	1	1	2
Mechanic	1	0	1
Total Labour	**7**	**5**	**12**

Maintenance crews will focus on the following tasks:

- Maintaining road widths and repairing damage to the ice sheets as required;
- Focused flooding along the road in areas where icing is lagging;
- Sanding of the portages as and when required;
- Ice profiling every second day until the road reaches 100% capacity, then weekly;
- Rescue and recovery work as required;
- Once hauling on the WIR is complete, maintenance crews will perform the following tasks to decommission the road and prepare for demobilization:
  - Remove all gravel on the ice surfaces that may have ended up on the ice as a result of sanding the portages.
  - Gather all road signs and properly store them for future use.
  - Remove any garbage that is found along the route.
  - Remove any hydrocarbon spills that are found along the route.
  - Final maintenance of all ice road construction equipment.
  - Demobilize from site.

6.5.5 Water Use for Winter Ice Road Construction and Maintenance

The expected water use for the construction and maintenance of the winter ice roads is estimated to be up to 121,500 m^3 every year to construct and maintain. The volume used will depend on environmental conditions and operational needs. Water will be drawn from various sources along the alignment of the winter ice road. Sabina will adhere to the DFO Operational Statements on Mineral Exploration, Ice Bridges and Snow Fills as well as DFO Under-Ice Water Withdrawal Protocol for the withdrawal of water.

6.6 CONSTRUCTION OF THE GOOSE PROPERTY

The Goose Property will be the primary site for the Back River Project. The development proposes four open pits and four underground mine operations.

Site infrastructure at the Goose Property includes the following: waste rock storage areas; ore stockpile; process plant; maintenance and service buildings; fuel tank farm; explosives storage; airstrip and associated navigation equipment; TSF; Goose Camp; laydown area including heated, unheated and outdoor storage; powerhouse and emergency powerhouse. The site layout of the Goose Property is presented in Figure 1.6-2. Characteristics of the infrastructure constructed at the Goose Property are presented in Table 6.6-1.

Table 6.6-1. Characteristics of the Infrastructure Constructed at the Goose Property

Potential Development Area	PDA is 5358 ha with ~15% of area being waterbodies Footprint of facilities is 758 ha
Site Roads	All-weather roads will be constructed with run-of-quarry rock placed directly onto the tundra to preserve the permafrost to a width of 8m. Construction materials are from locally developed geochemically suitable rock quarries. Roads will be constructed in accordance with mine haul road specifications, which require safety barricades. Roads will be private and not for public use.
Quarry Sites and Borrow Area	Estimated aggregate required for construction: 5 Mt Number of rock quarries: one Number of borrow areas: none Only geochemically suitable rock quarries and borrow sources will be developed.
Water Supply	Source: Goose Lake Quantity: 900 m^3/day Domestic uses (from Goose Lake) = 140 m^3/day; potable water treatment capacity Industrial uses (maintenance facilities, vehicle wash, other uses) = 100 m^3/day
Fuel Storage	On site fuel tank farm = tank farm consists of 3 steel tanks at 15 ML capacity. Fuel delivered by air freight or tanker trucks from Marine Laydown Area. ISO containers as required (each underground mine portal, AN facility, incinerator, boilers, and power plant)
Power Generation	Combined heat and power plant (CHP) consisting of five (N + 1) diesel fired reciprocating engine generator sets. Three generators will be rated for continuous duty 6.6 MW and two generators will be rated for continuous duty 5.1 MW. Seasonal open pit dewatering will be handled by diesel pumps.
Explosives	ANFO facility Bulk storage area for ammonium nitrate: up to 3,900 tonnes inert AN in sea containers Explosive magazines containing 32 tonnes of packaged explosives and 600 cases of detonators located in 40ft and 20ft magazines, respectively. Bulk ANFO mixing truck
Laydown and Storage Area	General laydown area for material and supplies. Secure sea containers for hazardous materials, e.g., mill reagents. Cold storage building
Waste Management (other than waste rock and tailings)	*Waste sorting facility* – adjacent to the Process Plant *Landfill* – for disposal of non-hazardous, non-leaching, inorganic garbage, to be located in one or more Waste Rock Storage Areas *Landfarm* – for treatment of hydrocarbon contaminated soils or snow, located in one or more Waste Rock Storage Areas *Incinerator* – at camp for incineration of camp combustible waste including sewage treatment plant sludge / pacto waste (3.0 kg/person/day) *Hazardous waste*: Temporary storage area at site. Dispose off-site in an approved facility. *Used tires and machinery*: Remove hazardous waste from equipment not being salvaged, clean and landfill equipment. Landfill used tires.

(continued)

Table 6.6-1. Characteristics of the Infrastructure Constructed at the Goose Property (completed)

Airstrip	All-weather airstrips and aprons capable of servicing passenger and large cargo aircraft will be constructed at the Goose Property Area. Ice airstrips will continue to be used as required. Dimensions: up to 1524 m long, 45 m wide. Airstrip equipped with a Global Positioning System (GPS) Instrument Approach system allowing for instrument flight rules (IFR) approaches and departures. Expected number of flights: Construction: 3/4 per week Operation: 2/3 per week Closure: 2/3 per week Post-closure: 1 per month (summer season) An operations center will contain radio equipment for ground to air communications, and all electrical services and controls for the airstrip. The automated weather observation station (AWOS) will be located along side of the control center. An emergency back-up diesel generator will be located at the operations center.
Wastewater Treatment	Sewage Treatment Plant provided for 465 person camp. Membrane bioreactor plant housed in 20 ft. container with a separate sludge drying system housed in a 40 ft. container. Treated effluent discharged to land during construction. Oily water treatment plant For light vehicle and mine maintenance shops – water treated and recycled within shop. Oil to be collected and either burned in an approved waste-heat generator or drummed and removed from site as hazardous waste.
Buildings	Process Plant and crusher buildings; Assay laboratory; explosives magazines; Detonator magazines; AN facility; Reagent storage; Core logging facility; Warehousing facility; Emergency facilities (fire and ambulance station); General maintenance building (site services); Mine maintenance and dry building; Waste management building; Light vehicle maintenance workshop; Heavy equipment maintenance workshop; Wash bay; 465 person camp complete with kitchen, Recreational facilities; Administration complex; Modular potable water treatment system; Modular sewage treatment system; Diesel power plant; Power utility building.
Overburden, Waste Rock Areas and Ore stockpiles	Develop overburden storage areas for each quarry and/or mine area Develop waste rock storage areas for Umwelt, Llama, Echo, and Goose Main Develop ore stockpile pad at the Process plant area
Water Crossings	Up to five water crossings (culverts) will be needed and will be designed to minimize Permanent Alteration to, or Destruction of, fish habitat (PAD), conform with DFO Measures to Avoid Causing Harm to Fish and Fish Habitat. Culvert diameters will range from 1.0 m – 2.5 m.

6.6.1 Water Use during Construction

6.6.1.1 Water Demand for Construction

For the Construction phase, water consumption has been estimated on the basis of domestic requirements (to support camps) and industrial requirements (to support construction use, industrial or milling water uses). Based on a construction work force of 611 people, domestic water demand will be 211 m^3/day; dust suppression and construction use will be 400 m^3/day, season-dependent; and industrial demand for geotechnical drilling, maintenance facilities and other uses will be in the range of 200 m^3/day.

During Construction, it is anticipated that the sources will be those currently accessed by the exploration camp. Once the construction of the larger freshwater water intake and pumping system required for the operation is completed, freshwater requirements for the construction camp will be drawn from this location. Water consumption for the operation phase is discussed in Section 7.10.1.

6.6.1.2 Construction of the Big Lake Pump Station

The environmental assessment for freshwater (Volume 6) indicated that the maximum water that can be withdrawn from Goose Lake without incurring a significant effect is in the range of 900^3/day year-round and 1,300 m^3/day during June through October. The freshwater demand for the Project is expected to exceed these volumes (refer to Section 7.10.2).

In light of this information, the Project includes the construction of a pump house and pipeline to supplement the water demand of the milling operation from Big Lake. During operation, up to 350 m^3/day will be pumped from Big Lake into the site water management system (refer to Section 7.10). Construction of this pump system will occur in Year -1.

6.6.1.3 Water Intake Design

The Goose Lake and Big Lake water intake will be designed in accordance with DFO guidelines for water intakes.

6.6.1.4 Drilling Activities

Sabina will retain its existing Type B water licence, 2BEGOO1520, for ongoing exploration activities.

6.6.1.5 Water Supply and Treatment Methods

Freshwater required for the Goose Process Plant will be pumped from Goose Lake. Additional freshwater will be required from Big Lake for industrial and domestic water usage. A pumping station will be installed in Big Lake to supplement water availability from Goose Lake during period of low water flows.

The domestic (potable) water supply will be treated and disinfected. The treatment plant will consist of multimedia filtration and activated carbon filtration, followed by UV disinfection and chlorination. Industrial water used in maintenance shops or wash down of vehicles will not be treated. To the greatest extent possible, industrial and wash water will be collected, treated for suspended solids removal, and recycled.

6.6.1.6 Water Uses in Maintenance Facilities and Vehicle Washing

Water will be used in the heavy equipment and truck washing facilities. An oily water treatment system will be installed in the heavy equipment maintenance facilities and to the greatest extent possible, treated oily wastewater will be recycled for reuse. During normal operation, make-up water will be required. However, upset conditions may occur which will require occasional discharge of excess water. The excess water will be released to the receiving environment, provided it meets the discharge water quality criteria presented below, in Table 6.6-2.

6.6.2 Goose Property - Ground Transportation and Associated Water Crossings (All-weather Roads)

6.6.2.1 Site Roads and Water Crossings

The site roads at the Goose Property will be constructed as all-weather roads. All-weather roads will be constructed with run-of-mine or run-of-quarry rock placed directly onto the tundra to preserve the permafrost. A layer of graded surfacing material will be placed to provide a protective trafficking layer. Construction materials are assumed to be from locally developed geochemically suitable overburden and rock quarries. Onsite roads will be private and not for public use.

Table 6.6-2. Proposed Oily Water Treatment Effluent Discharge Criteria

Parameter	Maximum Average Concentration (mg/L)
pH	6 – 9.5
TSS	35
Ammonia	4 mg/L average concentration; 8 mg/L max. grab concentration
Phosphorous	4 mg/L average concentration; 8 mg/L max. grab concentration
Benzene	0.370
Ethylbenzene	0.090
Toluene	0.002
Xylene	0.300
Oil and Grease	15 and no visible sheen
Arsenic	0.50
Copper	0.30
Lead	0.20
Nickel	0.50
Zinc	0.50

Some of the key, common design criteria for all-weather Haul, Service, and Access Roads are:

- design vehicle: Cat 775G or equivalent;
- maximum design speed: 80 km/h;
- maximum super-elevation: 4%;
- side slopes: 2H:1V;
- maximum grade: 10%;
- minimum horizontal curve radius: 20 m;
- drainage: major culverts and bridges to be designed to a 1-in-100-year return period;
- safety berms for fills greater than 3 m in height: 1.6 m.

Haul Roads

The following design criteria apply to Haul Roads in accordance the *Mine Health and Safety Act* (1994; Northwest Territories and Nunavut), and the appropriate Transportation Association of Canada Geometric Guidelines:

- design vehicle: Cat 775G or equivalent;
- minimum width of travelling surface: 20 m; and
- safety berms for fills greater than 3 m in height: 1.6 m.

Service Roads

Service roads are used for smaller vehicles (i.e., light trucks) to access ancillary infrastructure and are designed to these specific criteria:

- design vehicle: light/medium truck;

- minimum width of travelling surface: 8 m;
- safety berms for fills greater than 3 m in height: 0.5 m;
- design speed: 50 km/h;
- side slopes: 2H:1V;
- maximum grade: 8%; and
- drainage: major culverts to be designed to a 1-in-100-year return period.

Access Roads

Access roads are used to accommodate off-site traffic supplying the site with materials and supplies. There are a very limited number of all-season access roads. The following design criteria apply to access roads:

- design vehicle: B-train;
- minimum width of travelling surface: 10 m; and
- safety berms: where required.

Two types of stream crossings are being considered for the site roads:

- relatively small crossings assuming non fish-bearing water; and
- larger crossings assuming fish-bearing water.

All crossings will use culvert diameters ranging from 1.0 m to 2.5 m. Sabina shall conduct a fish passage flow assessment as part of the culvert design process. This information will be further provided as part of the water licence process. In the design, an allowance will also be included for regular drainage culverts and road signs. Water crossings may be the subject of a DFO authorization or Letter of Advice.

No infilling of lakes or stream crossing will be required for the site road construction. Speed limit will be imposed for site traffic and dusting is not expected to be problematic.

6.6.2.2 Public Access to Roads

Due to safety considerations, all site road networks within the Goose Property will be restricted to Sabina's use. Visitors (hunters arriving by snowmobile, for example) to the site will be asked to register their presence at the camps administration centre. Sabina's community communication will emphasize this requirement.

6.6.2.3 Laydown Area and Material Storage

Laydown and material storage areas will be developed during the construction stage. An estimated 30 ha of laydown area will be required to store equipment, materials and supplies for the construction of the site facilities. Laydown areas will be constructed with run-of-quarry rock placed directly onto the tundra to preserve the permafrost. As per the road construction, a layer of graded surfacing material will be placed to provide a protective trafficking layer. The surface will be sloped to prevent pooling of water and runoff will be directed to the tundra.

With the exception of large preassembly and modular equipment, most material used for construction will be containerized in sea containers.

6.6.3 Site Water Management During Construction

The site water management systems for the Goose Property will be designed and operated to meet the following objectives:

- to reliably supply water for various uses;
- to intercept and collect waters that may have been in contact with mining areas, mine wastes, tailings, or the process plant;
- to divert as much water as possible around the mine areas to avoid contact, and to direct these to downstream drainage systems; and
- to sample contact waters for potential contaminants and, if necessary, to treat to remove contaminants to meet permitted water quality guidelines prior to release.

Where contact waters have the potential to contain suspended solids, such as runoff from haul roads, drainage will be directed to silt fences or collection ponds for removal of suspended solids. This drainage may be released to the environment.

A site drainage plan has been developed (refer to the Site Water Monitoring and Management Plan in Volume 10).

During construction activities, where flows may directly or indirectly enter a waterbody, runoff water quality will comply with the following discharge criteria (Table 6.6-3):

Table 6.6-3. Proposed Surface Runoff Water Quality Criteria

Parameter	Maximum Average Concentration (mg/L)	Concentration of Grab Sample (mg/L)
Total Suspended Solid	50	100

Monitoring will consist of daily visual inspections during construction activity, spring freshet and after significant rainfall events with sampling of runoff where turbidity is evident. Construction activities will be conducted in such a way as to minimize impacts on surface drainage. Where construction activities necessitate temporary structures, Sabina will undertake corrective measures to minimize impacts on surface drainage. Guidelines for site development will be described in the Site Water Monitoring and Management Plan which will include master drainage plans for each site.

6.6.4 Quarries/Borrow Sources and Overburden

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 roads and pads. Additional material needed for roads and foundations will be sourced from the cut/fill balance of the Goose Plant Site area. 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. The Airstrip Quarry contains an estimated 1.5 Mt of suitable NPAG material with an estimated withdraw of 800 ktonnes proposed for construction use; additional material necessary for construction will be sourced from cut/fill operations from the Goose Plant Site Area and open pit mining. 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.

Quarrying of the Umwelt open pit will begin in Year -3. Overburden removal will occur during the preparation of mining and construction activities. The site overburden material and excavated material will either be handled as run of mine waste and stored accordingly, or segregated and used where possible in reclamation activities. Only geochemically suitable materials will be used for reclamation.

A quarry and borrow pit site specific management plan will be developed for each quarry or borrow pit (refer to Volume 10, Chapter 16). This site specific management plan contains the development plan, ARD screening of the material, drainage plan, and closure plan. Runoff from quarry sites will be managed to achieve the runoff water quality presented in Table 6.6-3.

6.6.5 Diesel Fuel Supply and Storage during Construction

6.6.5.1 Fuel Storage

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. Sabina will construct a 45 ML tank farm (three tanks at 15 ML) 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. There will be ISO containers situated throughout the Goose Property that will be utilized as day tanks at the underground mine portals, incinerator, AN facility, boilers, and power plants. The fuel tank farms 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. In calculating the volume, the footprint of the smaller tanks is subtracted. 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 (GNWT 2006; refer to Section 4.6 of these 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.

Water pooling within this secondary containment will be released to the receiving environment provided it complies with discharge water quality criteria presented in Table 6.6-4. Treatment will be provided for the pooling water should the water quality exceeds those criteria.

Table 6.6-4. Proposed Bulk Fuel Storage Pooling Water Discharge Criteria

Parameter	Maximum Concentration of Any Grab Sample (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

Refuelling stations will be equipped within a lined and bermed area to contain minor spills or leaks during refuelling. The liner (e.g., 40 mm Hypalon liner or equivalent) will be protected by aggregate bedding. Vehicles and mobile equipment will drive onto this bedding for refuelling. Fuel transfer is done by pumps.

The tanks fuel area will be provided with standard instrumentation and controls to monitor and safely manage the inventory in the tanks. Fuel storage areas and vehicles will be equipped with spill kits for emergency response. Each spill kit contains the appropriate type, size and quantity of equipment for the volume/type of product present in the storage.

6.6.5.2 Fuel Delivery to Back River Project Strategy

For the early construction work, current fuel storage capacity at the Goose Property will be increased with the addition of ISO containers or bulk storage tanks. These will be reused throughout the Project life at various site locations where power generators are installed to support mining operations. These containers will be mobilized to site via the Goose- MLA Winter Ice Road or flown in.

Fuel supply during construction of the Project will be either flown in or trucked from the MLA via the winter ice road.

The main end-use fuel depot for the Back River Project will be located at the Goose Property. Size of storage and quantities of fuel and timing of the construction of the tank farms at each site are presented in Table 6.6-4. Note that for early construction, the total fuel storage capacity available is 540,000 L at the MLA and nearly 1 ML (13 × 75,000 L) at Goose. For each subsequent year, fuel would be delivered to the MLA in the summer and transported to the Goose Property in the winter.

6.6.5.3 Fuel Consumption

The expected fuel consumption for construction activities at the Goose Property is presented in Table 6.6-5.

Table 6.6-5. Size of Fuel Storage and Expected Fuel Consumption

Site	Ultimate Storage Capacity	Construction Years -4 to -1	Operation Year 1 to 10	Peak Consumption
Marine Laydown Area	4 × 15 ML steel tanks	Build and use 4 × 15 ML tanks Use six 90,000 L ISO containers	Use 4 × 15 ML tanks Use six 90,000 L ISO containers	2.5 ML (Year 7)
Goose Property	3 × 15 ML steel tanks Multiple 75,000 L ISO containers	Use existing 75,000 L ISO containers Build and use 3 × 15 ML tanks	Use 3 × 15 ML tanks	53 ML (Year 3)

Arctic diesel-grade and Jet B fuel will be used by motor vehicle, mining equipment and any helicopters on the site. Limited quantities of propane and gasoline will be used in maintenance facilities for smaller motorized equipment and machinery. There is a potential to use No. 2 diesel for the power plant in lieu of the more expensive Arctic diesel commonly available in this area; the risk of low temperature issues associated with using No. 2 diesel is considered low. Note that Arctic diesel will be used for the mobile fleet regardless of fuel type for the power plant.

6.6.6 Explosives and Ammonium Nitrate Storage during Construction

Ammonium nitrate (AN) and fuel oil (FO) would be used as the explosive for quarries, mine development and production. Explosive products will be stored on site in accordance with Territorial and Federal regulations. Ammonium nitrate will be shipped and stored on site in tote bags within sea containers. Ammonium nitrate will be mixed with diesel oil on site to make ANFO explosive as needed.

6.6.6.1 Explosives Storage

The proposed locations for storage of ammonium nitrate and explosives are shown on Figure 1.6-2. The main storage of ammonium nitrate will be located at the Goose Property. For early construction, prepackaged explosives will continue to be delivered by air transportation. Larger quantities of explosives will be required for construction and explosives will then be manufactured on site. Larger quantities of ammonium nitrate will be delivered to the Goose Property via the MLA winter ice road (tote bags within containers). Up to 3,900 tonnes of ammonium nitrate will be stored at the Goose Property.

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. Both magazines will be surrounded on three sides with earthen berms to prevent propagation and significantly reduce the separation distances from other parts of the operations.

The location of the Goose explosive storage and ANFO facility is shown on Figure 1.6-2. The location of these facilities takes into account required separation distances as regulated by the Explosives Regulatory Division (ERD) of Natural Resources Canada (NRC).

6.6.6.2 AN Facility and Transportation to Work Sites

The handling and manufacture of explosives will be contracted out to a licenced operator. This operator will be responsible for obtaining licences and permits associated with the use, manufacture and storage of explosives. ANFO required for underground mining will be manufactured and bagged in one tonne totes utilizing bagging equipment located in the AN shop. The bagged ANFO will then be transported to the various underground mines for use in blasting operations. 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 augured from the one tonne tote bags into a 30 tonne silo that the bulk ANFO truck will drive under to load it's AN bin. Fuel oil will be loaded into the bulk ANFO truck from a 20,000 litre double-wall fuel tank also located on the AN facility pad. A truck wash facility will be located within the AN facility.

6.6.6.3 Ammonia Management

Sabina and the explosives supplier will adopt best management practices for transport, storage and use of explosives. Together with water management, spill prevention, and spill response, these measures lower the potential for ammonium contamination in the receiving environment. More information on explosives use and handling can be found in the Explosives Management Plan. More information on spill response can be found in the Spill Contingency Plan and the explosives supplier's Emergency Response Assistance Plan (ERAP).

The Water and Load Balance Report (Appendix V2-7H) and Site Water Monitoring and Management Plan have been developed and will be implemented to assist in ensuring that runoff does not have an adverse impact on the receiving environment. The management plan includes:

- potential sources of ammonia among other contaminants;
- estimates of all contaminants loading; and
- water management strategies to ensure water entering the receiving environment meets discharge criteria.

6.6.7 Chemical and Hazardous Materials Other than Fuel and Explosives

A variety of supplies and materials classified as potentially hazardous will be required at the Project. The hazardous materials to be handled may include:

- Petroleum Products (Fuel/Lubricants/Oils/Greases);
- Contaminated Snow/Water/Soil (Oil/Fuel);

- Oil and Fuel Filters;
- Used Sorbents and Rag;
- Hydraulic Fluid;
- Glycol;
- Empty Petroleum Hydrocarbon Containers and Drums;
- Process Reagents;
- Laboratory Reagents;
- Solvents;
- Paints;
- Fluorescent Light Tubes;
- Waste Equipment Batteries;
- Electronics and Electrical Materials; and
- Hazardous Medical Waste / Biomedical Waste.

Large quantities of reagents, hydrocarbons and other hazardous materials will be received in Year -1 (pre-operation period). The Hazardous Materials Management Plan (refer to Volume 10) has been developed to identify and monitor potentially hazardous materials with regard to safety and the environment. Transportation, storage, use and disposal will be considered for each stage of Project life. Safety to the workers and the surrounding communities will determine each stage of materials handling.

6.6.8 Waste Management during Construction

The total volume of waste generated at a given time during the life of the Project will be dependent on the 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. An inventory of the estimated types and quantities of waste that will be generated during the various phases of the Back River Project is presented in Table 6.6-6.

Table 6.6-6. Estimated Waste Quantities Generated

Project Phase	Annual Waste Quantities (tonnes)	
	Goose Property Incinerator	Goose Property Landfill
Construction (2 years)	600	800
Operations (10 years)	300	500
Active Closure (2 years)	50	100
Life of Project Totals (tonnes)	4,300	6,800

The estimated waste generation presented above is based on the same assumptions as applied to MLA; see Section 6.4.14.

The waste management infrastructure for the Project will be established at the onset of construction activities. The waste management infrastructure at the Goose Property will consist of:

- a sewage treatment plant;

- an incinerator for combustion of nonhazardous and combustible wastes;
- a landfarm for the treatment of contaminated soils and snow;
- a waste sorting facility;
- a landfill for disposal of non-hazardous solid wastes; and
- a hazardous waste storage area.

6.6.8.1 Wastewater and Sewage

The sewage treatment facilities established at the onset of construction activities will be maintained for the duration of the Project. Sewage and grey water from the camps and facilities will be conveyed in heat traced pipes or trucked to pre-packaged wastewater treatment plants (membrane bioreactor). During construction, treated sewage effluent will be discharged to a designated area in the terrestrial environment (see Appendix V2-7J). The discharge area will be designed to minimize erosion and degradation of permafrost. Once the TSF becomes available for use, treated sewage effluent will be discharged to the active tailings facility for the operational period.

While discharging on land (period of construction), Sabina will strive to comply with the discharge requirements of the Wastewater System Effluent Regulation (WSER) which is not yet applicable north of the 60th parallel. Until the WSER is applicable to the North, Sabina will comply with the effluent quality criteria presented in Table 6.6-7. These discharge criteria are in line with those imposed on other mining operations within Nunavut. The discharge locations for treated sewage effluent are also are presented in this table.

Table 6.6-7. Proposed Treated Sewage Effluent Discharge Quality Criteria

Parameter	Maximum Concentration of Any Grab Sample (mg/L)	
	Construction and Closure	Operation
BOD5	30 mg/L	100 mg/L
Total Suspended Solids	35 mg/L	120 mg/L
Fecal Coliform	1000 CFU/100 mL	10,000 CFU/100 mL
Ammonia	4 mg/L average concentration 8 mg/L max. grab concentration	Not applicable
Phosphorus	4 mg/L average concentration 8 mg/L max. grab concentration	Not applicable
Oil and Grease	No visible sheen	Not applicable
pH	between 6.0 - 9.5	Not applicable
Discharge Location	Tundra	Tailing Storage Facility and Tailings Facilities

Water will be used in the heavy equipment and truck washing facilities (refer to Section 6.6.1.6). An oily water treatment system will be installed in each of the heavy equipment maintenance facilities and to the extent possible, treated oily water will be recycled for reuse. During normal operation, make-up water will be required. However, upset conditions may occur which will require occasional discharge of excess water. The excess water will be released to the environment depending on water quality and operational needs, or pumped to the tailings facility as available.

6.6.8.2 Non-hazardous Solid Waste Management

Solid waste materials will be sorted at the source with material reused, recycled, incinerated, backhauled or placed in a landfill once available. Wastes will be transported directly to the disposal or storage area once sorted:

- solid waste to the landfill site;
- contaminated soils and snow to the landfarm; and
- combustible/kitchen waste to the incinerator.

Dedicated storage areas will be constructed to store the different types of solid wastes. All hazardous waste will be packaged, labelled and stored in appropriate containers in accordance with Canadian and territorial regulations.

Waste motor oil, transmission fluid and other petroleum fluids would be transferred to plastic tubs or other sealable containers and either transported off site and disposed at an approved facility, or incinerated (waste diesel only).

6.6.8.3 Incinerator

The incinerator will be capable of safely incinerating Class I, II, III, and IV solid wastes. Combustible solid waste such as paper, cardboard, wood, burlap cloth, fuel or oil-soaked absorbent material, semi-solid waste and food preparation waste would be burned in a dual stage, forced air incinerator. Sewage treatment plant (STP) sludge will have a minimum 30% solids content by weight. No chlorinated, hazardous and medical wastes will be fed to the incinerators. The combustible waste will be collected and stored in day bins placed at the camps, maintenance facilities and waste sorting areas. The incineration process is a batch operation and it will operate once per day. The Incineration Management Plan provides details on the waste incineration procedures.

The main source of domestic type solid wastes will be from the Accommodation Complex. The solid wastes, oil soaked materials, paper, etc. will come mainly from the Maintenance Shop, Warehouse and Power Plant facilities. The design and performance of the incinerator system will comply with all applicable CSA Codes and Standards. The incinerator emissions will meet the requirements set by Canadian Council of Ministers of Environment (CCME) latest revision and other local Provincial and/or Territorial codes and standards.

Ashes produced by incinerators that meet disposal criteria will be disposed of in the non-hazardous landfill in accordance with the landfill operation manual. Ash that does not meet the criteria will be stored and shipped off site to an approved waste disposal facility. The disposal criteria to be used will be specified in the Waste Management Plan.

Occasional open burning of acceptable waste products will be implemented and conducted in accordance with governing requirements.

6.6.8.4 Landfills

Non-combustible, non-hazardous materials will be landfilled in an approved onsite facility within a waste rock storage area. Water diversion and collection systems will incorporate the design of the landfill which will be design for the Life of the Project.

Groundwater water criteria are presented in Table 6.6-8.

Table 6.6-8. Proposed Landfill Seepage Monitoring Water Quality Criteria

Parameters	Maximum Average Concentration (mg/L)
pH	6.0 - 9.5
As	0.5
Cu	0.3
Pb	0.2
Ni	0.5
Zn	0.5
Total Suspended Solids	15
Oil and Grease	No visible sheen

6.6.8.5 Landfarm

Hydrocarbon contaminated soil, snow and ice may be treated within properly designed landfarms. The landfarm will be in use for the life of the Project and is located within a waste rock storage area. Remediated soils will be disposed of in the waste rock storage area or reused at site. Water pooling within the landfarm will be monitored for quality and will be sent to the TSF, TF, or will be 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 6.6-9. Otherwise, treatment will be provided.

Table 6.6-9. Proposed Landfarm Pooling Water Quality Discharge Criteria

Parameter	Maximum Average Concentration (mg/L)
pH	6 – 9
Total Suspended Solids	15
Oil and Grease	15 and no sheen
Total Lead	0.001
Benzene	0.370
Ethylbenzene	0.090
Toluene	0.002
Xylene	0.300

6.6.8.6 Hazardous Waste Management

Dedicated storage areas will be constructed for the temporary storage of hazardous waste at the Goose Property and at the Marine Laydown Area. Typical hazardous wastes consist of:

- waste batteries, oil, and solvents; and
- empty petroleum and reagent drums, carboys and pails.

Hazardous wastes will be stored at the properties and will be transported off site to an approved disposal facility. All hazardous waste will be handled, stored and transported in accordance with Canadian and Territorial regulations.

6.6.9 Air Transportation

The air transportation needs for the life of the Project at the Goose Property is discussed in Section 6.3.1.

6.6.10 Communication Systems

To meet OHS requirements, environmental protection, and operational and logistics efficiency, communications will be needed between:

- Project - outside Project area (for example Back River Project to Yellowknife, Cambridge Bay, Vancouver);
- Property – between sites (between Goose Property and MLA);
- Property – worksite (for example between George exploration camp and drill location); and
- Property – access/transportation corridors (road, air, marine).

The primary basis for communication across the Project between the sites will be the phone system. This will be similar to the current communication network used at the Project with each exploration camp using a site telephone network linked to a C band satellite through a transmission-receiving dish which provides voice communications from site to other telephone links. Back-up communication will be available via satellite using hand-held satellite phones.

For on-site communication at each site, hand-held VHF radios will be mandatory for all employees working or travelling in remote areas from the main camp. Communication is across a common frequency with separate discrete frequencies for specific work areas or groups. For example, these frequencies cover areas such as General Camp group channel; Helicopter operations channel; Drilling group channel; specialized non dedicated channel for short term jobs so the common camp channel is left clear. Satellite phones and SPOT devices will also be used primarily by field personnel if the work area is outside the VHF radio range. Back-up power sources and replacement batteries for all communications equipment will be available to provide continuous, uninterrupted operation either at fixed facilities or at temporary and/or emergency sites.

Each site will also have a site based computer network which is linked through a satellite dish which provides network communications to other network/email links within the company as well as others. Wi-Fi communication access would be available around each camp’s infrastructure.

Communication between air to ground and marine to ground would be through dedicated portable radio units. Communication along the winter ice road corridors will be accommodated using the VHF radios and/or satellite phone network established as part of the on-site communication and between site systems.

Radio repeater towers will be established at various locations along the winter ice road corridors and in areas of worksites allowing VHF radio contact between field and camp base stations.

6.6.11 Power Generation

The locally-generated power supply will be installed during the construction phase of the project and will remain in place for the Life of the Project. Due to the short life span of the Project (less than 20 years from start of construction to closure), there is no economically viable alternative to diesel generators and Arctic diesel fuel grade will be used to power the generators.

During construction, power plants will be constructed at the following locations:

- four 1 megawatt (MW) power plants to power the construction and early development activities. These will be re-purposed for other uses and sites after the completion of construction.
- one diesel generator will provide backup power to the airstrip operations; and
- one 30.0 MW (total installed capacity) power plant will be constructed for the process plant, camp and maintenance facilities.

A single power plant will be used to meet the electrical power demand necessary to support the complete Goose Site operation including the underground mines. The main power plant will consist of a bank of three 6.6 MW plus two 5.1 MW diesel generators which will provide redundancy through an N+1 configuration. Only the airstrip will have a back-up generator. The Emergency Response Plan presented in Volume 10 discusses emergency power supply.

In order to maximize overall efficiency and energy conservation, this power plant will operate as a combined heat and power plant, meeting the operation's peak electrical power and heating requirements. Buildings and facilities at the Goose Site and the Umwelt underground mine will be heated primarily by heat recovered from the power plant using a hydronic (glycol) system. When required, shortfalls in available heat will be made up with diesel-fired glycol boilers.

The underground mines at Umwelt, Llama and Goose Main will require heating of the intake air. The mine air heating system at Umwelt will consist of glycol heat exchangers that use waste heat from the diesel generators at the main power plant rather than add to the generation load. Llama and Goose Main would be heated by indirect fired diesel heaters. To conserve energy and save on mine air heating costs, mining below the permafrost at Goose Main would be delayed towards the end of the mine life.

In addition to the reduced capital of compact infrastructure, smaller buildings offer the cost advantage of requiring less energy to heat them.

6.6.12 Ancillary Project Facilities and Infrastructure

6.6.12.1 Workers Accommodation

During the early stage of the construction, the existing camp at the Goose Property will be used to accommodate the workforce that will build the construction camp. The construction facility will accommodate the expected 465 people required for the construction phase. Any additional, overflow capacity would be accommodated in the existing exploration camp.

6.6.12.2 Maintenance Facilities and Service Buildings

Table 6.6-1 summarizes the list of buildings and facilities that will be constructed at the Goose Property.

6.6.13 Construction of Tailings Storage Facility

The TSF will store tailings solids, process water, and contact runoff from the Goose Property. It will be constructed in a single stage, its crest elevation aligned with the retention requirements of the operation.

6.6.13.1 Site Selection

A tailings alternatives assessment has been completed taking into consideration an area surrounding the Goose Property, including options within and outside of the Goose PDA. The alternatives assessment report is presented in Chapter 4 of this volume.

Sabina focused on developing the mine plan to maximize the use of mined-out open pits for tailings deposition, thereby substantively reducing the volume of tailings for which a constructed TSF was required. In addition, the landowner confirmed that they are not in favour of subaerial tailings deposition on any Inuit Owned Land (IOL). With this guidance, along with goals of reducing environmental impact and capital cost as drivers, a TSF location was chosen approximately 1.5 km southeast of Goose Main open pit, see Figure 1.6-2. This chosen location is within the PDA and is not located on IOL.

6.6.13.2 Summary of Geotechnical Investigations

The geotechnical data collected in the TSF location during the 2015 geotechnical site investigation (Appendix V2-7C) included the following:

- geotechnical drilling and logging of 20 geotechnical triple-tubed drillholes in the FS TSF location. Drillholes ranged in depth from 6.5 to 16.5 m and included sampling of both overburden and upper bedrock;
- installation of thermistor strings in 10 drillholes;
- geotechnical laboratory testing of soil and bedrock samples included moisture/ice content determination, grain size analyses, specific gravity, direct shear, consolidation, and salinity on select samples collected from the geotechnical drillholes.

6.6.13.3 Design Basis and Operating Criteria

Objectives

The principal objectives for the design of the TSF are to ensure protection of the regional groundwater and surface waters both during operations and in the long-term (post-closure), and to achieve effective reclamation at mine closure. The design of the TSF has taken into account the following requirements:

- Permanent, secure, and total confinement of all solid waste materials within an engineered disposal facility.
- Control, collection, and removal of free draining liquids from the tailings during operations for recycling as process water to the maximum practical extent.
- The inclusion of monitoring features for all aspects of the facility to ensure performance goals are achieved and design criteria and assumptions are met.

Summary of Design Basis and Operating Criteria

The following factors have been considered in the design of the TSF:

- physical and chemical characteristics of the tailings material, including metal leaching and acidic drainage potential, as well as the potential for liquefaction;
- hydrology and hydrogeology, including local climatic conditions and extreme weather events (including projections of increased extreme weather events as a result of global climate change);
- foundation geology and geotechnical considerations, as well as seismic data and earthquake risk;
- availability and characteristics of construction materials;
- topography of the TSF footprint and adjacent areas; and
- permafrost conditions.

The water management associated with the TSF can be found under Section 7.10.

The TSF containment structure will be designed and constructed according to stringent engineering standards. The long-term monitoring and inspection of containment structures for the TSF will be considered during the design and construction phase. Appropriate instrumentation will be installed during construction to facilitate monitoring during the mine operations and closure phases. Specific design allowances will be made for, and consideration will be given to: permafrost, slopes, seismic activity, and site drainage requirements, particularly during peak flow conditions.

The TSF has been designed to provide secure and permanent storage of tailings solids, and to optimize the management of water for reuse in the process. The design basis is summarized in Table 6.6-10.

Table 6.6-10. Design Basis for the Tailing Storage Facility

Item	Design Criteria
Mine Production	Total ore milled = 19.8 Mt Throughput = 6000 tpd 10 years
Tailings Properties	% solids = 49% Average in-situ dry density of 1.1 t/m^3 from start up to the end of Year 1, 1.2 t/m^3 from start of Year 2 to EOM Ice entrainment allowance of up to 20% (i.e., about 0.63 Mm^3)
Tailings Storage Facility	Frozen foundation rock fill dam with geomembrane Geosynthetic clay liner (GCL) into a key trench, dam of run of mine NPAG waste rock Embankment constructed for approx. 3 years of tailings production plus Inflow Design Flood (IDF), freeboard, and process water Basin and embankments covered with the GCL, between compacted bedding material, or anchored to pony wall. Overlaps will be at least 0.5 m wide Minimum 600 mm of bedding material (sand) Inflow Design Flood (IDF) of 1/3 between 1:1000 year event and probably maximum flood; approximately 131 mm Wind and Wave run-up and additional allowances of 1.4 m Minimum static factors of safety: 1.3 – During Construction 1.5 – During Operations and Closure

Dam Hazard Classification

The design, construction, operation and monitoring of dams, including tailings dam have to be completed in accordance with appropriate Provincial and Federal regulations and industry best practices. The primary guidance document in this regard, is the 2013 Canadian Dam Safety Guidelines (CDA 2013) published by the Canadian Dam Safety Association (CDA) and the dam safety guidelines specific to mining dams (CDA 2014).

A key component of the guidelines is classifying the dam(s) in question into hazard categories (Dam Class) which establishes appropriate geotechnical and hydro-technical design criteria. Table 6.6-11 is a reproduction of the recommended Dam Classifications as presented in the CDA Guidelines. This classification is based on Incremental Consequence of a dam failure (as opposed to Total Consequences). The Incremental Consequences of failure are defined as the total damage from an event with dam failure, less the damage that would have resulted from the same event (e.g. a large earthquake, or a large flood event), had the dam not failed.

Table 6.6-11. Dam Hazard Classification

Dam Class	Population at Risk[1]	Incremental losses		
		Loss of Life[2]	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 possible but impractical.	Very high economic losses affecting important 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).

[1] *Definitions for population at risk:*

None *- There are 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 through 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, 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).*

[2] *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.*

Determining the appropriate hazard rating is subjective and is dependent on site specific circumstances and may require an agreement between the proponent, regulator and stakeholders. During the dam classification process, each of the four hazard rating components in Table 6.6-11 (i.e. population at risk, loss of life, environmental and cultural values, and infrastructure and economics) is considered individually, and the overall dam hazard rating is defined by the component with the highest (i.e. most severe) rating. It is important to note that the hazard rating refers to the downstream consequences in the inundation zone of a dam breach.

No general population resides within the Property area or nearby; therefore, the “Population at Risk” category receives a qualifier of “None”. By definition of Table 6.6-11, “Loss of Life” is judged to be

"Unspecified". This is based on the presumption that once the TSF dam construction is complete and tailings deposition is started, all activities downstream of the facility will be related to the tailings and water management. Ongoing repair and maintenance work is anticipated to be carried out by relatively small crews, and will be short duration activities. Loss and/or deterioration of fish habitat is a real risk, although the diluted supernatant will not likely have an acutely toxic effect on fish in the local watershed. Furthermore, restoration and compensation is possible for the system, based on the fact that any tailings spill would impact the southeast portion of Goose Lake and not likely spill over into Propeller Lake. For these reasons, the most appropriate classification with respect to Environmental and Cultural Values is "High".

Economic activity undertaken directly downstream of the TSF while the facility is actively operating will be of very short duration. Development of the Goose Main open pit, 2 km downstream of the TSF is currently scheduled to overlap for only three months with active deposition in the TSF. The preliminary closure concept for the TSF is complete encapsulation within the waste rock originating from the Goose Main open pit. The water managed in the TSF will have to be drained to allow completion of the waste rock cap, which will further reduce the risk of catastrophic failure. Therefore, with respect to the Infrastructure and Economics the most appropriate classification is "Low".

Therefore, the highest hazard rating is defined by the Environmental and Cultural values category, which means the designated dam hazard rating for the Back River TSF containment dam is HIGH.

Seismicity

A preliminary assessment of the regional seismicity has been carried out to enable selection of appropriate design earthquake events for the TSF, WRSAs, and other facilities at the Property. Review of historical earthquake records and regional tectonics indicates that the Back River Property is located in a region of very low seismicity surrounded by large regions of sparse, diffuse seismicity. Historical earthquake data provided by the database of Natural Resources Canada (NRCan) for events since 1985 (for Magnitudes greater than 3.0) indicates that there have been only seven earthquakes recorded within 500 km of the Project site since 1985. The largest of these events was a Magnitude 4.5 earthquake in 2001, located approximately 340 km to the west. The closest of these events was a Magnitude 3.6 earthquake in 1995, at a distance of approximately 225 km to the southeast.

Based on the dam hazard classification of HIGH, the Dam Safety Guidelines (CDA 2013) recommend the seismic stability analysis be completed assuming the Peak Ground Acceleration (PGA) for 1:2,475 year event. For the Property area, this event results in a PGA of 0.036 g.

A reasonable design earthquake for this stable region of the Canadian Shield is a Magnitude 6.0 event. There is potential for larger earthquakes to occur, but rarely. A Maximum Credible Earthquake (MCE) of Magnitude 7.0 is recommended for the region of the Canadian Shield. Such an event would have a very low probability of occurrence.

Tailings Storage Facility

The TSF will store both tailings solids and process water. The TSF is situated south of the Goose Main open pit, and is composed of two embankments:

- the TSF containment dam is a 1,744 m long embankment at its centerline, 14 m high, and is oriented east-west; and
- the South Dyke is a 200 m long embankment at its centerline, and a maximum height of 3m; this is situated at the very south end of the facility, parallel to the PDA.

During the DEIS, a zero discharge tailings facility was proposed. During the FEIS, the design was advanced to maximize in-pit tailings disposal with a small tailings facility lined on the upstream face to control and reduce seepage from the facility, which is expected. A seepage analysis through the TSF liner was completed, which concluded that if the TSF was at full supply level, seepage of up to 1,210 m^3/year could occur. Seepage will be collected in a downstream berm with 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.

The following elements have been included in the assessment of the TSF as a water retaining facility:

- all runoff from within the TSF catchment will be stored within the TSF pond;
- tailings slurry will be discharged to the TSF at approximately 6,000 tpd;
- tailings supernatant water will be reclaimed and pumped back to satisfy process plant process water make-up requirements at an average rate of 4,900 m^3/day;
- the supernatant TSF pond will grow at an average annual rate of 4.4 Mm^3/year;
- the operational supernatant pond volume will be managed by selective tailings deposition to ensure that the beaches are saturated, thus reducing the potential for dust generation; and
- the Goose seepage collection ponds will collect seepage and sediment laden runoff from the waste rock stockpiles and pumped back to the active tailings area.

The TSF has been designed to include freeboard allowances for ice entrainment, storm water storage, wave run-up, and other contingencies which include sloping beaches, ice expansion of supernatant pond, and seismic settlement.

Material quantities for the construction of the TSF containment dam and the South Dyke are summarized in Table 6.6-12. All fill and excavation volumes represent neat volumes, i.e. “in place”, with no allowance for swelling and compaction. The liner quantities are neat quantities, with no allowance for seams and waste.

Table 6.6-12. Summary of TSF Material Quantities

Material	Quantity
Main Dam	
Liner Bedding (m^3)	61,400
GCL (m^2)	102,400
Run-of-mine waste rock (m^3)	604,500
Transition Fill (m^3)	106,400
Key-trench excavation (m^3)	56,400
South Dyke	
Run-of-mine waste rock (m^3)	5,700

6.6.13.4 General Description of Tailing Storage Facility Layout

<u>TSF Containment Dam Components</u>

The main design components of the TSF containment dam are as follows:

- Key Trench:

  - The key trench will be excavated into the frozen overburden underlying the dam and terminated either in frozen overburden or exposed bedrock at depth. This surface will be the base of the grout curtain.
- Grout Curtain:
  - The grout curtain will be used to seal any shallow fractured bedrock foundation zones that are encountered; this will be a cement-based grout with the addition of bentonite and other dispersants.
- Pony Wall:
  - A reinforced concrete pony wall will be cast to attach the geosynthetic liner to. The pony wall will be doweled into bedrock or attached to the top of the grout curtain to ensure a good bond.
- 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. It will be deployed on the upstream face of the dam, attached to the pony wall on the sides, and place into the base of the key trench directly onto the prepared exposed foundation; imperfections will be filled with granular bentonite. The GCL will be sandwiched between to 0.3 m thick compacted layers of crushed pea gravel.
- Bulk Dam Fill:
  - The bulk dam fill, including the key trench, will consist of run of mine waste rock; the size will be limited to material smaller than 600 mm and be well graded with a good mix of fines.
- Transition Zone:
  - The GCL is protected within a bedding zone of fine crushed gravel. A transition material of 150 mm minus crushed ROM waste rock will be placed between the bedding zone and the bulk dam fill to minimize losses of this bedding material.
- Bedding Zone:
  - 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 and be pea gravel size.
- Dam Shell:
  - No specific dam armouring is required, include no special upstream riprap. The dam shell will be constructed of the same ROM waste rock as the bulk dam fill; however, consideration should be given to using more gap graded material with less fines on the upstream slope, which will stand up better over the long term and limit the washing out of finer material.
- Monitoring Instrumentation:
  - A series of ground temperature cables and survey prisms will be installed to the monitor the foundation thermal regime and deformation performance.
- South Dyke:
  - To ensure the TSF remains within the PDA, a small retaining dyke is required along the southern end. The structure will be a saddle dyke built of ROM waste rock. Neither key trench nor impermeable liner is required because the tailings deposited against the dyke will push water away from the structure, directing it downstream the north end of the TSF.

- Seepage Collection:
  - Seepage collection will be achieved by constructing a berm downstream of the dam. This berm will incorporate an impermeable liner keyed into permafrost. Water collected will either be pumped back onto the TSF or discharged to the environment, as appropriate.

TSF Containment Dam and South Dyke Construction

Typical construction equipment will be used at the dam, and the TSF will be constructed in a single phase. The mining fleet will be used for hauling the excavated overburden and the dam fill, with smaller articulated trucks used in the narrower areas near the top of the dam. Bulldozers and smooth drum vibratory compactors will be used to complete the fill placement. Hydraulic excavators may be used for special tasks as required. Drilling and blasting will be done using conventional tracked blasthole drills.

Tailings Piping System

The tailings distribution and deposition system will extend from the Goose Process Plant to the TSF and consist of one main delivery pipeline. Deposition pipelines to three separate discharge points will be used over the life of the TSF. The delivery pipeline will be an overland insulated and heat-traced HDPE line located along the main access road from the Goose Process Plant to the TSF.

The tailings piping system is designed using the following parameters:

- daily milling rate of 6,000 t/day;
- solids content of 49% by weight;
- tailings flow rate average of 370 m^3/hr; and
- slurry density of 1.2 t/m^3.

Reclaim System

Reclaim water will be carried in a dedicated HDPE pipeline that will convey water pumped from the tailings reclaim barge to the Goose Process Plant; this reclaim system is estimated at 200 m^3/hr.

6.6.13.5 Tailings Storage Facility Development Plan and Schedule

Construction Schedule

The dam will be completed before the Goose Process Plant begins production. Construction of the TSF dam and South Dyke will start in Q4 of Year -2 with excavation of the key trench, followed by grouting of the shallow fractured bedrock zones. The key trench excavation and backfill must be completed in the winter (i.e., end of Q1 of Year -1) 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.

6.7 SUMMARY OF CONSTRUCTION ACTIVITIES (YEAR -4 TO -1)

Sabina will proceed with full construction activities once the Project Certificate and the Type A Water Licence are both issued. The expected sequence of some key construction activities is as follows.

Year -4 Construction Activities (Post Project Certificate, Pre-Type A Water Licence)

- Complete fieldwork for Marine Laydown Area & Goose-Bathurst winter ice road (including survey of ice-thickness, final route engineering and environmental baseline studies; Q2 to Q3).
- Continue environmental baseline programs, exploration activities including drilling, mapping, sampling and geophysical programs, and geomechanical/geotechnical assessment for engineering and design.
- Deliver some equipment, material, and fuel during the summer and transfer to a temporary laydown at the MLA.

Year -3 Construction Activities (Post Type A Water Licence)

- Construct the MLA (includes barge landing, fuel storage tank and laydown/camp; Q2 to Q3).
- Operate existing Goose rock quarry via ice road (Q1 to Q2).
- Operate new quarry location at Umwelt area (Q1 to Q2).
- Crush and stockpile rock material (Q1 to Q2).
- Build all-weather road from existing Goose camp to quarry area to Umwelt area (Q2 to Q3).
- Construct the storage pad at Umwelt (up to 350 m × 500 m), Goose fuel storage farm including one tank (15 ML) and laydown for material and supplies (Q1 to Q4).
- Extend Goose airstrip up to 1,524 m (Q1 to Q3); this will include the installation of culverts under the airstrip to maintain the current stream alignment in Rascal Stream East. As such, no stream realignment is currently proposed.
- Deliver construction materials and supplies via air transport, ice and all-weather airstrip (Q1 to Q4).
- Deliver major equipment and materials to Marine Laydown Area via barges or freighters during summer. This will include up to 15ML of fuel which will either be stored in an appropriate vessel, or placed on land, or a combination of both. Also to be stored at the Marine Laydown Area over the winter may include large, heavy equipment, construction supplies, facilities for the 465 person Goose camp and any other material that cannot be flown in by any available aircraft (Q3).
- Partially dewater Llama Lake (Q2 to Q3).
- Construct winter ice road from Marine Laydown Area to Goose Property (Q4).

Year – 2 Construction Activities

- Construct and operate winter ice road from Marine Laydown Area to Goose Property (Q1 to Q2).
- Construct earthworks for process plant (Q1 to Q2).
- Mobilize and install 465-person construction camp at Goose (Q2).
- Construct process plant and ancillary plant buildings (Q2 to Q4).
- Construct TSF and reclaim system (Q1 to Q2, Q4).
- Construct fuel storage for 30 million litres at Goose Property (Q2 to Q3).
- Construct diversion and collection systems (Q2 to Q3).
- Start mining Umwelt open pit; continue quarrying waste to required pit outline. Start stockpiling ore (Q2 to Q4).
- Start process plant and plant fit-out (Q3 to Q4).

Year -1 Construction Activities

- Complete process plant, plant and camp indoor construction (Q1 to Q3).
- Upgrade construction camp to permanent standard as construction winds down (Q1 to Q3).
- Start commissioning using stockpiled ore (Q3).
- Complete dewatering and treatment at Llama
- Dewater Umwelt Lake

7. Detailed Project Description - Operations

7. Detailed Project Description - Operations

Operations at the Back River Project (year 1 to 10) focus on the economic recovery of gold and delivery to market. Other activities during operations will include ongoing exploration supported by the Project Infrastructure and ongoing progressive reclamation.

7.1 RESOURCES AND RESERVES

AMC have categorized the Back River grade estimates as a combination of Measured, Indicated and Inferred resources in accordance with the criteria set out in the Canadian NI 43-101. The Measured, Indicated and Inferred resources currently reported for the Llama, Umwelt, Goose Main, and Echo, and George deposits are summarized in Table 7.1-1. Sabina's mineral tenures are shown on Figure 1.4-1.

Table 7.1-1. Back River Project Resource Estimates (October 2014)

Deposit	Tonnes (kt)	Au (g/t)	Metal (koz Au)
Measured			
Goose Main Open Pit	4,478	4.32	621
Goose Main Underground	110	6.24	22
Llama Open Pit	1,874	5.86	353
Llama Underground	110	5.72	20
Umwelt Open Pit	3,699	6.07	722
Umwelt Underground	1.0	9.21	0.3
Total Measured	**10,273**	**5.27**	**1,740**
Indicated			
Goose Main Open Pit	2,877	4.19	388
Goose Main Underground	853	7.32	201
Echo Open Pit	321	6.07	63
Echo Underground	596	6.17	118
Llama Open Pit	821	6.01	159
Llama Underground	752	8.72	211
Umwelt Open Pit	1,963	5.38	340
Umwelt Underground	3,387	8.92	972
George Open Pit	4,321	5.04	700
George Underground	2,079	6.62	443
Total Indicated	**17,969**	**6.22**	**3,593**
Total Measured and Indicated	**28,242**	**5.87**	**5,333**
Inferred			
Goose Main Open Pit	215	3.20	22
Goose Main Underground	429	6.83	94
Echo Underground	71	5.91	14
Llama Underground	295	6.77	64

(continued)

Table 7.1-1. Back River Project Resource Estimates (October 2014; completed)

Deposit	Tonnes (kt)	Au (g/t)	Metal (koz Au)
Umwelt Open Pit	121	2.29	9
Umwelt Underground	1,788	11.59	667
George Open Pit	929	4.75	142
George Underground	3,902	6.69	840
Total Inferred	**7,750**	**7.43**	**1,851**

Notes:
CIM definitions were used for the Mineral Resources.
Open-pit Mineral Resources are constrained by an optimized pit shell at a gold price of US$1,500 /oz gold.
The cut-off grade applied to the open pit Resources is 1.0 g/t gold. The underground cut-off grade is 4.0 g/t gold for all George Mineral Resources (LCP North, LCP South, Locale 1, Locale 2, GH, and Slave), 3.5 g/t gold for Goose Main, Echo and Llama, and 4.5 g/t for the Umwelt deposit.
The George Mineral Resources were estimated within mineral domains expanded to a minimum width of 2 m for the underground Resources.
Drilling results up to December 31, 2013, are included except for Echo (new drilling to July 4, 2014) and Loc1 and Loc2 (new sampling to July 21, 2014).
The numbers may not add due to rounding.

To convert Mineral Resources to Mineral Reserves for the Goose Deposits (JDS Mining 2015), extraction design was undertaken, mining cut-off grades (COGs) were employed, mining dilution was added, and mining recovery factors were applied. To calculate the Mineral Reserves for the Back River Property, mining methods and economic viability were determined for each deposit at the Goose Property. The total mineral reserves are summarized in Table 7.1-2.

Table 7.1-2. Total Mineral Reserves for the Goose Deposits (as of Feb 13, 2015)

Area	Classification	Tonnes (kt)	Au (g/t)	Contained Au (koz)
Umwelt Open Pit	Proven	3,104	6.08	606
	Probable	466	4.45	67
Llama Open Pit	Proven	1,351	6.20	270
	Probable	122	5.36	21
Goose Main Open Pit	Proven	3,447	4.37	484
	Probable	873	4.45	125
Echo Open Pit	Proven			
	Probable	112	4.60	17
Total Open Pit	**Proven**	**7,902**	**5.35**	**1,360**
	Probable	**1,573**	**4.53**	**229**
Umwelt Underground	Proven	2	8.10	1
	Probable	4,462	6.26	898
Llama Underground	Proven	82	7.02	18
	Probable	870	7.67	215
Goose Main Underground	Proven	172	4.81	27
	Probable	1,072	5.80	200
Echo Underground	Proven			
	Probable	592	5.26	100

(continued)

Table 7.1-2. Total Mineral Reserves for the Goose Deposits (as of Feb 13, 2015; completed)

Area	Classification	Tonnes (kt)	Au (g/t)	Contained Au (koz)
Total Underground	**Proven**	**256**	**5.54**	**46**
	Probable	**6,997**	**6.28**	**1,413**
Total Back River Property	**Proven**	**8,158**	**5.36**	**1,405**
	Probable	**8,570**	**5.96**	**1,642**

Notes for open pit:
A gold price of 1,250 US$/oz is assumed.
An exchange rate of CDN$1.05 to US$1.00 is assumed.
Dilution and recovery factors are applied as per Open Pit mining method.
A COG of 1.39 g/t was used for the Umwelt Open Pit Mineral Reserve estimate.
A COG of 1.41 g/t was used for the Llama Open Pit Mineral Reserve estimate.
A COG of 1.37 g/t was used for the Goose Main Open Pit Mineral Reserve estimate.
A COG of 1.30 g/t was used for the Echo Open Pit Mineral Reserve estimate.
Notes for underground:
A gold price of 1,250 US$/oz is assumed.
An exchange rate of CDN$1.05 to US$1.00 is assumed.
Dilution and recovery factors are applied as per underground mining method.
A COG of 3.18 g/t was used for the Umwelt underground Mineral Reserve estimate.
A COG of 3.80 g/t was used for the Llama underground Mineral Reserve estimate.
A COG of 3.77 g/t was used for the Goose Main underground Mineral Reserve estimate.
A COG of 3.21 g/t was used for the Echo underground Mineral Reserve estimate.

7.1.1 Geology

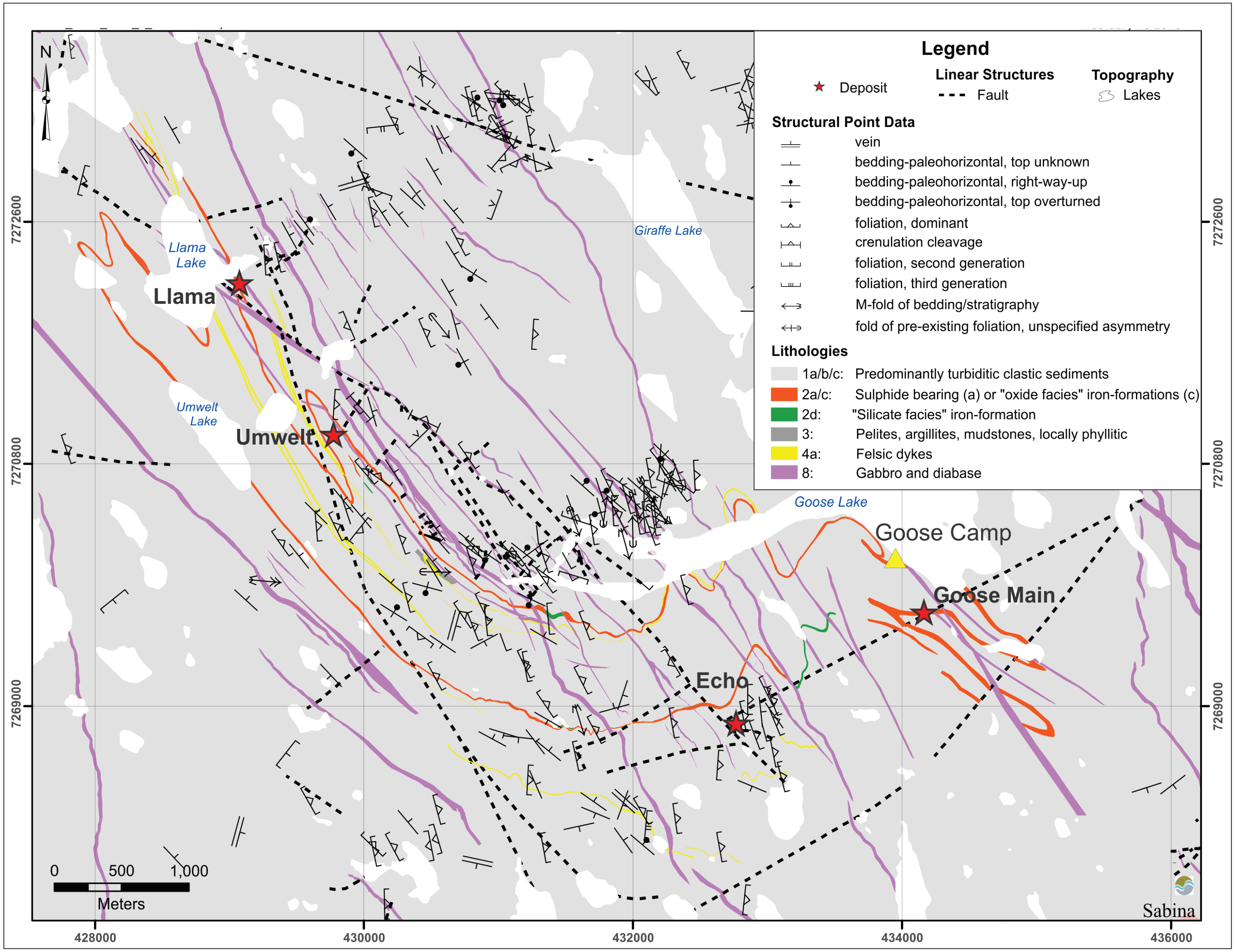
This section is composed of excerpts taken directly from the NI 43-101 technical report titled "Technical Report and Feasibility Study for the Back River Gold Property, Nunavut" (June 2015).

The Back River Project is located in the central-eastern portion of the Slave Structural Province and forms part of the Canadian Shield. The Slave Structural Province is predominantly comprised of metamorphosed greenstone and turbidite sequences and plutonic rock underlain by older gneiss and granitoids. Volcanic-turbidite series rocks are widespread and abundant, consisting of large areas of turbidites flanked by narrow volcanic belts. Iron formations are locally abundant in the volcanic-turbidite series and host most of the stratabound gold deposits.

The region underwent three periods of deformation including large scale folding, uplift, and sub-vertical foliation.

The Goose Property is underlain by a turbidite sequence cut by felsic and gabbroic dikes. The turbitidite sequence is comprised of greywacke, iron formations, and mudstones. Most of the gold mineralization is hosted in the central greywacke and lower iron formation units. All units are cross-cut by gabbro dikes (Figure 7.1-1).

The targeted gold deposits in the Back River Project (located within the Goose property) are hosted by oxide and silicate iron formations that are cut by quartz and sulphide-bearing quartz veins. Most of the known or observed gold mineralization identified is associated with the sulphide-bearing quartz veins which are accompanied by pyrite, pyrrhotite, arsenopyrite, silicification and shearing. The gold mineralization to a lesser extent also occurs within greywacke units beneath the iron formations. Gold appears to have a spatial association with narrow porphyritic felsic dikes wherever these units are present.



Source: GSE_GEO_STR_lt_StructureMap

Figure 7.1-1

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Goose Property Structural Geology

Figure 7.1-1

Rescan Engineers & Scientists

Regional structural features have been identified from field mapping and from interpretation of geophysical data sets (Figure 7.1-1). Deposit scale features such as folding and faulting have been identified from drill core intersections and field mapping. Host rock units exhibit folding; Goose Main sits in an antiform, both Llama and Umwelt sit in antiform/synform sets and Echo sits in the hinge of an open fold. Most faults transecting the deposits have been identified firstly by lithologic offset, and then subsequently supported by observations from drill core and field mapping. The Llama fault trends northwest/southeast and may be coincident with a gabbroic dyke. The Umwelt fault trends north-northwest/south-southeast and truncates the deposit on the western limb. Multiple faults are seen at Echo, most of which trend north/south; however, one fault trending northwest/southeast truncates the deposit to the west. Three faults are modelled at Goose Main; one offsets mineralization and trends north/south, one trends north-northeast/south-southwest and the other trends northeast/southwest. All lithologies and fault structures have been modelled in 3D and were used by various groups to assist in geomechanical, geochemical and groundwater studies which support the Feasibility.

7.1.2 Mineralization

This section is composed of excerpts taken directly from the NI 43-101 technical report titled “Technical report and Feasibility Study for the Back River Gold Property, Nunavut, Canada” (June 2015).

Gold mineralization at the Goose Property (Goose Main, Umwelt, Echo, and Llama) is situated within folded silicified and sulphidized oxide iron formations and locally in the underlying greywacke located within antiform structures. As a result, the mineralization geometry is relatively continuous between sections and down-dip. However, within the interpreted mineralized zones, gold grades can be highly erratic and discontinuous. Further details on the mineralization at the Goose Property are given Table 7.1-3 which presents the orientation, length along the plunge direction, average down-dip dimension, and mean true thickness of the mineralization by deposit. The zones all subcrop, beneath 4 to 6 m overburden.

Table 7.1-3. Goose Property Mineralization Summary by Deposit

Deposit	Folded	Trend of Fold Axes (°)	Plunge of Fold Axes (°)	Dip of Fold Axial Plane (°)	Dip	Length Along Plunge Direction (m)	Average Length Down Dip (m)	Mean True Thickness (m)
Goose Main	Yes	285	15	70	W	650	480	15
Llama	Yes	145	20	75	E	1,080	220	12
Umwelt	Yes	135	26	50	E	1,530	240	15
Echo	Yes	145	63	90		410	350	6

7.1.2.1 Llama Deposit

Based on available assay data, gold mineralization is recognized to be hosted in both chemical and clastic sedimentary lithologies as well as quartz ± feldspar porphyry dikes. Late gabbro dikes are known to post-date the timing of gold mineralization and are not host to economic concentrations of gold. Banded oxide facies iron formation, consisting of chert + grunerite + magnetite, hosts the majority of the known gold mineralization. Silicate facies iron formation consisting of actinolite + chert + grunerite and locally interbedded clastic sediments, hosts relatively lesser gold mineralization. Clastic sediments consisting of greywacke, siltstone, and mudstone are noted to be gold-mineralized but typically return low levels of gold, with isolated elevated gold assays. In some cases, felsic dikes have been proven to host gold; however, the abundance of such is considered relatively insignificant to date.

Gold mineralization is best characterized as an event of widespread quartz ± carbonate veining and sulphidization related to brittle faulting and subsequent folding. Mineralization consisting of pyrite ± arsenopyrite ± pyrrhotite, rare chalcopyrite, and free gold is observed to occur within quartz ± carbonate veining of all lithology types with the exception of gabbro. Gold-mineralized quartz veining occurs commonly in local concentrations within an interpreted structural corridor which parallels the fold axis. Replacement sulphidization of host lithology is also recognized within the Llama Gold Zone where pyrrhotite ± arsenopyrite (including loellingite) ± pyrite replace magnetite and grunerite to varying degrees.

Oxide facies iron formation is noted to have the highest level of sulphidization of all lithologies and is most intense proximal to brittle deformation interfaces of the structural corridor. Silicate facies iron formation is noted to have a lesser degree of sulphidization, and similarly correlates with proximity to brittle deformation within the structural corridor. Relatively lower sulphidization of silicate facies iron formation is interpreted as a product of less abundant primary and metamorphic iron-rich minerals. Mineralization in clastic sediment lithologies is limited to dominantly quartz ± carbonate vein style gold mineralization; however, intervals of silicification with fine-grained disseminated sulphides have been observed. Gold mineralization of this style is best observed proximal to areas of brittle deformation, typically occurring at or near contacts with iron formation.

7.1.2.2 Umwelt Deposit

Gold mineralization has been noted within quartz ± carbonate veining and sulphidized iron formation lithologies most commonly associated with arsenopyrite ± pyrite ± pyrrhotite. Pyrite and pyrrhotite are the most common sulphides in the Umwelt deposit with pyrrhotite becoming significantly more prominent as the gold-mineralized zone becomes deeper to the south. Arsenopyrite is the most common sulphide associated with gold, occurring as fine- to coarse-grained, euhedral, individual masses of crystals occasionally located preferentially along bedding planes or trailing along fractures, and as vein halos. Pyrrhotite appears to be replacing magnetite in at least some instances; it is present in beds ± magnetite, associated with veins and fractures. Gold-mineralized zones are characterized by sulphide and silica alteration including quartz flooding, accompanied by shearing and veining.

7.1.2.3 Goose Main Deposit

Most of the observed gold mineralization at the Goose Main deposit is associated with quartz veins, silicification, and shearing. Gold mineralization occurs within silicified and variably sulphidized iron formation and, to a lesser extent, meta-sedimentary units that appear to have a spatial association with narrow porphyritic felsic dikes and mudstones. Sulphide minerals observed include pyrite, arsenopyrite, and pyrrhotite. Sulphide gold mineralization may be associated with accessory chlorite, carbonate, hornblende, and grunerite. Visible gold is locally present, especially when sulphides are greater than 10% and when coarse-grained arsenopyrite is present.

The deposit is located within the Goose antiform structure, which is situated within a greater than 500-m-wide corridor of widely spaced, sub-parallel, north to northeast trending, southeast dipping, normal faults that have up to 30 m of left-lateral displacement and a down-dropping of individual fault blocks of up to 75 m.

Approximately 60% of the gold mineralization occurs within the lower iron formation (sulphidized oxide iron formation), and the remaining 40% occurs in the core of the underlying central greywacke. Very minor gold and sulphide mineralization is developed in the upper iron formation. Visible gold is common and typically occurs as sub-millimetre sized grains, although larger aggregates of up to several millimetres are not uncommon. Visible gold is typically spatially associated with pyrrhotite and/or pyrite in the presence of arsenopyrite. Gold mineralization is more pronounced and of higher grade in areas of brittle deformation, and of lower grade or absent in areas of ductile deformation. Where D2 deformation is absent, gold grades are also low to absent. Late D2 deformation appears to be the key gold mineralizing event, where existing partially or wholly discordant quartz veins acting as fluid pathways are commonly boudinaged, re-oriented parallel to S0 to S1 foliation, and gold-mineralized.

7.1.2.4 Echo Deposit

Gold mineralization at the Echo deposit is defined within, but is not limited to, the contact of the iron formation / interbedded sediments with the regional turbiditic lithologies. Brittle deformation is prominent at the contact; there is also a moderate amount of shearing present locally. A poorly-mineralized quartz feldspar porphyry dyke intrudes proximal to the structurally-influenced contact and is interpreted to be closely related to the timing of gold mineralization. Alteration consists of varying amounts of grunerite + chlorite + quartz + calcite ± biotite. Mineralization associated with intervals returning higher gold values (up to 120 g/t gold) consists of pyrrhotite + pyrite + arsenopyrite + chalcopyrite occurring with quartz ± calcite veining, as well as replacement of the host rocks. The overall sulphide content ranges from a trace amount up to a maximum of 10% over 0.5 m.

Banded silicate iron formation consisting of actinolite +grunerite +quartz ± tremolite hosts the majority of the known gold mineralization. Oxide iron formation is similarly mineralized but forms only a minor portion of the host. Clastic sediment lithologies appear to be less favourable hosts and appear to be best mineralized within areas of deformation that occur at contacts with iron formation. Because the area is largely covered by overburden, the relationship between the Goose Main deposit and the Echo zone is not well understood. This area has potential for the development of additional gold targets.

7.1.3 Overview of Hydrogeological Conditions and Permafrost

The Back River Project is located in an area defined as continuous permafrost. Refer to FEIS Volume 5, Chapter 2 for more discussions on area permafrost conditions.

Generally the deep regional groundwater flow path below the permafrost will be controlled by the elevations of the larger lakes that are connected to this unfrozen zone through taliks. The Project area is relatively flat and consequently the elevations of the relatively larger lakes within about a 50 km radius are similar. The largest lakes in closest proximity are Propeller Lake, Gander Lake, and Beechey Lake. The regional hydraulic gradient is therefore expected to be small with the regional flow towards the northeast and/or southwest. Data from the vibrating wire piezometers installed in 2012 and 2013 indicate piezometric levels close to the elevations of the surrounding lakes.

The Goose Property includes four deposits: Umwelt, Llama, Goose Main, and Echo. These deposits will be mined to the depths listed below.

- Umwelt deposit: Open pit to 135 mbgs, underground mine to 650 mbgs;
- Llama deposit: Open pit to 135 mbgs, underground mine to 380 mbgs;
- Goose deposit: Open pit to 150 mbgs, underground mine to 390 mbgs; and
- Echo deposit: Open pit to 45 mbgs, underground mine to 325 mbgs.

The basal permafrost at the Goose Property is estimated to extend to a depth of about 490 to 570 mbgs; this is assuming the 0°C and without consideration of the groundwater quality. The deep groundwater on the Property is expected to have a high concentration of total dissolved solids (salinity), which will lower the freezing point of the water. For this reason, hydrogeological design parameters currently assumes that water will be unfrozen and free to flow below the -2°C isotherm; this corresponds to 320 to 350 mbgs.

On average, K values are generally low, ranging between $1x10^{-11}$ and $6x10^{-6}$ m/s, with a geometric mean of $3x10^{-9}$ m/s. The spatial distribution of K values does not show any particular pattern and there is no obvious correlation with lithology or structural features. The only visible trend is the progressive decrease in K with increasing depth.

The potential for connection between a shallow groundwater system in the overburden units and the deeper bedrock groundwater system will be localized in areas of taliks associated with lakes. Away from lakes, permafrost exists at relatively shallow depths and keeps the two systems separated (if the shallow groundwater system is even significant).

The analyses of baseline ground temperatures, mapping of potential open taliks, and thermal modeling suggest frozen ground conditions exist for most of the open pits, with an exception of where the Llama open pit intercepts Llama Lake and the talik associated with this lake. A portion of the underground workings are also expected to extend be within unfrozen zones (i.e. Umwelt, Llama, and Goose Main). The Echo underground mines, as well as Echo, Umwelt, and Goose Main open pits are within permafrost.

7.1.4 Overview of Precipitation and Hydrological Conditions

Observations recorded at meteorological station operating at the Goose property during the period January 2004 to July 2014 indicate that the climate in the Project area is typical of the Arctic, and consists of a winter period (October to May) of snow and extremely cold mean monthly temperatures ranging from -33.0 to -1.3°C and a cool spring, summer and fall period (June to September) with mean monthly temperatures ranging from -0.3 to 14.5°C.

The precipitation gauges recorded summer rainfall (June through September). In addition, in March 2012 winter adapters were installed to allow for year-round precipitation data collection. The winter adapter was removed again from the tipping buckets in June 2013, and re-installed in September 2013. In 2014, due to limited access and lack of onsite personnel for maintenance, the winter adapters were not installed. Therefore future precipitation data is limited to summer rainfall only. During the 2004 to 2014 monitoring period, summer rainfall ranged from 4 mm to 211 mm. Summer rainfall for the months with available data is generally similar to data from the regional stations for the same period. Therefore, annual precipitation at the Goose meteorological station can be inferred from the regional station data.

Based on data from regional meteorological stations, total annual precipitation ranged from a low of 125.2 mm in 2009 to a high of 344.2 mm in 2007 mm during the 2004 to 2014 period. Compared to climate normal total annual precipitation, which ranges from 247 mm to 298 mm, total annual precipitation at the regional stations was lower in 2004, 2006, 2008, 2009, 2010, 2011 and 2012, about the same in 2005, and higher in 2007 and 2013, suggesting that the 2004 to 2014 period was generally drier than the climatic norms. At the Kugluktuk A regional climate station, the majority of the precipitation (65%) occurred during the spring, summer and fall months.

Climate normal data indicate that 53 to 60% of total precipitation fell during the spring, summer and fall months, suggesting that a slightly greater proportion of the total annual precipitation was falling during these seasons during the 2004 to 2012 period. The discrepancy between climate normal and the period reported could be from sample size differences or changes in seasonal variation.

The Back River Project area lies near the northern reaches of the North American continent. As such, it is primarily subject to cold, dry Arctic air masses and American continental air masses from the south.

The area is subject to high wind speeds due to the relative absence of obstructions to impede the wind (e.g., trees, buildings, mountains). In the Project area wind speeds are generally greater than 3 m/s and predominately from the north westerly quadrant.

Solar radiation is monitored at the Goose meteorological station. Summer is a season of nearly perpetual sunlight, while winter is dominated by night, twilight and extreme cold. Generally there is an energy deficit during winter months (October through May) and an energy surplus during summer months (June through September).

Lake evaporation was calculated using data from the Goose Lake micro-met station installed in July 2012. Total evaporation values in the Back River Project area from July 7 to September 15, 2012 were estimated to be 269.4 and 260.8 mm based on total monthly evaporation values calculated using the Penman Combination and Priestly-Taylor methods, respectively. Total evaporation values from June 1 to September 13, 2013 were estimated to be 391 and 335 mm. The data is consistent with other Arctic evaporation studies.

The Back River Project lies within three regional watersheds: the Back River watershed, the Ellice River Watershed, and the Western River Watershed.

The northern portions of the proposed Project are located within the headwaters of the Western River Watershed, which flows into Bathurst Inlet. The majority of the Goose property area straddles the watershed divide between the Ellice River and Back River watersheds. The Ellice River Watershed drains northward and discharges to the Queen Maud Gulf located east of the Kent peninsula. The Back River Watershed drains east and then north and discharges approximately 500 km northeast from the Project area into Rae Strait.

Locally, the basins within the Project area are characterized by extensive networks of lakes, low elevation relief with hummocky topography, and exposed bedrock uplands. To characterize the hydrologic regime and estimate surface water availability, a baseline hydrometric monitoring program was initiated in 2010. Hydrologic data have been collected and analyzed at up to 22 hydrometric monitoring stations during 2010 to 2015. During this time period, continuous time series water level (stage) data were collected at each station and manual discharge measurements were completed. Based on the stage and discharge data collected, stage-discharge rating equations were determined and annual hydrographs produced. These data are complimented with bathymetric surveys of the larger lakes.

Hydrologic processes in the Project area are generally dominated by snow accumulation and melt, with surface water runoff and flows being drained and routed through lakes. Volumetric outflows from each of the monitored drainages were generally found to be a function of drainage area.

Most of the annual runoff occurs during spring freshet in early-to-mid June and is derived from the melting snow pack. Additionally, summer frontal systems may generate precipitation events that produce moderate runoff late in the open water season. Following freshet, a low flow period typically develops through July and August. Due to the presence of permafrost, there is limited groundwater support for smaller streams; however, there may be interaction between groundwater systems and larger rivers and/or lakes through taliks or openings in the permafrost. As a result of the permafrost, baseflow in streams is supported only by flow through the shallow upper active layer of the soil and release from storage features including lakes and wetlands.

In very small basins, the freshet can be as short as a few days and will often occur immediately after ice break-up in the channels or lakes. Streamflow in these basins may cease after freshet with the streams remaining dry until the late summer rains begin. In contrast, in rivers draining larger drainage areas, the freshet peak may be delayed after ice break-up; the timing of this delay may vary but typically increases with increasing drainage area. The delay occurs as snowmelt from the upper portions of the basin flow downstream through the drainage system.

Average annual runoff was 149 mm for the Goose Property. Annual runoff varied from a minimum of 34 mm to a maximum of 227 mm in the Goose Property area.

In all drainages the maximum monthly runoff occurred in June, accounting for approximately 50% of annual runoff for the Goose Property area. On average, the monitored streams flowed for 27% of the year in the Goose Property area, and they were either frozen or dry for the remainder of the year.

Snow depth, snow water equivalent, and snow density were surveyed at the Goose Property in 2011 and 2012. The recorded SWE values varied from 12.1 cm to 35.3 cm on the Goose Property. The recorded snow densities varied from 33 to 37% on the Goose Property.

7.1.5 Overview of Geotechnical Conditions

The general topography of the Property consists largely of rolling plains shaped by thick ice sheets from the Pleistocene glaciation. Bedrock typically consists of metamorphosed interbedded greywacke and mudstone turbidite formations with minor iron formation and intrusive units overlain by glacial overburden materials. Folding and faulting of the bedrock is evident in exposures of varying quantities. The surface of the bedrock exposures have undergone extensive frost action with the development of localized felsenmeer.

Overburden includes a number of glacial deposits consisting predominantly of till. Occasional esker deposits of sand and gravel form long ridges of stratified sand and gravel that can reach hundreds of kilometres in length.

7.1.5.1 Summary of Geotechnical Investigations Completed to Date

A summary of geotechnical field investigations is provided in Table 7.1-4. Additional detail can be found in Appendix V2-7C: Site-Wide Geotechnical Design Parameters Report.

Table 7.1-4. Summary of Historic Drilling and Test Pitting Programs

Date	Area	Investigation Type	Installations	Laboratory/In-Situ Testing	Reference
December 2001	South of Marine Laydown Area	6 offshore drill holes	-	Indicator testing (PSD[6], water contents, Atterberg Limits)	Nishi-Khon/SNC Lavalin 2001
August 2010	Goose Lake Airstrip	4 test pits	-	Indicator testing (PSD, water contents), Proctor Compaction	SRK (Apendix V2-7C)
December 2011	Goose Lake Airstrip	11 drill holes in airstrip area	1 thermistor	Indicator testing, Proctor Compaction, triaxial shear strength testing	SRK (Apendix V2-7C)

(continued)

Table 7.1-4. Summary of Historic Drilling and Test Pitting Programs (completed)

Date	Area	Investigation Type	Installations	Laboratory/In-Situ Testing	Reference
April to August 2013[1]	Goose Property, George Property, MLA	34 drill holes at Goose Property (4 at airstrip, 4 at Goose Property[2], 4 at plant site[3], 21 in tailings area[4]); 67 hand-dug test pits (31 at Goose Property, 28 at George Property, 8 at MLA)	9 thermistors at Goose Property (4 at airstrip, 1 at plant site, 4 at tailings area)	Indicator testing	Knight Piésold (2013)
March to April, June 2015[5]	Goose Property, MLA	36 drill holes at Goose Property (3 at plant site, 9 water management holes, 3 at other planned infrastructure locations, 1 under Llama Lake, 20 at TSF); 11 drill holes at MLA (spread across the Freight and Fuel Storage, Camp, and Laydown Areas); 4 hand-dug test pits at in the MLA Fuel Storage Area	10 thermistors at the TSF	Indicator testing (PSD, water contents, specific gravity, atterberg limits, in-situ density), pore water salinity, direct simple shear, consolidation, concrete aggregate, groundwater quality	SRK (Apendix V2-7C)

Notes:
[1] Program was completed in support of pre-feasibility study (PFS) to educate engineering design and was based on the mine plan at that time.
[2] Goose pit rim has changed slightly in the FS mine plan from the PFS mine plan.
[3] The plant site is in a different location in the FS mine plan than in the PFS mine plan.
[4] The tailings impoundment area (TIA) was a ring-dyke facility in the PFS mine plan and has been superceded by the FS tailings storage facility (TSF), a valley-fill facility with a Main TSF Dam and small South TSF Dam far to the south of the original TIA in the FS mine plan.
[5] Program was completed in support of feasibility study (FS) to educate engineering design and was based on the FS mine plan.
[6] Particle Size Distribution (PSD).

In 2012, SRK carried out a geotechnical and hydrogeological site investigation at Back River to support pre-feasibility level engineering studies for the mining areas in the Goose deposit area.

The geotechnical data collected during 2012 included the following:

- Geotechnical and oriented core data collection from 22 diamond core drill holes (17 dual purpose holes from resource drilling and five geotechnical specific holes) across the Umwelt and Goose underground and open pit mining areas, and Llama open pit.
- 'On-rig' geotechnical logging of rock mass parameters and collection of oriented discontinuity data by Sabina staff and supervised by SRK's site senior consultant.
- Limited laboratory strength testing of selected rock samples.
- Review of available exploration drill core by SRK structural geologists.
- Structural geologic review to determine potential brittle geologic structures intersecting the various mining areas.

The hydrogeological data collected during 2012 included the following:

- Sixteen hydraulic conductivity tests using an IPI packer system within the talik zones at the Back River deposits.

- Installation of multi-point thermistor strings in 3 drillholes at the Llama deposit (2 installations), and at the Umwelt deposit), to complement the existing thermistor located at the Goose deposit.
- Dataloggers programmed to record ground temperature and hydraulic pressure on 6 hour intervals.

In 2013, Knight Piésold Ltd. completed the geomechanical, hydrogeological, and geotechnical work needed to support the feasibility mine design for the proposed underground and open pit developments, as well as the design of on-site and off-site infrastructure.

The geomechanical and hydrogeological data collected during 2013 included the following:

- A review of all available geological and structural information.
- Training of Sabina technicians in drill supervision, core orientation and basic geomechanical logging.
- Detailed geomechanical logging of 35 oriented and triple-tubed diamond drillholes at the Goose and George mining areas.
- Hydraulic conductivity testing within known or suspected taliks and below the estimated base of the permafrost.
- Selection of core samples for laboratory rock strength testing.
- Installation of thermistors and piezometers with data loggers in 13 drillholes.
- Characterization of the hydrogeological conditions in the vicinity of the open pits.

The geotechnical data collected during 2013 included the following:

- Geotechnical drilling and logging of 34 geotechnical drillholes at the Goose open pit area, proposed plant site, airstrip and PFS Tailings Storage Facility. Drillholes ranged in depth from 5.0 to 24.5 m and included sampling of both overburden and upper bedrock.
- Installation of thermistor strings in 8 drillholes.
- Excavation of up to 70 test pits in the overburden active layer at the Goose open pit area, proposed plant site, airstrip, PFS Tailings Storage Facility, and marine laydown area.
- Geotechnical laboratory testing of soil samples for moisture/ice content determination, grain size analyses, specific gravity and salinity on select samples collected from the geotechnical drillholes.

In 2015, SRK completed the geotechnical and hydrogeological work in support of the FEIS proposed open pit and underground developments, as well as the design of on-site and off-site infrastructure (Appendix V2-7C).

The geotechnical and hydrogeological data collected during 2015 included the following:

- Geotechnical drilling and logging of 30 triple-tubed geotechnical drillholes at FS Tailings Storage Facility, Goose Plant Site, Goose Area WRSAs, and water retention structures. Drillholes ranged in depth from 6.5 to 16.5 m and included sampling of both overburden and upper bedrock.

- Geotechnical drilling of a single 177m triple tubed drillhole into the talik zone under Llama lake to explore the hydraulic conductivity and provide information on water quality at depth.
- Installation of thermistor strings in 10 drillholes.
- 23 hydraulic conductivity tests using an IPI packer system within the foundations of the TSF and water retention berms.
- Geotechnical laboratory testing of soil and bedrock samples for moisture/ice content determination, grain size analyses, specific gravity and salinity on select samples collected from the geotechnical drillholes.

7.2 MINING

The Goose Property (Figure 1.6-2) consists of several mineral deposits, four of which have been identified as being economical at current metal prices:

- Goose Main deposit – combination of open pit and underground mining;
- Echo deposit - combination of open pit and underground mining;
- Umwelt deposit – combination of open pit and underground mining; and
- Llama deposit – combination of open pit and underground mining.

7.2.1 Review of Similar Operations

There are operations in settings similar to the Project that can provide insight on the long-term stability of the underlying permafrost and frozen materials; this information can provide guidance on Project design and planning, through Operations and into Closure. Key Project components where this information will assist include the mining, transport and processing of ore, ore stockpiling, and design of the WRSAs and the TSF.

An operation that can be considered comparable to the Project is the operating Meadowbank Gold Mine, an open pit gold mine located in the Kivalliq Region of Nunavut. The Meadowbank Final EIS was prepared by Cumberland Resources in 2005 and updated by Agnico-Eagle Mines. Another similar project is Meliadine, an advanced exploration gold project, also owned by Agnico-Eagle Mines and located in the Kivalliq Region. The Nunavut Impact Review Board issued a Project Certificate in February 2015, setting out the terms on which the Meliadine project can proceed. A Final EIS was submitted in 2014 in which the possible interactions between open pits and permafrost were modelled. Sabina has completed a site specific thermal analysis for the Back River Project. Results of this modelling can be found in Appendix V2-7A: Hydrogeological Characterization and Modeling Report.

7.2.1.1 Mining Activities and Long-term Permafrost Interactions

Three elements will permanently alter the land surface beyond post-closure: open pit lakes, WRSAs, and the TSF. In the context of permafrost, considerations must be made as to what effects (short and long term) the permanent alterations to the land surface may have on the permafrost regime. Undisturbed permafrost is comprised of two elements: (a) the deep permafrost extending at depth which is continuously frozen, and (b) the active layer within 2 to 3 metres of surface which thaws during each summer.

Open pit mines will be flooded with water as part of the closure process; note that some open pits will be used for active Tailings Facilities (TFs) for tailings, and potentially waste rock, deposition during the mine life before they are filled with water. This process of open pit flooding will likely result in the retreat of permafrost away from the flooded pit forming a talik beneath each pit that will eventually stabilize in size as the heat flow between water and rock comes into balance. The possibility of potential taliks that this filling may cause has been reviewed and analyzed as part of the thermal modelling for this Project. Results of this modelling can be found in Appendix V2-7A: Hydrogeological Characterization and Modeling Report.

The WRSAs, TFs, and TSF are designed so that permafrost enters the core of these facilities isolating PAG material from water. At the closure of each facility, an encapsulating layer of NPAG material with a thickness greater than the active layer thickness will ensure the core does not melt. While these facilities are in the process of freezing as the permafrost aggregates, runoff will be managed and treated if required. Once steady-state frozen conditions develop, discharge is expected to meet site specific water quality requirements.

The current mine plan calls for various ore stockpiles. These will be live stockpiles so it is difficult to predict their local thickness and the freeze-thaw cycle that will occur within them. The sulphide content of the ore is low. Therefore, spontaneous heating is not foreseeable. All ore will be removed and processed by the end of the mine life so stockpiles will have no long-term effect on the permafrost. During operations, runoff from the ore stockpiles will be collected and managed as part of the site water management plan.

Shallow, permanent features, such as roads and airstrips, will be designed so that the active layer remains within the engineered material and does not penetrate the pre-existing substrate. This condition may be relaxed in the interests of reducing the amount of material to be moved where the substrate is structurally strong. Experience with the existing 915-metre Goose all-weather airstrip suggests that the sand overburden at the Goose Property is structurally strong. Mine buildings will have no long-term effect on the landscape as they will be demolished and landfilled during Active Closure.

Once the mine is closed, all heat sources will be removed. The temperature of the underground mine workings will return to that of the pre-existing permafrost. The operation of the mine will have no long-term effect on the surface albedo; therefore, the effect of solar heating will be the same as on the surrounding landscape.

7.2.2 Measures to Mitigate Extreme Natural Hazards Events

The environment has the potential to affect the design, operation, and closure of the Project. Natural hazards in the form of 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. Included in the context of extreme weather is the potential for global climate change to affect the Project. Engineering hazard assessments have been completed to outline these potential effects and the engineering measures that will be implemented to mitigate these hazards. Details of this assessment can be found in Volume 9, Chapter 2: Effects of the Environment on the Project.

7.2.3 Mining Sequence

The mine production schedule for the Back River deposits incorporates four mineral deposits at Goose (Umwelt, Llama, Goose Main, Echo). The mill feed tonnage will be sourced from a series of open pit and underground mines and supplemented from high, medium and low grade ore stockpiles. Access to underground mines will be established by declines driven outside of the pit extent to allow flexibility in mine scheduling. Figure 1.6-2 shows the Goose Site General layout.

The basic criteria used for the development of the mine schedule are:

- Maximize NPV;
- Maintain plant throughput at a net yearly production of 2.2 Mtpa ore;
- Ensure suitable and adequate waste material is produced from the open pits in the pre-production period to satisfy construction requirements;
- Maximize the mill head grade in the early years of the operation through the use of ROM stockpiles and accelerated open pit mining;
- Plan up to two open pits active in production at any time (deposits are most economical when the open pit mines as well as the underground workings are mined concurrently);
- Maximum pit production rate per period according to the geometry of the phases and the number of shovels that can work within that geometry. Maximum total yearly mine open pit production is 13.6 Mt (LOM average 8.0 Mt/yr);
- Capitalize pre-stripping tonnage (18.9 Mt total material, to be mined in Year -2 and Year -1 using owner-operated equipment and resources);
- Establish ROM stockpiles (with different gold cut-off grades) to allow for blending of stockpiled material in order to maximize mill head grade;
- Plan on operating 355 days per year

Table 7.2-1 below shows the open pit production schedule.

7.2.3.1 Cut-off Grades

Cut-off grades are presented in the notes section for each mining area in Table 7.1-1. Back River Project Resource Estimates (October 2014). Average annual grades are presented in Table 7.1-2.

7.2.4 Open Pit Mining

A conventional load-haul (also known as truck and shovel) mining method was selected for all open pits included in the mining schedule. Bench height in the final pit design is 20 m for all pits. During the working stages, the waste areas will be drilled, blasted, and loaded using 10 m benches. In order to achieve the planned selectivity, 5 m benches will be used when the operation is at or near the ore zones. It is also expected that, as the knowledge of the ore body increases, certain ore zones will be recovered on 10 m benches without compromising the selectivity.

7.2.4.1 Unit Operations and Equipment

A summary of the open pit mining unit operations and equipment involved are as follows:

Drilling: production drill is planned to be performed on 10m benches (selective mining of 5 m benches is also planned) using 250 mm diameter holes. Wall control and pre-splitting holes will be drilled using 115 mm holes.

Blasting: conventional blasting will be performed with ammonium nitrate fuel oil (ANFO) and pre-splitting explosives. Based on the results of the hydrology work by Knight Piésold and SRK, water-resistant explosives are not anticipated to be required. The estimated powder factors are 0.26 kg/t.

Loading: primary loading is planned to be performed by diesel front shovels with a 7 m^3 bucket. A wheel loader with a 7-m^3 bucket and a 4-m^3 excavator would be used for secondary loading, rehandle and shovel support.

Table 7.2-1. Open Pit Mining Schedule

Description	Unit	Total	Y-2	Y-1	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Umwelt														
Waste	kt	19,942	5,376	11,568	2,957	41	0	0	0	0	0	0	0	0
Total Ore	kt	3,570	340	1,603	1,561	67	0	0	0	0	0	0	0	0
Average grade	g/t	5.86	4.70	5.18	6.68	8.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SR	w:o	5.59	15.82	7.22	1.89	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Material	kt	23,512	5,716	13,170	4,518	108	0	0	0	0	0	0	0	0
Llama														
Waste	kt	16,005	0	0	7,587	7,694	724	0	0	0	0	0	0	0
Total Ore	kt	1,473	0	0	110	910	453	0	0	0	0	0	0	0
Average grade	g/t	6.13	0.00	0.00	5.95	5.99	6.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SR	w:o	10.86	0.00	0.00	68.71	8.45	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Material	kt	17,478	0	0	7,698	8,604	1,177	0	0	0	0	0	0	0
Goose Main														
Waste	kt	27,111	0	0	0	3,514	11,307	9,508	2,770	11	0	0	0	0
Total Ore	kt	4,320	0	0	0	90	1,130	1,885	1,195	21	0	0	0	0
Average grade	g/t	4.38	0.00	0.00	0.00	5.18	4.28	4.38	4.37	7.45	0.00	0.00	0.00	0.00
SR	w:o	6.27	0.00	0.00	0.00	39.01	10.01	5.04	2.32	0.54	0.00	0.00	0.00	0.00
Total Material	kt	31,431	0	0	0	3,604	12,437	11,393	3,965	32	0	0	0	0
Echo														
Waste	kt	1,224	0	0	0	0	0	949	275	0	0	0	0	0
Total Ore	kt	112	0	0	0	0	0	45	67	0	0	0	0	0
Average grade	g/t	4.60	0.00	0.00	0.00	0.00	0.00	4.64	4.56	0.00	0.00	0.00	0.00	0.00
SR	w:o	10.92	0.00	0.00	0.00	0.00	0.00	20.90	4.12	0.00	0.00	0.00	0.00	0.00
Total Material	kt	1,336	0	0	0	0	0	994	342	0	0	0	0	0

(continued)

Table 7.2-1. Open Pit Mining Schedule (completed)

Description	Unit	Total	Y-2	Y-1	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Other Sources														
Waste	kt	12,872	0	0	0	0	0	0	2,056	7,189	1,749	909	969	0
Total Ore	kt	1,289	0	0	0	0	0	0	57	678	261	73	220	0
Average grade	g/t	5.11	0.00	0.00	0.00	0.00	0.00	0.00	6.37	5.50	5.07	4.16	3.97	0.00
SR	w:o	9.99	0.00	0.00	0.00	0.00	0.00	0.00	36.04	10.61	6.71	12.45	4.40	0.00
Total Material	kt	14,160	0	0	0	0	0	0	2,113	7,866	2,010	982	1,189	0
Open Pit Summary														
Total Waste	kt	77,153	5,376	11,568	10,545	11,249	12,031	10,457	5,101	7,200	1,749	909	969	0
OP ore	kt	10,765	340	1,603	1,672	1,067	1,582	1,931	1,318	698	261	73	220	0
OP grade	g/t	5.20	4.70	5.18	6.64	6.10	4.91	4.38	4.47	5.56	5.07	4.16	3.97	0.00
Strip Ratio	w:o	7.17	15.82	7.22	6.31	10.54	7.60	5.42	3.87	10.31	6.71	12.45	4.40	0.00
Total Material	kt	87,918	5,716	13,170	12,216	12,315	13,613	12,388	6,420	7,898	2,010	982	1,189	0

Source: Modified from JDS 2015

Hauling: Primary haulage is planned to be done with 64-t payload haul trucks (CAT 775G or equivalent).

Support Equipment: standard wheel dozers, water trucks, motor graders, and track dozers are included in the mining plan.

Dewatering and water management associated with open pits is addressed in Section 7.10. Details of planned dust monitoring and mitigation can be found in the Volume 10, Chapter 17: Air Quality Monitoring and Management Plan. Detailed equipment lists can be found in Section 7.3.

7.2.4.2 Open Pit Design

Table 7.2-2 presents the main geometrical parameters used in the pit design.

Table 7.2-2. Pit Design Parameters

Description	Value
Ultimate Pit Design Parameters - All pits	
Bench Height (Rock)	5 m (single bench)
Final Configuration	20 m (quadruple bench)
Bench Height (Overburden)	10 m
Bench Face Angle	55°- 75°
Bench width	8.6 m - 10 m
Inter-ramp wall angle (IRA)	42°-55°
Ramp Width - double lane	20 m
Ramp width -single lane	15 m
Overall slope angle (OSA)	37°- 55°
Main Haul Road Parameters	
Reference Truck Width	5 m
Total Width for Two Lanes*	20 m
Maximum Ramp Gradient*	10%

**Pit ramp widths may be reduced from 20 m (two lane) to 15 m (single lane) and maximum grade may increase to 12% as the ramp approaches pit bottom to increase ore recovery.*

7.2.4.3 Pit Slope Stability

For the open-pit design, a series of stability analyses were carried out, including 2D numerical modelling and kinematic analyses. Ground stability was evaluated using 3D geological models provided by Sabina along with available rock mass data and observations from onsite KP personnel. Each deposit was divided into geomechanical domains based predominantly on modelled lithology. Potential hazards associated with structure, such as faults, low angle of rock-to-pit-wall intersection angles, and low quality zones were identified in some pit walls. In the absence of major structure, most walls show very low likelihood of instability due to the strong rock mass and relatively small pit size.

The pit slope design recommendations are presented in Table 7.2-3, which shows the recommended design maximum (or minimum) values and those adopted for this study. Due to the generally good rock mass quality and relatively shallow depth of the pits, the approach has been to limit the bench height to 20 m and steepen bench face angles while providing sufficient berm widths to contain structurally controlled failure. The design assumes that final pit walls will include pre-split blasting to reduce blasting effects on final pit wall stability.

Table 7.2-3. Pit Slope Design Recommendations

Component		Design Value
Overburden	Overall Slope Angle	24°
	Berm Width	5 m
	Bench Height	10 m
Rock	Overall Slope Angle	37° - 55°
	Bench Face Angle	55° - 75°
	Inter Ramp Angle	42° - 55°
	Road Width	20 m
	Berm Width	8.6 m - 10 m
	Final Bench Height	20 m

Overburden material is expected to average 6 to 10 m for the open pits, with a maximum thickness of 20 m at the Goose Main open pit. Thawing of frozen overburden could result in slumping and local bench-scale failures. To account for this, overburden will be designed at a maximum bench width of 5 m and maximum bench height of 10 m, giving an overall overburden slope angle of 24°.

7.2.4.4 Hydrogeological

Preliminary groundwater inflow estimates were developed by SRK to facilitate the mine design work. These estimates were based on the latest mine plan, hydraulic conductivity estimates, thermistor data, and other field programs. A brief summary is provided in this section.

Table 7.2-4 present the predicted yearly average inflows for the Umwelt underground mine, Llama open pit and underground mines, and the Goose Main underground. Note that no inflows are listed for Umwelt open pit, Goose Main open pit, Echo open pit or Echo underground; these mines are all entirely within permafrost and as such, no groundwater inflows can be expected.

Table 7.2-4. Goose Property Groundwater Inflows

	Flow in m^3/d			
Year No.	**Umwelt Underground**	**Llama Underground**	**Llama Open Pit**	**Goose Main Underground**
-2	0	0	0	0
-1	0	168	0	0
1	0	334	120	0
2	89	350	109	0
3	543	264	702	0
4	440	246	Interpolated	0
5	596	0	Interpolated	0
6	498	0	Interpolated	21
7	405	0	Interpolated	85
8	359	0	Interpolated	77
9	329	0	Interpolated	64
10	312	0	Interpolated	0

Highlighted grey cells illustrate underground pre-development and blue cells illustrate mining period.

7.2.4.5 Open Pit Mining Infrastructure

In-pit infrastructure to support open pit mining will be limited to dewatering and lighting equipment, which will be diesel powered.

The only major structures will be the mine maintenance facilities located near the Goose Process Plant. Open pit mine maintenance facilities will include truck, tire, welding, and light vehicle shops.

Design details for water management related infrastructure including seepage and runoff control from open pits is located in Appendix V2-7I: Water Management System Design Report.

7.2.5 Underground Mining

The Project has four deposits that have the necessary grade, continuity, and tonnage to be considered for underground mining: Umwelt, Llama, Goose Main, and Echo (Table 7.2-5). These deposits are located at the Goose Property.

All of the underground mines would be located below open pits. An open pit/underground crossover review was performed for each deposit to determine the most economic depth of transitioning from open pit to underground mining.

7.2.5.1 Access and Decline Infrastructure

The underground deposits at Back River are planned to be accessed via declines driven from surface typically 4.5 m wide by 5.0 m high at a -15% gradient. The declines would be used for haulage of ore and waste, access of personnel, equipment, materials, and services. They are also planned to be used as an exhaust airway. The locations of the decline portals were chosen to ensure environmental offset limits from streams and lakes were maintained. Underground portals are driven from surface, rather than pit bottom, to provide flexibility in mine scheduling and reduce risk of flooding. Grading or diversion berms can be used if required to prevent runoff entering portals.

Level access crosscuts and attack ramps are planned to be developed off the decline at a 4.5 by 5.0 m profile. All infrastructure development, which is not planned to be used as an access, i.e. remucks, ventilation drifts and sumps, were designed at a 4 m by 4 m profile.

Underground access portal locations are shown on the Goose Property layout provided in Figure 1.6-2.

7.2.5.2 Underground Mining Method and Stope Design

The most suitable underground mining method was selected for each deposit based on the known characteristics, such as grade, dilution, dip, continuity, thickness, etc.

Mining methods involving cemented backfill were avoided because freight costs to bring such large quantities of cement to the remote site would be very high. Uncemented rock fill requires an overhand mining strategy. Sill pillars in ore are required to allow concurrent mining of multiple blocks.

The post pillar cut and fill (PPCF) method was selected for the Umwelt deposit due to its shallow dip. Other bulk mining methods, like long-hole stoping, would create unstable hanging-wall exposures of the weak Middle Mudstone. PPCF mining limits the hanging-wall exposure and allows the installation of ground support. High production rates can be attained with this mining method.

Table 7.2-5. Underground Mining Schedule

Description	Unit	Total	Y-2	Y-1	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Umwelt UG														
Total Ore	kt	4,464	0	0	0	386	584	584	584	584	584	565	502	92
Average grade	g/t	6.26	0.00	0.00	0.00	5.38	7.55	7.00	6.15	6.22	6.13	5.93	5.52	5.13
Llama UG														
Total Ore	kt	952	0	0	282	231	310	130	0	0	0	0	0	0
Average grade	g/t	7.61	0.00	0.00	6.82	7.92	8.73	6.12	0.00	0.00	0.00	0.00	0.00	0.00
Goose Main UG														
Total Ore	kt	1,244	0	0	0	0	0	0	276	346	302	264	55	0
Average grade	g/t	5.66	0.00	0.00	0.00	0.00	0.00	0.00	4.89	5.14	5.33	7.71	4.85	0.00
Echo UG														
Total Ore	kt	592	0	0	0	0	0	0	0	137	204	185	66	0
Average grade	g/t	5.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.32	5.39	5.15	5.02	0.00
Other Sources UG														
Total Ore	kt	1,775	0	0	0	0	0	0	0	0	453	659	542	121
Average grade	g/t	6.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.92	7.26	6.17	5.59
Underground Summary														
UG ore	kt	9,028	0	0	282	617	894	714	860	1,067	1,544	1,673	1,165	212
UG grade	g/t	6.30	0.00	0.00	6.82	6.33	7.96	6.84	5.75	5.75	5.81	6.65	5.76	5.39
UG Au	ounces	1,827,739	0	0	61,750	125,505	228,782	156,837	158,939	197,311	288,368	357,556	215,925	36,766

Source: Modified from JDS 2015

All the other deposits at the Property are steeply dipping and could be amenable to longhole stoping methods. Longitudinal open stoping (LOS) was selected for Echo, which have favourable geotechnical conditions and good continuity within the ore zones.

At Llama and Goose Main, drift and fill (DF) mining was chosen instead of LOS with consideration to geotechnical conditions which may cause excessive hanging-wall dilution from the Middle Mudstone and the due to irregular geometry of the mineralization (JDS, 2015).

7.2.5.3 Pillar Design

Geotechnical design recommendations were developed by Knight Piésold for each deposit, based upon the available data and the selected mining methods. This included achievable stope spans, expected mining dilution, sill pillar, rib pillar, and crown pillar dimensions, ground support standards, and access development placement. Underground and open pit designs were completed by JDS taking these recommendations into account.

Additional detailed information on select engineering areas (underground and open pit mine design, cut/fill slope design, and MLA design, and road and airstrip design) may be found in Sabina's Feasibility Study (June 22, 2015) located on the SEDAR website (http://www.sedar.com/).

7.2.5.4 Backfilling

All of the selected underground mining methods require backfill to maintain ground stability and to provide a work base for the equipment on the next cut above. The primary source for backfill material is planned to be development waste from the underground mines. At each underground operation, there will be a net shortage of backfill material. The shortfall will be made up by utilizing potentially acid-generating waste rock from the open pit operations. Using waste rock for backfilling would reduce the surface environmental impact, since potentially acid generating material would be permanently stored underground. Unconsolidated waste rock is planned to be used to eliminate costs for cement.

During pre-production, underground waste rock is planned to be hauled to surface and stored on a temporary backfill stockpile on the laydown pad close to each underground portal. Upon commencement of underground production, development waste would be hauled by the underground trucks directly to the area requiring backfill. When there is no backfill from underground development faces available, the temporary waste stockpile on surface would be used as backfill source. When all the underground development waste is depleted, open pit haul trucks are planned to transport waste rock from the open pits to this portal stockpile, as required.

7.2.5.5 Underground Mine Ventilation

Ventilation systems for the underground operations for the Project are designed to dilute and remove dust, diesel emissions and blasting fumes, and maintain compliance with Nunavut mine regulations. Ventilation networks were modelled in Ventsim software for each underground mine, based on the detailed mine designs.

Airflow requirements for each underground operation were based on expected diesel emissions of the underground mining fleets. According to the Nunavut mining legislation, "the ventilation quantity shall be at least 0.06 m^3/s for each kW of the diesel powered equipment operating at the work site" (Mine Health and Safety Act, Section 10.62 (2)).

Mobile equipment lists were compiled for when each mine would be in full production. The power rating of each piece of equipment was determined, and then utilization factors, representing the equipment in use at any time, were applied to estimate the amount of air required. Ventilation losses, ranging from 15 to 20% depending on the complexity of the ventilation network, were applied to determine total ventilation requirements.

Prior to establishing the primary ventilation system, consisting of fresh air raise and main fan, all the air required for the advance of the decline is planned to be supplied by auxiliary ventilation. Steel ducting and fans would be installed to provide least 38 m^3/s of air to the decline face. Once the first ventilation raise is established, the duct and fans would be stripped out of the decline and reused for development of the next underground operation.

Auxiliary fans are planned to be used to ventilate the advancing development and active production levels. Fans and ducting would be removed on retreat and used again on the next cut, stoping sublevel, or advancing face.

At the underground operations where groundwater inflows are expected, intake air would require heating during the winter months to prevent ice build-up on roadways and in ventilation raises. The deposits that are expected to require mine air heating are Umwelt, Llama, and Goose Main.

At these mines, the intake air is envisioned to be heated to a temperature of + 2°C. The mine air heating system at Umwelt would consist of glycol heat exchangers, using waste heat from the diesel generators at the main power plant. Llama and Goose Main would be heated by indirect fired diesel heaters. To save on mine air heating costs at Goose Main, mining below the permafrost would be delayed towards the end of the mine life. Goose Main would be only heated during the final year of mining.

Heating calculations based on average site temperatures and modelled intake air flows were used to estimate fuel requirements for mine air heating.

At Llama, the expected annual consumption of diesel for mine air heating is 2.26 million litres, and at Goose Main 2.36 million litres.

Echo underground mine, which is 100% in permafrost, would not be heated to save capital and operating costs for heating, but would rely instead on a brine system to keep service water from freezing during the winter. Calcium Chloride would be mixed in a brine plant on surface and distributed through service water piping throughout the mine. Arctic mines such as Raglan and Ekati have used brine systems for many years.

7.2.5.6 Underground Mine Dewatering

Groundwater inflows are only expected at Umwelt, Llama, and Goose Main underground mines. Analysis suggests that the -2°C temperature isotherm should be used to delineate the base of permafrost; inflows are anticipated where mine working extend below this isotherm, which correlates to about 320 to 350 mbgs. The average groundwater inflow rates per year are provided in Section 7.2.4.4. In mining areas above the permafrost, no groundwater inflows are expected.

Mine dewatering must accommodate groundwater inflows in mining areas below the permafrost, as well as inflows from drills and other equipment on all mining elevations. Twin 43 kW submersible pumps are planned to be installed at specific dewatering sumps at 90 m vertical intervals with staged pumping to surface. The second pump at each sump would be used as a backup pump in case of failure or if peak inflows occur. Drain holes are designed to be utilized in the access crosscut sumps, draining to the closest dewatering sump.

Mine dewatering will be achieved using a combination of submersible and horizontal pumps located throughout the working levels. The pumps will handle mine water via multiple lifts throughout the mine to minimize the pump size and power requirements.

For decline and production development, a face pump will be deployed to pump water to a nearby sump. This sump will transfer water via the raise system to sumps on higher elevations, in a staged configuration, for discharge to surface. Reticulation will be heat-traced, as required.

The dewatering monitoring program will be incorporated into the operational monitoring plan.

7.2.6 Metal Leaching/Acid Rock Drainage

The metal leaching/acid rock drainage (ML/ARD) characterization for the Back River Project has involved a phased approach to reduce the level of uncertainty associated with ML/ARD for defined lithologies. ML/ARD programs were completed between 2007 and 2015 (Appendix V2-7D: Geochemical Characterization Report).

Test methods used for the ML/ARD characterization programs included static and kinetic tests on overburden, quarry rock, waste rock, and tailings. The static tests included expanded Acid-base Accounting (ABA) using the Standard Sobek or Siderite corrected NP method for Neutralization Potential (NP) determination, and calculations of acid potential (AP) based on the total sulphur content. Other static tests included trace element and whole rock oxide analyses, and mineralogical analyses. Kinetic tests included six field leach barrels and 43 humidity cell tests on waste rock, and 3 humidity cell tests on tailings. Some of these tests have operated for a number of years, and will continue to operate for an extended period of time. In addition, in 2015 Sabina completed seepage monitoring downgradient of the current Goose airstrip, which was constructed of run of quarry (ROQ) material from the Airstrip Quarry; this field data, in addition to all other static and kinetic testing data, was used to refine site geochemical characterization.

The proportions of PAG and NPAG material within each stratigraphic unit and each deposit were estimated based on the proportion of PAG and NPAG samples within each of these units. Due to similarities in the geology and the static testing results for the Umwelt, Llama, and Echo deposits, the laboratory results for those deposits were combined. Results for Goose Main were grouped separately due to the observation that there were generally higher concentrations of carbonates in that deposit.

Overburden is also present in all of these deposits and test results indicate that this material is consistently NPAG. Due to the overburden physical properties, it is currently assumed that some of this material may be unsuitable for construction purposes. However, during Closure it is possible that some of this overburden can be used as a portion of the capping material on the WRSAs.

The current waste management strategy is to segregate PAG and NPAG material in the WRSAs; details are defined in Section 7.2.7. Based on detailed analysis, the in-situ ratio of PAG/NPAG material is 35%/65% for the Goose Property. However, it is anticipated that there will be some inefficiencies in the segregation process. It is also assumed that the segregation methods will be designed to ensure that minimal amounts of PAG are mixed with the NPAG. This typically means that less NPAG, and therefore more PAG, is recovered than what is present in-situ for each deposit. To account for operational inefficiency in recovering NPAG, conservative recovery factors have been applied to each of the stratigraphic units, based on the understanding of the unit and the reasonableness of recovery. These recovery factors have been estimated as 75% recovery of all NPAG in all stratigraphic units, with the exception of only 50% in the Umwelt and Llama UIF, and 0% NPAG recovery in the LIF. The results show that approximately 34 million tonnes (58%) of PAG and 25 million tonnes (42%) of NPAG waste rock would be produced during mining. An additional 5 million tonnes of overburden is present. Testing data for the overburden indicates that it is likely NPAG. Table 7.2-6 shows waste rock type by deposit at the Goose Property for both in-situ quantities, and quantities with recovery factors applied.

Table 7.2-6. Waste Rock Classification – Goose Only

Scenario		Quantity ('000s t)*			Distribution % (excl. OVB)	
		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	13,052	5,601	1,289	70%	30%
	Llama	10,546	4,422	1,037	70%	30%
	Main	10,101	14,255	2,755	41%	59%
	Echo	584	390	250	60%	40%
	Total	**34,283**	**24,668**	**5,331**	**58%**	**42%**

**Additional 12,872 kt of waste rock as contributed by Other Sources are excluded.*

Through geochemical characterization programs completed to date, there exists a potential for ML/ARD and at some point, some part of the mine operations or its associated infrastructure will generate water that may have a negative impact to the environment and/or exceed regulatory criteria.

The nature of the rock, the specifics of the chemical reactions, the resultant solution chemistry/ concentration, and the severity of the environmental impact are all site specific. Details of water management, and the associated water quality, can be found in Section 7.10. Mitigation measures have been incorporated into mine design and are part of ongoing mine scheduling, ore management, waste rock management, tailings management, quarry management, and reclamation plans over the Project life.

For this assessment, ML/ARD potential, resultant predicted water quality and impact assessment are presented in various volumes and appendices of the Back River Project FEIS including:

- Geochemical Characterization Report (Appendix V2-7D);
- Water and Load Balance Report (Appendix V2-7H);
- Site Water Monitoring and Management Plan (Volume 10, Chapter 7);
- Mine Waste Rock Management Plan (Volume 10, Chapter 9); and
- Tailings Management Plan (Volume 10, Chapter 22).

In response to a meeting request from NRCAN during the prehearing conference (Commitments NRCAN-36 and NRCAN-37), Sabina met with representatives of NRCAN to discuss detailed geochemistry questions.

7.2.7 Waste Rock Storage Areas

Proposed waste rock storage area locations are shown in Figure 1.6-2. Volume 2 Appendix V2-4A reviews the site selection alternatives for disposal of waste rock.

To minimize haul distances, there is generally a separate WRSA for each open pit. The waste rock storage area layouts have thus far been planned with the following basic criteria:

- Depending on the potential to generate acid, waste will be segregated into three categories: overburden, non-potentially acid generating (NPAG), and potential acid generating (PAG). This process will require management similar to ore control. Further details can be found in Section 7.2.6
- PAG material will be encapsulated within the WRSA, beneath a 5 m cap of NPAG cover material, so that the PAG material will remain permanently frozen. There may be the need for some rehandling of waste rock during closure to place the NPAG cover over the PAG materials.
- PAG material has been shown to not react rapidly and thus the need for placing the PAG to achieve seasonal freeze back is not mandatory. As such, placement of PAG material can be driven by reasonable operational lift thicknesses, as defined by hauling equipment.
- Waste rock storage areas will be located to minimize flow-through drainages, and diversions will be constructed to minimize surface runoff entering WRSAs.
- Some PAG material may be placed underground as backfill for ground stability, providing containment and ultimate freezing of the backfilled waste material.

7.2.7.1 Waste Rock Production

The current mine production schedule produces approximately 64 Mt of waste materials (overburden and waste rock), approximately 58% of which is anticipated to be grouped as PAG.

Preliminary geochemical characterization of the mine waste rock was completed by Rescan, with continued analysis by SRK; results are presented in Volume 2. Static geochemical tests were completed on samples of drill core and pulps selected to represent the most recent geological model. The primary stratigraphic units (i.e. model units) are listed as follows:

- Upper Greywacke (UGWK);
- Phyllite, present at Goose Main and Echo Only (PHY);
- Upper Iron Formation (UIF);
- Middle Mudstone (MM);
- Lower Iron Formation (LIF); and
- Lower Greywacke, (LGWK & DIF) – results listed separately below.

Gabbro (GAB) and Quartz Feldspar Porphyry (QFP) cross cut these units. Although it is considered unlikely that the QFP would be segregated during mining, both of these units were treated as individual units for the purpose of quantifying the PAG/NPAG distribution.

The number and spatial distribution of samples were determined to be insufficient for development of an acid-base accounting (ABA) block model. Therefore, the proportion of PAG and NPAG in the waste rock production schedule was based on the proportion of PAG and NPAG presentation within each major stratigraphic unit for each deposit. Table 7.2-7 below provides the in-situ proportion of PAG and

NPAG waste rock by stratigraphic unit and deposit. Note that minor units are not listed below; these can be found in detail in Appendix V2-7D.

Table 7.2-7. Waste Rock Lithology at Goose Property (as of January 2015)

Deposit	Type	OVB	PHYL	UGWK	LGWK	UIF	MM&LIF	GAB	QFP	DIF
Main	PAG/uncertain	0%	14%	68%	22%	8%	22%	7%	0%	22%
	NPAG/low S	100%	86%	32%	78%	92%	78%	93%	100%	78%
Umwelt/ Llama/Echo	PAG/uncertain	0%	100%	46%	40%	56%	69%	15%	29%	40%
	NPAG/low S	100%	0%	54%	60%	44%	31%	85%	71%	60%

The quantities of waste produced are summarized in Table 7.2-6.

7.2.7.2 Waste Rock Disposal

The strategy for disposal of waste rock and overburden generated from mining activities at the Back River Project is storage in surficial waste rock storage areas. The storage design requirement for Goose is approximately 5 M tonnes of overburden, 34 M tonnes of PAG waste rock, and 25 M tonnes of NPAG waste rock. Approximately 3 M tonnes of PAG waste rock has been slated for use as underground mine backfill.

Acid generation from PAG waste rock will be prevented by incorporating the material into the core of the WRSAs. The PAG waste rock will be placed in a manner to prevent basal permafrost degradation and promote aggregation of the permafrost into the waste rock. At closure, the PAG waste rock will be covered by a coarse (high permeability) cover of NPAG waste rock, including some overburden, to protect the PAG waste rock from seasonal thawing (i.e., NPAG material will contain the active layer). Kinetic testing of waste rock has been completed and analysis confirms that PAG waste rock reacts over a long time scale.

Geotechnical information was collected at the proposed waste rock storage areas during the 2015 field season. A summary of this field program and historic geotechnical investigations is provided in Section 7.1.5. Exploration, geotechnical, and overburden drill data on the Goose Property overburden thicknesses ranging from 0 to 25 m. Thicker sequences of overburden occur in the Goose Main open pit, Llama open pit, and Goose Airstrip areas. Preliminary data also indicates bedrock on surface in many areas. Little to no organic material is present on the surface and the upper 1 to 2 m of rock is expected to be frost shattered.

The waste rock disposal criteria, specifically the PAG waste rock disposal criteria, was developed based on thermal models that considered average freezing and thawing depths of waste rock calculated using climactic inputs from representative regional climate stations, thermistors installed on site, and typical material parameters. The active layer depth ranges from approximately 1.3 to 4.2 mbgs; due to the presence of salinity of some surficial groundwater, the active layer may take up to 60 days to refreeze in some areas (Appendix V2-7C).

An overall waste material disposal criteria have been developed for all three of waste rock types produced at the Back River Project: overburden, PAG waste rock, and NPAG waste rock. The waste disposal criteria are outlined below:

- PAG and NPAG waste rock will be placed in lifts in a “bottom-up” approach in order to maximize stability and promote aggregation of permafrost.

- Ultimate side slopes for all areas should be less than 3H:1V (with the exception of Echo that will have side slopes of 2.4H;1V), but angle of repose interim slopes with suitable setbacks are acceptable.
- PAG waste rock will be capped with, and surrounded by, a final lift of 5 m of NPAG waste rock.
- Overburden stockpiles will be co-disposed with PAG waste rock, with ultimate placement at least 20 m from the other edge of the WRSAs.
- Some overburden that has been deemed geotechnically suitable will be used at closure as part of the 5 m cover on some WRSAs.

Design for climate change is an important consideration for all sites, although it may be considered particularly important for this Project as prevention of acid generation relies on continuing cold climatic conditions. Long term predictions of climate change scenarios have been completed and 5 m cover of NPAG waste rock is predicted to be sufficient to contain active layer fluctuations associated with climate change.

7.2.7.3 Waste Rock Storage Locations

The Llama WRSA is planned to be southeast of the Llama open pit, and the Umwelt WRSA will be east of the Umwelt open pit. The TSF WRSA will be constructed on top of the TSF, which is located south-southeast of the Goose Main open pit. In addition, a small Echo WRSA northeast of Echo open pit will hold the waste rock from that mine (Figure 1.6-2).

7.2.7.4 Physical and Chemical Properties of the Waste Rock

A brief overview of the physical, chemical properties, ML/ARD characteristics of the waste rock is presented in Section 7.2.6 and the detailed ML/ARD characterization of the ore is presented in Appendix V2-7D: Geochemical Characterization Report.

7.2.8 Ore Crushing and Ore Stockpiles

A fleet of 64-tonne trucks will move ore from the open pits and underground mines to the ore stockpiles located at the Goose Plant Site. Ore will be sorted based on ore grade into one of three stockpiles: low grade (LG), mid-grade (MG), or high grade (HG). The three stockpiles will be located on the same pad northwest of the process plant. The process plant mill feed will be made up of ore from stockpiles and ore fed directly from the open pit and underground mines.

The ore stockpiles will be built in a series of lifts in a “bottom-up” approach similar to WRSAs. Foundation design will follow the site-wide infrastructure foundation design criteria described in Volume 2 Appendix V2-7C. Thermal modelling was conducted to support the WRSA design which shows short- and long-term thermal stability of underlying permafrost will be achieved. Because of the similar design, these principles have been applied to the stockpile foundation design. See the Volume 2 Appendix V2-7E: WRSA Design Report for more details.

7.2.8.1 Ore Grade and Quantities

An estimated mill feed and stockpile balance schedule is shown in Table 7.2-8. Refer to Table 7.2-1 for the mining production schedule.

Table 7.2-8. LOM Mill Feed and Stockpile Schedule

Description		Total	Y-2	Y-1	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Mill Feed Blender														
Total Mill feed from mine	kt	15,924		183	1,284	1,441	2,190	2,190	1,960	1,765	1,804	1,746	1,149	212
	g/t	6.23		9.60	8.64	6.89	6.54	5.69	5.31	5.67	5.70	6.54	5.54	5.39
	koz	3,190		56	357	320	461	401	335	322	331	367	205	37
	%	93.4%		92.0%	91.8%	91.6%	93.0%	94.0%	94.1%	94.0%	94.0%	94.0%	94.0%	93.7%
Total Mill feed from stockpile	kt	3,868		36	633	749			230	425	386	444	494	473
	g/t	3.52		9.29	7.39	4.03			1.97	1.97	1.97	1.97	1.97	3.58
	koz	438		11	150	97			15	27	24	28	31	54
	%	92.7%		92.0%	92.0%	92.0%			93.1%	93.1%	93.1%	93.1%	93.1%	93.3%
Total Mill Feed														
Process ore	kt	19,793		219	1,916	2,190	2,190	2,190	2,190	2,190	2,190	2,190	1,643	685
Process grade	g/t	5.70		9.55	8.23	5.92	6.54	5.69	4.96	4.96	5.05	5.62	4.47	4.14
Process Au	koz	3,628		67	507	417	461	401	349	349	355	395	236	91
Process Recovery	%	93.3		92.0	91.8	91.7	93.0	94.0	94.0	93.8	93.9	93.8	93.7	93.4
Stockpile														
BALANCE														
HG ore stockpile	kt		93	404									18	
MG ore stockpile	kt		123	700	749								219	
LG ore stockpile	kt		124	620	1,012	1,255	1,541	1,995	1,984	1,559	1,173	730	236	0
Stockpile	kt		340	1,724	1,761	1,255	1,541	1,995	1,984	1,559	1,173	730	473	0

7.2.8.2 Ore Handling and Stockpiling

Ore will be fed to the primary crusher, a vibrating grizzly - primary jaw crusher system, by front end loader from the stockpiles. The size of the ore will be further reduced in secondary crushing circuit by a cone crusher. The resulting fine ore will be transported in a covered conveyor to the enclosed Fine Ore Stockpile. Reclaim belt feeders located underneath the fine ore stockpile will draw material from the stockpile to onto a covered conveyor which feeds the process plant.

Dust associated with the stockpiles is not expected to be significant. Crushing and screening operations will be conducted in fully enclosed units to prevent dust dispersion. Details of planned dust monitoring and mitigation can be found in Section 7.2.9 and in the Air Quality Management Plan (Volume 10).

7.2.8.3 Physical and Chemical Stability of the Ore

A brief overview of the physical, chemical properties, ML/ARD characteristics of the ore is presented in Section 7.2.6 and the detailed ML/ARD characterization of the ore is presented in Appendix V2-7D: Geochemical Characterization Report.

7.2.8.4 Runoff and Seepage Management

Runoff and seepage from the ore handling facilities will be collected in the Ore Stockpile Pond. The collected water will be managed with other mine contact water. Refer to site water management section in Section 7.10 for more details.

7.2.9 Dust Mitigation and Dust Suppression Methods

Detailed discussion of dust monitoring and a Dust Reduction Plan is presented in the Air Quality Monitoring and Management Plan (V10 Ch17). A selection of dust mitigation and suppression methods are presented below.

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 Dust Reduction Plan will include the following:

- Adherence to all permits, authorizations and approvals.
- Ensuring all-weather roads (local site roads) are regularly compacted and kept in good repair.
- Use of water sprays or dust suppression fluids compatible with the ambient air temperatures to suppress dust generation from equipment in the crushing facility, underground mines or open air. 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.
- Implementation of a dust suppression programs for the haul roads, undergrounds, and air strip.
- Application of water, calcium chloride, and/or approved chemical dust suppressants along the highest-use segment of roads.
- Minimize the discharge heights from the crushers onto conveyers, and conveyors onto stockpiles and enclose conveyors and transfer points where possible.
- Erection of windbreaks or fences around known problem areas to limit the dispersion of dust emissions.

7.3 MINING EQUIPMENT

7.3.1 Open Pit Equipment

To determine the number of equipment units required for each major fleet, productivities were calculated based on estimated annual operating hours and mechanical availability. Annual operating hours varied by fleet due to associated use of availabilities and operating inefficiencies. An annual summary of the fleet requirement for open pit mining is shown in Table 7.3-1.

7.3.2 Underground Equipment

The selection of underground mining equipment is based on the mining methods, drift and stope dimensions, production rate, and operating and capital costs. Since the overall life of mine is nearly ten years, it was assumed that only new equipment would be purchased. Over time, the equipment is planned to be rebuilt or replaced, as recommended by the manufacturers.

A summary of selected mobile equipment for the underground operations at Back River is shown in Table 7.3-2.

Table 7.3-1. Fleet Sizes for Open Pit Mining

Type	Size	Year											
		-2	-1	1	2	3	4	5	6	7	8	9	10
Production Drill-MD 6240	152 mm to 27 0mm	2	2	2	2	2	2	2	2	1	1	1	-
Small Drill-MD 5125	115 mm	1	1	1	1	1	1	1	1	1	1	1	-
Haul Truck-Cat 775G	65 t	11	10	10	13	14	14	11	12	6	6	5	3
Shovel-Cat 6015	7 m^3	2	2	2	2	2	2	2	2	1	1	1	1
Excavators-Cat 390	4 m^3	1	1	1	2	2	2	2	2	1	1	2	1
Loader-Cat 988	7 m^3	1	1	1	1	1	1	2	2	1	1	1	1
Track Dozers -D9	5 m	0	1	1	1	1	1	1	1	0	0	0	0
Track Dozers-D8	4 m	3	2	2	3	3	3	3	2	2	2	2	1
Wheel Dozer -Cat 824	4.2 m	1	-	1	1	1	1	1	1	1	1	1	1
Grader-Cat 14m	4.2 m	3	2	2	3	3	3	3	3	2	2	1	1
Water truck - Cat 775	65 t	1	1	1	1	1	1	1	1	1	1	1	1

Table 7.3-2. Underground Production and Development Equipment List

Item	Description	Year											
		-2	-1	1	2	3	4	5	6	7	8	9	10
Haulage Truck (30 t)	Sandvik TH430	2	5	9	9	8	10	14	17	16	14	5	2
LHD 6.0 yd^3 (10 t)	Sandvik LH410	1	3	4	4	4	5	8	8	8	8	3	1
LHD 3.7 m^3 (6.7 t)	Sandvik LH307	0	1	3	3	3	3	3	3	3	3	1	0
Jumbo (2 boom)	Sandvik DD421-60	1	3	4	4	4	5	7	8	8	6	2	1
Diamond Drill	Boart Longyear LM55	0	1	1	1	0	1	1	1	1	1	0	0
Production Drill Large	Sandvik Solo 311-7	0	0	0	0	0	1	4	4	4	4	2	0
Production Drill Small	Boart Longyear Stopemaster	1	0	1	1	1	1	0	0	1	0	1	1
Rockbolter	Maclean 928 Scissor	1	3	6	6	6	7	10	11	10	8	4	1
Shotcreting Machine	Maclean SS3	1	1	1	1	1	1	2	2	2	2	2	1
ANFO Loader	Maclean AC2 ANFO	1	2	3	3	3	3	6	6	6	6	3	1
Boom Truck	Maclean BT3	1	2	2	2	2	2	4	4	4	4	2	1
Mechanics Truck	Toyota Landcruiser	1	2	2	2	2	2	4	4	4	4	2	1
Fuel-Lube Truck	Maclean FL3	0	1	1	1	1	1	2	2	2	2	2	0
Supervisor/Service Vehicle	Toyota Landcruiser	0	1	1	1	1	1	2	2	2	2	2	0
Electrician Vehicle	Toyota Landcruiser	0	1	1	1	1	1	2	2	2	2	2	0
Scissor Truck	Maclean SL3	1	2	2	2	2	3	6	6	6	5	2	1
Forklift/Telehandler	Cat TH407C	1	1	1	1	1	1	2	2	2	2	2	1
Utility Vehicle / Nipper	Toyota Landcruiser	1	2	2	2	2	2	3	3	3	3	2	1
Portable Welder	Lincoln Electric Classic 300 HE EPA	0	1	1	1	1	1	2	2	2	2	2	0
Personnel Carrier	Toyota Landcruiser	1	2	2	2	2	3	6	6	6	6	2	1
Grader	Cat 12M	1	1	1	1	1	1	2	2	2	2	2	1
Front End Loader (Surface)	Cat 966K	1	1	1	1	2	2	4	4	4	4	3	1

7.3.3 Surface Support Equipment

A fleet of mobile site support equipment is utilized to provide support to operations at each of the three sites. A list of site support equipment for each site is provided in Table 7.3-3.

Table 7.3-3. Surface Equipment List

	Equipment Quantity (Peak LOM)	
Equipment Description	**Goose**	**MLA**
3/4 T Ambulance / Rescue - Ford F450	2	1
1 T Diesel Crew Cab Pick-up - Ford F350	13	1
2 T Diesel Pick-up (Blaster's Box) - Ford F550	2	0
2 T Diesel Pick-up c/w Heated Van - Ford F550	1	0
5 T Flat Deck Truck	2	1
10 T Fuel Truck - Western Star 4900 SA (Custom)	2	0
20T Picker Truck - Western Star 4900 XD	2	0
Fuel / Lube Truck - Western Star 6900 (Custom)	2	0
Welding / Service Truck - Ford F550 (Custom)	4	1
5 T Pumper - Fire Truck	2	0
100T Lowboy Trailer	2	0
Roll Off Truck c/w deck, water tank, vacuum tank, garbage bins	2	0
Dump Truck 10m^3 capacity- Western Star 4900	1	1
Winch Tractor with 60T Winch	2	1
Tri-Axle Single Drop, Scissor Neck Trailer	2	1
44 Passenger Bus - Freightliner	3	0
Excavator (~1.0 m^3) CAT 320DL	1	0
Vibrating Packer - Cat CS56	1	0
Tool Carrier - Cat 930H (Old IT28)	3	0
Tool Carrier - Cat 966K (c/w Attachments)	2	1
Skid Steer Loader (1 m^3)	3	1
5 T Fork Lift Zoom-Boom - Terex GTH-5519	2	1
Tire Manipulator Attachment for 966k	2	1
Container Handler - Taylor TXLC975	2	2
Track Dozer - CAT D6T	1	4
30 tonne Articulated Trucks CAT 730	2	0
Mobile Crushing/Screening Plant	1	0
165T Crawler Crane	1	0
Mobile Crane - RT90 - Grove RT890E	2	0
Pipe Fusing Machine (Able to Fuse 28" DR17)	1	0
Pipe Fusing Machine (Able to Fuse 12" DR11)	1	0
Diesel Lake Dewatering Pumps	7	0

Modified from JDS (2015)

7.4 POWER SUPPLY AND FUEL SUPPLY/STORAGE

The power supply for the camps and mine infrastructure and the Marine Laydown Area is discussed in Section 6. The locations of the main tank farms at each site are also described in Section 6.

For the underground mines, the major electrical power consumption will be attributed to:

- main and auxiliary ventilation fans;
- drilling equipment; and
- air compressors.

High voltage cable will enter the mine via the main declines and be distributed to electrical sub-stations located on sub-levels. All equipment and cables will be fully protected to prevent electrical hazards to personnel.

High voltage power will be delivered at 4.16 kV and reduced to 600 V at electrical sub-stations. All power will be three-phase. Lighting and convenience receptacles will be single phase 120 V power.

The mine power requirement was calculated by estimating the expected demand from the various major pieces of electric equipment used for the underground mine. Power usage takes into account the expected kW draw as well as the utilization of each piece of electric equipment.

7.5 COMMUNICATIONS SYSTEMS

Site-wide communications design will incorporate proven, reliable, and state-of-the-art systems to ensure that personnel at the mine site have adequate voice, data, and other communication channels available. A number of integrated systems will be provided for on- and off-site communication at the plant. A site LAN will be provided to consolidate services into a single network infrastructure. Computers, cameras, telephones, and any Internet Protocol (IP) devices requiring connection to the corporate network will utilize the LAN. Further to the hardwired portion of the LAN, wireless access points will be placed in common areas such as the recreation hall, administration area, dining area, and construction office.

External communications with the Back River property will be via satellite data links to each of the sites. The satellite links will support corporate network and voice telephony traffic between sites and off site. They will provide connections to the public telephone network and secure connections to the internet for camp and office use.

Local communications around each of the Back River sites will be a combination of optic fibre and microwave connections between key facilities. Site communications will support mine and process plant production, security, monitoring and corporate traffic across the site, including radio and telephony.

Each Back River site will have local computer server, storage and data backup capability in environmentally appropriate HVAC and UPS supported facilities. An information systems emergency response and business continuity plan will be developed to address information systems preparedness for Back River operations in a subsequent phase of the project.

The corporate network on each site will provide wired and Wi-Fi connectivity between computing devices and servers to support corporate applications. The corporate network will support secure firewall connection for local production process plant and pit communications systems. Quality of

Service connections will be implemented for off-site voice and data traffic via satellite communications. Each Back River site will have a limited video conference capability to better support communications between sites and reduce travel requirements.

Each Project site will have a dedicated VHF radio system for surface communications. At the mines VHF radio coverage will extend underground via a leaky feeder radio antenna system. Underground operations will make use of dedicated emergency phones in refuges. Each Back River site will have air band radio to communicate with air traffic for operation of local runways. The Marine Laydown Area will also make use of Marine band radio to communicate with sealift operations.

Seasonal communications along the ice road will be supported via operating procedures on a truck-to-truck simplex radio system. Ice road transport, emergency response, and supervisory vehicles will be equipped with emergency backup satellite phones.

7.6 EXPLOSIVES AND AMMONIUM NITRATE STORAGE DURING OPERATIONS

ANFO will be used as the explosive for mine development. Explosive products will be stored on site in accordance with territorial and federal regulations. Ammonium nitrate will be shipped and stored on site in tote bags within sea containers. Ammonium nitrate will be mixed with diesel oil on site to make ANFO explosive as needed.

More detail on explosives management can be found in Volume 10, Chapter 13: Explosives Management Plan.

7.6.1 Explosives Storage

The main storage of ammonium nitrate will be located at the Goose Property at the AN Facility laydown pad. A temporary storage area (for transit) will also be developed at the Marine Laydown Area. Ammonium nitrate will be delivered by sealift and stored at the Marine Laydown Area until it can be transported to the Goose Property via the winter ice road. The quantities of ammonium nitrate stored are as follows:

- Marine Laydown Area: up to 3,900 tonnes from mid-August to mid-March. Transportation to Goose Property will take place during the winter months, once the winter ice road is ready for use.
- Goose Property – up to 3,900 tonnes.

Packaged explosives and explosive detonators will be stored in approved explosive magazines located on separate pads at the Goose site. No packaged explosives will be storage at the MLA during operations.

Bulk AN will be stored in one tote bags within sea containers. Prior to use AN will be augured from the tote bags into a 30 tonne silo at the AN Facility. ANFO required for underground mining will be manufactured and bagged in one tonne totes utilizing bagging equipment located in the AN Facility. Fuel oil will stored in a 20,000 litre double-wall fuel tank also located on the AN Facility pad.

The underground mines will store quantities of packaged explosives to meet the mine’s needs for up to seven days. Day boxes would be used as temporary storage for daily consumption. Two underground magazines are planned at each operation to separately store 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 floor.

7.6.2 AN Facility and Transportation to Work Sites

The handling and manufacture of explosives will be contracted out to a licenced operator. This operator will be responsible for obtaining licences and permits associated with the use, manufacture and storage of explosives.

ANFO required for underground mining will be manufactured and bagged in one tonne totes utilizing bagging equipment located in the AN shop. The bagged ANFO will then be transported to the various underground mines for use in blasting operations. 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 from the AN silo and fuel oil from the fuel tank at the Goose AN Facility. A truck wash facility will be located within the AN Facility.

7.7 CHEMICAL AND HAZARDOUS MATERIALS OTHER THAN FUEL AND EXPLOSIVES

A variety of supplies and materials classified as potentially hazardous will be required at the Project. The hazardous materials to be handled may include:

- petroleum products (fuel/lubricants/oils/greases);
- contaminated snow/water/soil (oil/fuel);
- oil and fuel filters;
- used sorbents and rags;
- hydraulic fluid;
- glycol;
- empty petroleum hydrocarbon containers and drums;
- process reagents;
- laboratory reagents;
- solvents;
- paints;
- fluorescent light tubes;
- waste equipment batteries;
- electronics and electrical materials; and
- hazardous medical waste/biomedical waste.

As discussed in Sections 6.6 and 6.7, designated areas for storage and handling of these materials will be included in the infrastructure developed at each site. Further information can be found in the Hazardous Materials Management Plan (Volume 10, Chapter 12).

7.8 MILLING PROCESS DESCRIPTION

7.8.1 General

Test work completed to date indicates that the Back River deposits are similar in their metallurgical characteristics. The gold occurrence suggests a reasonable gravity recovery with a fine-grained nature and association with arsenopyrite and pyrite minerals. The simplified flowsheet of the milling process is presented in Figure 7.8-1 and more detailed descriptions of the unit processes are provided in Appendix V2-7F.

Metallurgical test work to date suggests grinding to 50 μm followed by whole ore leaching will provide good recoveries.

7.8.2 Crushing and Grinding

The ore will be crushed in two stages then ground in a ball mill and a fine ore mill. Gravity concentration will recover coarse gold as a unit operation after ball milling. The gravity product will be intensive leached.

7.8.3 Leaching and Gold Recovery

After crushing and grinding, gold will be recovered by leaching followed by a carbon-in-pulp (CIP) circuit. The leach circuit will continue with carbon elution, electrowinning and smelting to produce gold bullion.

7.8.4 Treatment of Leach Residue

Leaching the milled material as part of gold recovery will use cyanide solution. The process facilities will include a cyanide detoxification plant that will reduce the cyanide concentration prior to release to the tailings facilities. Residue from the CIP circuit will be pumped to a 27 m diameter high-rate thickener to recover residual cyanide and water. The thickener overflow will flow by gravity to the process water tank for reuse as dilution water in the process. The underflow of the thickener will be sent to the cyanide detoxification circuit prior to being pumped to the TSF or Tailings Facilities (TF – mined out open pits) where suspended solids will consolidate. The tailings from the leaching circuit is anticipated to have elevated ammonia content. The supernatant water will be pumped back to the process plant for reuse in the process.

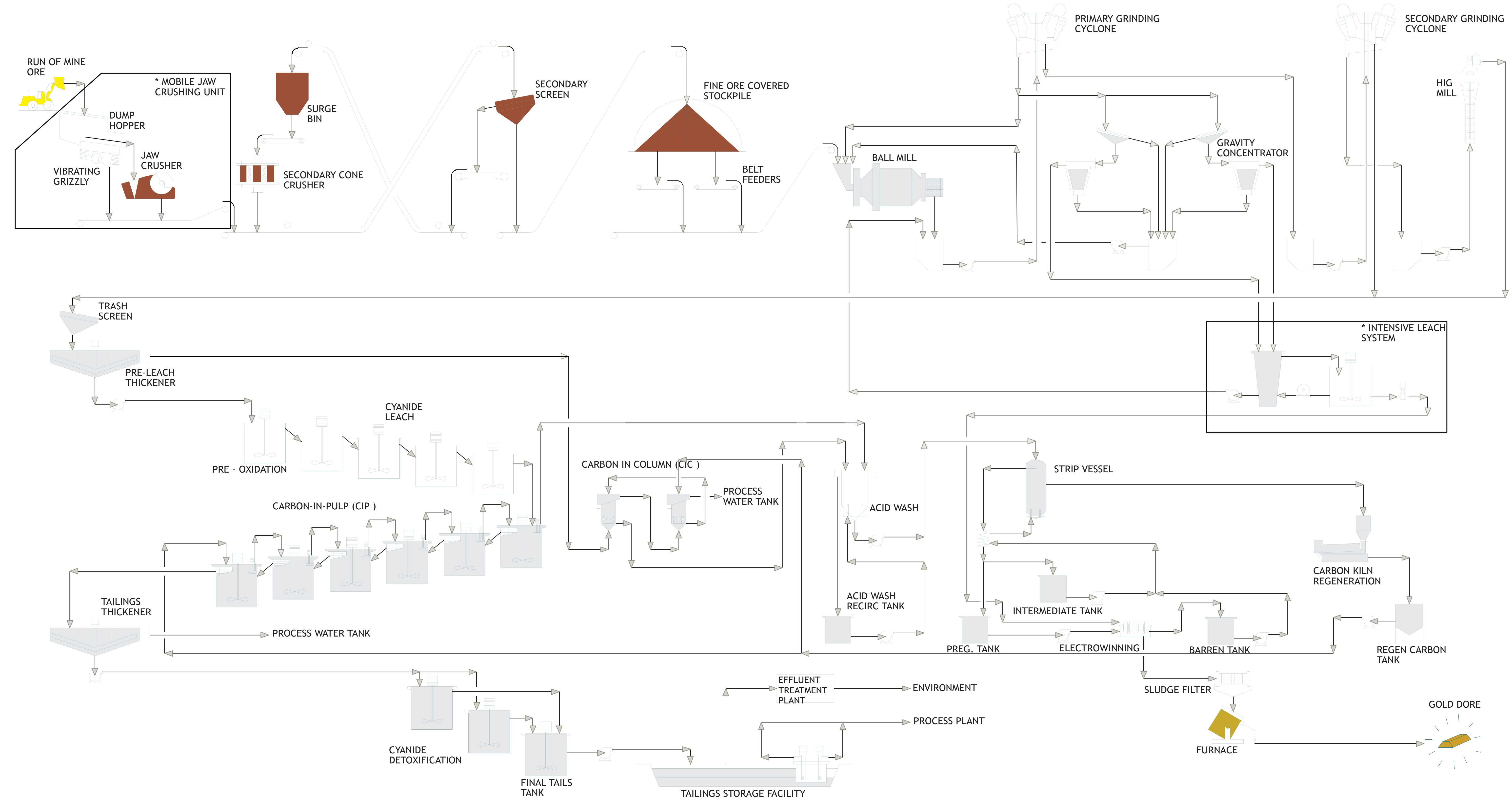
7.8.5 Cyanide Detoxification

The underflow from the tailings thickener will be pumped to a cyanide detoxification circuit. The residual cyanide in the underflow of the thickener will be decomposed by a sulphur dioxide (SO_2)/air oxidation process. Sodium metabisulphite (SMBS) will be fed into two agitated tanks to produce SO_2 and process air will be sparged into the bottom of the tanks before the slurry reports to the final tailings tank. The cyanide detoxification tanks will be located outdoors. SO_2 gas alarms/monitors will be provided to monitor SO_2 concentration in the areas.

7.8.6 Reagents

The reagents used in the process will include:

- CIP and Gold Recovery:
  - slaked or hydrated lime ($Ca(OH)_2$);
  - sodium cyanide (NaCN);
  - activated carbon;
  - sodium hydroxide (NaOH);
  - lead nitrate ($PbNO_3$);
  - hydrochloric acid (HCl);



Sabina GOLD & SILVER CORP.

HATCH

Source: Hatch (2015).

					DRAFTSPERSON	A. MCLEAN	2014-08-11
					DESIGNER	K. LEE	2014-08-11
					CHECKER	G. RITSON	2015-03-11
					DESIGN COORD.	L. ROLANDI	2015-03-11
					RESP. ENG.	K. LEE	2015-03-11
					LEAD DISC. ENG.	K. LEE	2015-03-11
2	GENERAL REVISION	AM	GR	2015-03-11	ENG. MANAGER	G. SCHWAB	2015-03-11
1	GENERAL REVISION	AM	GR	2014-10-09	PROJ. MANAGER	G. SCHWAB	2015-03-11
0	ISSUED FOR USE	AM	GR	2014-09-05	CLIENT	W. CARSON	2015-03-11

Approved for Use

Figure 7.8-1

BACK RIVER FEASIBILITY STUDY

BACK RIVER GENERAL
OVERALL
PROCESS FLOW DIAGRAM

NTS	DWG. No. H347084-0000-05-030-0100	3

- Cyanide Destruction:
  - sodium metabisulphite (SMBS);
  - copper sulphate ($CuSO_4$);
  - slaked lime ($Ca(OH)_2$);
- Others:
  - flocculant; and
  - antiscalant.

All the reagents will be prepared in contained areas in proximity to the points of application but also close to available storage for the feed stock. The reagent storage tanks will be equipped with level indicators and instrumentation to ensure that spills do not occur during operation. Appropriate ventilation and fire and safety protection will be provided at the facility.

The liquid reagents (including HCl and antiscalant) will be added in the undiluted form to the required process circuits via individual metering pumps.

All the solid type reagents (CaO, NaOH, $PbNO_3$, NaCN, $CuSO_4$, and SMBS) will be mixed with fresh water to a solution strength of 10 to 25% in the respective mixing tanks, and stored in separate holding tanks before being added to various addition points by metering pumps. The lime slurry will be distributed to various addition points through a closed pressure loop.

Flocculant will also be delivered to the site in solid form. The flocculant will be prepared in a packaged preparation system, including a screw feeder, a flocculant eductor, and mixing devices. The flocculant mixing system will run automatically based on the solution level in the holding tank. The mixed solution will be transferred and stored in an agitated flocculant holding tank. Flocculant will be made up to a 0.2% solution strength and added via metering pumps to the leach feed thickener and the tailings thickener. Cyanide monitoring/alarm systems will be installed at the cyanide preparation and leaching areas. Emergency medical stations and emergency cyanide detoxification chemicals will be provided at the areas as well. Further details on cyanide management can be found in the Cyanide Management Plan (Volume 10, Chapter 12).

7.8.7 Process Plant Water Consumption

The circulation water load between the TSF and the process plant will be in the range of 4,800 m^3/day. Tailings will be pumped to the TSF or TFs as a slurry containing 49% solids. The tailings will settle and consolidate in these catchments. The water content of the consolidated tailings will be in the range of 36 to 40% water and the ponded supernatant will be returned to the process plant for use as process water. Expected water losses and the water balance for the Goose Property are discussed in Section 7.10.

7.8.8 Process Plant Power Consumption

The process plant peak power consumption is expected to be in the order of 25 MW which accounts for the ore process from grinding through utilities.

7.8.9 Storage and Transportation of Final Product

Refined gold doré bars will be the final product. The gold bars will be stored in a secure section of the process plant and transported off site via air on a semi-weekly basis.

7.9 TAILINGS MANAGEMENT SYSTEM

The FS mine plan entails a ten-year mine life with about 19.8 million tonnes (Mt) of ore processed at a rate of 6,000 tpd. Based on an assumed density of 1.2 tonnes per cubic metre (t/m^3), the required tailings storage capacity is in the order of 16.5 million cubic metres (Mm^3).

The tailings management system at the Goose Property will entail deposition of 19.8 million tonnes (Mt) of tailings at three separate locations. The initial 2 years of production will be deposited in a purpose-built Tailings Storage Facility (TSF) located about 2 km south of the Goose Main open pit. Tailings deposition will then transition to in-pit deposition into the mined-out Umwelt open pit (referred to as Umwelt Tailings Facility [Umwelt TF]) for a period of about four years. Finally, tailings deposition moves to the mined-out Goose Main open pit (referred to as Goose Main TF), for deposition during the remaining four years of the mine life. This is summarized in Table 7.9-1 below.

Table 7.9-1. Tailings Deposition Location Summary

	Period (Year and Quarter)	Tailings (Mt)	Tailings (Mm^3)
TSF	Y-1 Q4 to Y2 Q3	3.8	3.1
Umwelt TF	Y2 Q4 to Y6 Q3	8.6	7.2
Goose Main TF	Y6 Q3 to Y10 Q2	7.4	6.2
Total Project	Y-1 Q4 to Y10 Q2	19.8	16.5

Geotechnical instrumentation in the tailings embankment and foundation during construction and over the life of the Project. The instrumentation will be monitored during the construction and operation of the TSF to assess 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.

With Llama already considered for use as a temporary saline water holding pond, and Llama connected to the already effected Umwelt pit, Sabina may opt to also use Llama as a contingency for tailings or waste rock management in the future. If this was the case the MMA and the mitigation and management plans presented in the FEIS (including water discharge criteria) remain appropriate.

7.9.1 TSF Operations – Tailings Deposition Strategy

Numerous mines have operated, or currently operate, tailings facilities in cold regions under severe winter (freezing) conditions. From these operational mine experiences, design and operating considerations have been developed for Back River Property, which include:

- Shape the tailings storage surface (during summer tailings deposition) to provide a winter pond that can be maintained "localized" in one, or specific, areas of the facility.
- Concentrate winter tailings discharge from a single, relocate-able, point. This will tend to channelize the flow and move it through and under the ice cover, where the solid/liquid separation occurs. This prevents sheet tailings flow over the ice (a freezing of water and subsequent ice entrainment in the tailings).
- Store sufficient water in the tailings facility prior to freezing, to provide for all anticipated ice and pore water losses during winter (i.e. develop and maintain a good water/ice balance).
- The potential for dusting can be exacerbated during cold winter conditions as a “freeze drying” process tends to destroy capillary tensions in partially saturated sand materials, making it more

susceptible to dusting. Appropriate provisions will be required to prevent dusting such as increasing the freeboard height and installing sediment control fencing along the embankment crests downwind of the prevailing wind.

7.9.2 Seepage Control

7.9.2.1 Containment Dam Concept

A frozen foundation dam would allow for construction of a conventional dam on the deep permafrost foundation, while making use of the permafrost conditions to seal the water retaining feature of the dam with the foundation. There are no known deposits of low permeability soils on the Property, and Arctic conditions pose great challenges for the construction of low permeability cores. The decision was therefore made to construct the TSF containment dam as a frozen foundation rockfill dam (built from run-of-mine (ROM) waste rock) with a geosynthetic liner. For this concept to function, the liner will be frozen into the key trench permafrost, and over the life of the structure, the foundation will not thaw deep enough to compromise this seal.

7.9.2.2 Seepage and Runoff Collection

The inferred foundation conditions at the TSF containment dam are not conducive to constructing seepage collection ditches or drains. Seepage collection will therefore be done by constructing a berm downstream of the dam. The berm will incorporate an impermeable liner keyed into permafrost. Depending on the quality of the water, seepage may be directed to sumps from where it will be pumped back into the TSF supernatant pond or discharged to the environment, as appropriate.

7.9.3 Tailings Water Recycle Circuit – Ice Formation

The active tailings facility (being the TSF or one of the TFs) will also serve as the main source of reclaim water for the process plant. Supernatant liquid from the settled tailings, runoff from precipitation, and snowmelt collected in the TSF or TFs will be managed and pumped back to the Goose Process Plant. The free water will be drawn from beneath the ice.

7.9.4 Consolidated Tailings Chemistry

Tailings geochemical characterization (Appendix V2-7D) confirms that the tailings are potentially acid generating (PAG), albeit with very slow reaction rates, with a potential for metal leaching, with the exception of some samples from the Goose Main deposit. 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 remove ammonia, arsenic, and copper.

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 (estimated to be decades) of time, 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.

Detailed ML/ARD characteristics of the tailings, waste rock, and ore are presented in Appendix V2-7D: Geochemical Characterization Report. Predictions of tailings pore water chemistry are presented in Appendix V2-7H: Water and Load Balance Report.

7.9.5 Monitoring of the Tailings Storage Facility

The TSF will be controlled and monitored using a formalized procedure that is incorporated into the mine's Environmental Management System (EMS). Geotechnical instrumentation will be installed in the tailings embankment and foundation during construction, and utilized over the life of the Project. The instrumentation will be used to monitor and 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. Key control and monitoring subject areas will include:

- inspections of the TSF with regard to performance monitoring, instability indicators, stability monitoring, tailings deposition, water management and control, and quality of effluent;
- construction controls, including the use of a construction management program;
- procedures for dust control; and
- quality assurance and quality control measures for operations, monitoring, and inspections.

Procedures related to the environmental management of the TSF will be clearly documented, together with the roles and responsibilities of relevant staff. This documentation will be revised as needed to ensure that it is up to date and accurate, and it will be maintained throughout the mine operations and mine closure phases.

Sabina will adopt the guidelines developed by the Mining Association of Canada, entitled *Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities* (2005), which provides useful guidance in documenting staff roles and management procedures, including:

- roles and responsibilities of personnel assigned to the tailings storage facility;
- procedures and processes for managing change;
- the key components of the tailings storage facility;
- procedures required to operate, monitor the performance of, and maintain the facility to ensure that it functions in accordance with its design, meets regulatory and corporate policy obligations, and links to emergency planning and response; and
- requirements for analysis and documentation of the performance of the facility.

7.10 WATER MANAGEMENT DURING OPERATIONS

7.10.1 Water Use During Operations

Water on the Project will be 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 inflow to mining areas. Each type of water is managed separately throughout each Project phase using water management infrastructure including diversions, event ponds, pipelines, and culverts.

Freshwater will be required to support the domestic and industrial water requirements at the Goose Property and the Marine Laydown Area. Freshwater will also be required to support the Goose Process Plant, ongoing exploration activities, winter ice road building, and other activities.The freshwater will be sourced for Goose Property and saltwater for MLA from the locations shown in Table 7.10-1. Any water intakes and discharge pipes will be designed in accordance with DFO guidelines for water intakes.

These pumping station and water intakes will be established during the Construction phase (refer to Section 6 for details).

Table 7.10-1. Water Supply during Operation

Site	Volume	Source
Goose Property	Domestic: up to 148 m^3/day Industrial: up to 900 m^3/day Dust suppression: up to 400 m^3/day Total water demand: 1,448 m^3/day	Goose Lake and Big Lake. Recycle additional water from TSF and TFs.
Marine Laydown Area	Domestic: 48 m^3/day Miscellaneous Industrial: 24 m^3/day Total water demand: 72 m^3/day	Bathurst Inlet desalination or local freshwater source.
Winter Ice Road	675 m^3/km/season	Multiple sources

7.10.2 Water Management at the Goose Property

During Operations, the majority of water movement will be from the Process Plant to the tailings facilities (in the form of tailings slurry) and from the tailings facilities to the Process Plant (as reclaim water). There will be no discharge of waste water at the Goose Property during Operations. All waste water generated from the camp sewage treatment plant, the maintenance facilities, and pit inflow water will be pumped to the active tailings facility.

While most of the site water will be recycled water from the active TSF or TF, a net water make-up will be required due to the losses of water in the consolidated tailings, evaporation losses, and, ice formation within the tailings facilities during the winter months. In addition to reclaim water, the Process Plant and camp facilities will required a daily freshwater volume of approximately 900 m^3/day, divided as follows:

- average required for gland seals 398 m^3/day;
- average required for reagents 132 m^3/day;
- potable water during operations 148 m^3/day; and
- Additional fresh water allowance 200 m^3/day.

The additional freshwater allowance accounts for miscellaneous needs including process plant cooling water, lime scrubber water, and truck wash water. The above values are required from a fresh water source year round, regardless of how much recycled water (runoff from catchments or mine process water) is available. An additional 400m^3/day will be required during the open water season for dust suppression purposes.

Freshwater to support domestic and industrial uses will be sourced from Goose Lake and Big Lake. Water intake will be designed in accordance with DFO guidelines. These pumping stations and water intakes will be established during the Construction phase (refer to Section 6 for details).

Freshwater and make-up water will be pumped from an intake from Goose Lake (Appendix V2-7J) and reclaim water will be drawn from the active tailings management facility (Appendix V2-7G). These two dedicated HDPE pipelines, located along the pipeline access road, will convey the freshwater and the reclaim water to the storage tanks located at the Goose Process Plant. A separate storage tank will be needed for the freshwater, while the reclaim storage tank will also be used for the make-up water as necessary. A bypass HDPE line will be installed for the make-up water to enable circumventing the storage tank at the Process Plant and discharging directly into the active tailings facility.

7.10.2.1 Site Water Balance

During Operations, Goose Process Plant will reclaim an estimated average of 4,914 m^3/day from the active tailings facility. Tailings will be pumped to the TSF or TFs as a slurry containing 50% solids, and the tailings will settle and consolidate to a final density of 1.2 t/m^3. Based on the estimated process plant capacity of 6,000 tonnes per day and the tailings properties, the slurry will result in 6,000 m^3/d of water and 5,000 m^3/d of solids. The volume of water entrained in tailings voids is a function of the void ratio (3,000 m^3/day) and tailings density.

During Operations, water consumption requirements from Goose Lake include 900 m^3/day of freshwater make-up year round and 400 m^3/day for dust suppression during the open water season. Water requirements from Big Lake include up to 148 m^3/day for domestic use during Operations. Refer to Appendix V2-7H: Water and Load Balance Report for additional details on the water balance.

7.10.2.2 Availability of Water during Winter and Exceptionally Low Flow Years

Make-up water will be drawn from Goose Lake or Big Lake. The environmental assessment for freshwater (Volume 6) indicated that the maximum water that can be withdrawn from Goose Lake without incurring a significant effect is 900 m^3/d and 1,300 m^3/d during the winter and summer, respectively. The maximum water consumption from Big Lake is 411 m^3/d year round.

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.

The site-wide water balance (Appendix V2-7H) provides additional information on multiple scenarios for high to low flow years, as well as a sensitive analysis of the most influential factors.

7.10.2.3 Alterations to Drainage Patterns as a Result of Mining at the Goose Property

Sabina's water management approach is to collect and move all mine contact water (open pit runoff and seepage, waste rock stockpile runoff, stockpile runoff, and underground mine dewatering) to the active tailings management facility. These diversions will result in the diversion of a small percentage of natural drainage of the Goose watershed. Water collected within the tailings management facilities will be reused in the process plant for processing. Furthermore, during mine construction, diversion ditches (structures) will be constructed to divert non-contact runoff from mine workings. Therefore, drainage patterns within the Goose PDA will be altered either permanently or for the life of the mine workings in the areas shown in Table 7.10-2. Figure 7.10-1 shows the Goose Property conceptual water management strategy.

Table 7.10-2. Drainage Pattern Alterations at Goose Property

Permanent Drainage Pattern Alterations at the Goose Property	
Tailings Storage Facility	• Physical footprint of the facility causes permanent changes to drainage patterns. • Perimeter ditches/berms/structures to intercept and divert non-contact flows away from TSF. • All precipitation and inflows in TSF are contained and there are no releases to the receiving environment until the Post-Closure phase. • Seepage intercepted and pumped back to TSF. • Controlled release at Post-Closure; runoff directed to a single discharge location to facilitate monitoring and treatment if required.
Waste Rock Storage Areas and Landfill sites	• Physical footprint of the facility causes permanent changes to drainage patterns. • Perimeter ditches/berms/structures to intercept and divert non-contact flows away from waste rock areas or landfill. • All precipitation and runoff are contained, collected and pumped to the active tailings facility. There is no release of runoff to the receiving environment until the Closure phase. • Controlled release in Closure; runoff directed to a minimal number of discharge points to facilitate monitoring and treatment if required.
Site infrastructure (plant site, stockpiles, laydown, airstrip)	• Physical footprint of the facility causes permanent changes to drainage patterns. • Perimeter ditches/berms/structures to intercept and divert non-contact flows away from infrastructure areas. • To the extent possible (more infilling that cut), building pads are constructed on top of permafrost thus altering drainage patterns. • At closure, infrastructure is removed and surfaces are scarified to promote natural rehabilitation of disturbed areas.
Temporary Drainage Pattern Alterations at Goose Property	
Umwelt Pit	• Temporary diversion of streams flowing through the current footprint of the Umwelt Pit (Year -2 to Year 8).
Llama Pit	• Temporary diversion of streams flowing through the current footprint of Llama pit. • Dewatering of Llama Lake beginning in Year 1.
Goose Main Pit	• Temporary diversion of streams flowing through the current footprint of the Goose Main Pit (Year 2 to Year 6).
Echo Pit	• Temporary diversion of streams flowing through the current footprint of the Echo Pit (Year 4 to Year 5).

7.10.2.4 Diversion and Collection Systems

Diversion and collection systems will be a combination of event ponds, pumped pipelines, berms, and culverts. Non-contact water will be diverted off-site to limit the volume of contact water on site. Contact water will be collected and moved to the active tailings management facility. To preserve the permafrost, trenching or ditching will be limited wherever possible, and diversion structures will be built as above ground berms. Additional information on diversion berms, the timing of construction and decommissioning is provided in Appendix V2-7I: Site-Wide Water Management Report.

7.10.2.5 Llama Lake Dewatering

Beginning in Year -3, there will be a need to partially dewater Llama Lake to allow Umwelt Pit development start in Year -2. Early Construction contact water is pumped to, and stored in, the dewatered Llama Lake, which becomes Llama Reservoir. Contact water collected in the Llama Reservoir is treated at the water treatment plant during the open water season of Year -1; this water is then discharged into Goose Lake. It is assumed that 50% of the lake volume can be discharged directly to Goose Lake, while the remaining 50% will require treatment for total suspended solids (TSS), and potentially arsenic, prior to discharge. Llama Lake will be fully dewatered by the end of Year -1 in advance of Llama open pit mining in Year 1.

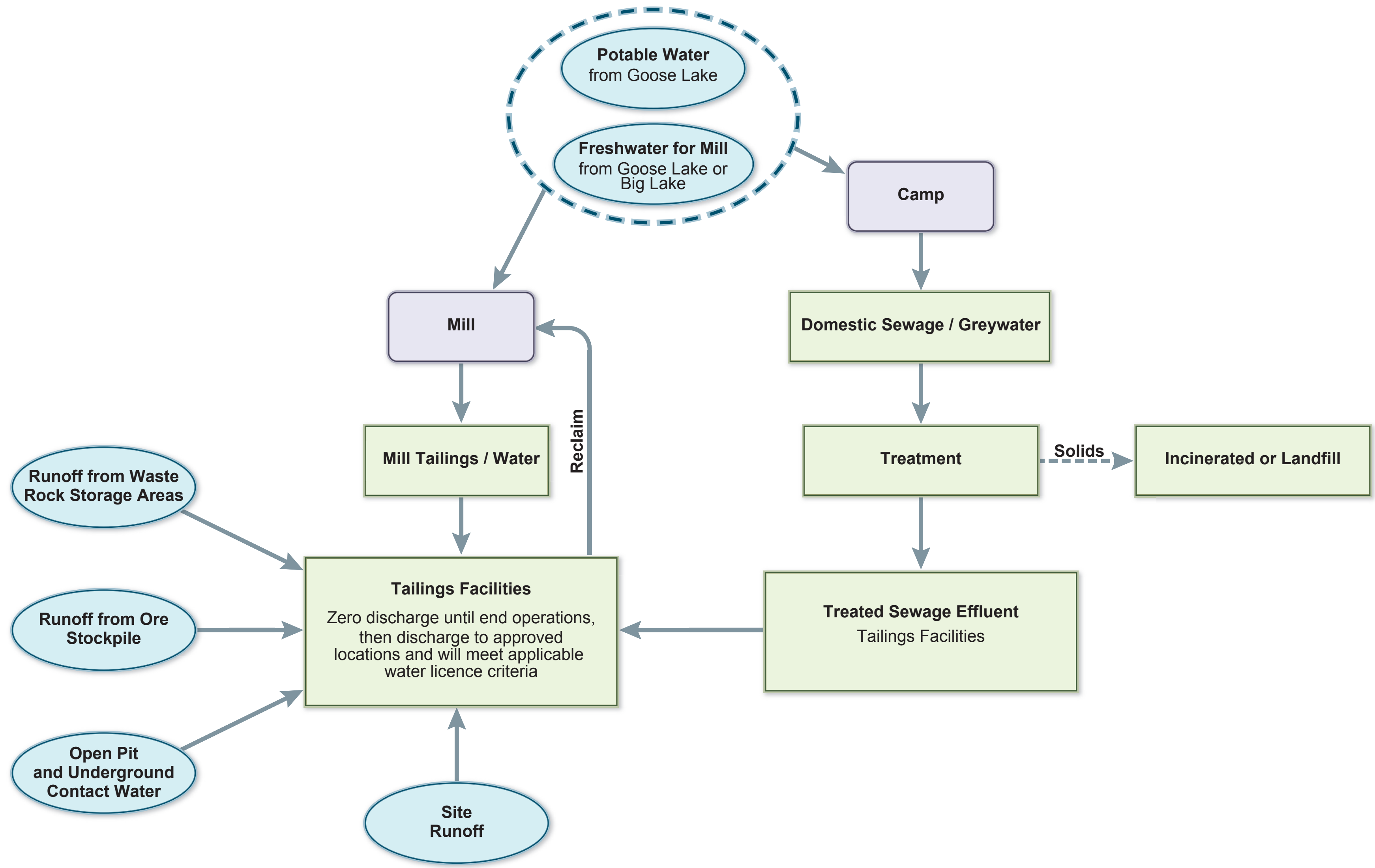


Figure 7.10-1

Conceptual Water Management - Goose Property

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During the dewatering process, sediment basins will be established as required. Once complete, bottom sediments within the pit boundaries will be disposed of in the TSF. Diversion ditches and berms will be established around the perimeter of the future open pit to divert water. A dewatering plan will be prepared and approved by regulators prior to dewatering activities. This plan will include provisions for diversion of incoming flows to the Llama Lake. Refer also to the Site Water Monitoring and Management Plan (Volume 10, Chapter 7) and the Site Water Management Report (Appendix V2-7I), for more on lake dewatering methodology and timing.

In advance of the dewatering, a “fish-out program” will be completed following DFO’s protocols and in collaboration with local communities.

7.10.2.6 Umwelt Lake Dewatering

Beginning in Year -3, there will be a need to dewater Umwelt Lake to provide storage capacity for saline water from groundwater inflows encountered during mining. It is assumed that 50% of the lake volume can be discharged directly to Goose Lake, while the remaining 50% will require treatment for total suspended solids (TSS) prior to discharge. A dewatering plan will be prepared and approved by regulators prior to dewatering activities. This plan will include provisions for diversion of incoming flows to Umwelt Lake. Refer also to the Site Water Monitoring and Management Plan (Volume 10, Chapter 7) and the Site Water Management Report (Appendix V2-7I) for more on lake dewatering methodology.

In advance of the dewatering, a “fish-out program” will be completed following DFO’s protocols and in collaboration with local communities.

7.10.2.7 Open Pit Water Management and Pit Dewatering during Mining Operation

During Operations, runoff and seepage will occur during the summer period and are not expected to be large quantities of water. Pit inflow (seepage) is expected at Llama open pit as it overlies an open talik; flows are estimated to average 300 m^3/day, with a maximum of 700 m^3/d. All other pits are developed fully in permafrost, as such, no other open pits are expected to have significant inflows. Water pooling in the open pits (from surface runoff or snow melt) will be channeled to collection ponds within the pit and pumped to the active tailings facility.

7.10.2.8 Expected Pit Inflows and Water Quality

Once mining activity has ceased, diversion structures will be breached and the open pits will be allowed to fill with the natural drainage. There is a possibility that exposed pit walls could cause a deterioration of pit water quality. Predictions for pit inflow water quality are presented in Appendix V2-7H: Water and Load Balance Report.

The pit water quality will be monitored until the pit is full. Should monitoring indicate a trend in ARD release, accelerated filling of the pit will be considered.

7.10.2.9 Underground Mine Dewatering

The underground operations will extend to approximate maximum depths of 650 m from the surface and will have a peak ore production rate of approximately 1670 kt/year in Year 8. Seepage water will be channeled to sumps and pumped to the surface for disposal.

Management of Saline Water

Due to the depth of the Umwelt, Llama, and Goose Main underground mine operations, it is anticipated to pass below the basal permafrost and intersect the regional groundwater system. Inflow is also expected from Llama open pit as it overlays an open talik. Groundwater inflows to these undergrounds and Llama open pit are anticipated to be saline. This water will be collected and pumped to the Saline Water Pond; during Closure, this water will be pumped into mined-out underground workings as well as the mined-out Llama open pit to create a meromictic lake in Llama Reservoir (Appendix V2-7H).

7.10.3 Water Management at the Marine Laydown Area

Water management during the Operations phase remains the same as during the Construction phase (Figure 7.10-2). Refer to Section 6.4.

7.11 OTHER INFRASTRUCTURE REQUIRED FOR OPERATIONS

As discussed in Section 6, all camps, warehouses, maintenance facilities, and other administrative buildings required for the operation will be erected during the Construction phase of the Project. The camps and associated sewage treatment facilities will be downsized as necessary. Refer to Section 6 for a description of these facilities.

7.11.1 Camps

For the Operations phase, the camps constructed during the construction period will be re-used to accommodate the similarly sized workforce required for the operation. The Goose camp will accommodate 465 persons.

7.12 SUMMARY OF OPERATION ACTIVITIES AT GOOSE PROPERTY

Table 7.12-1 summarizes the key aspects of the mining operation for the Goose Property. The layout of the Goose Property is presented in Figure 1.6-2.

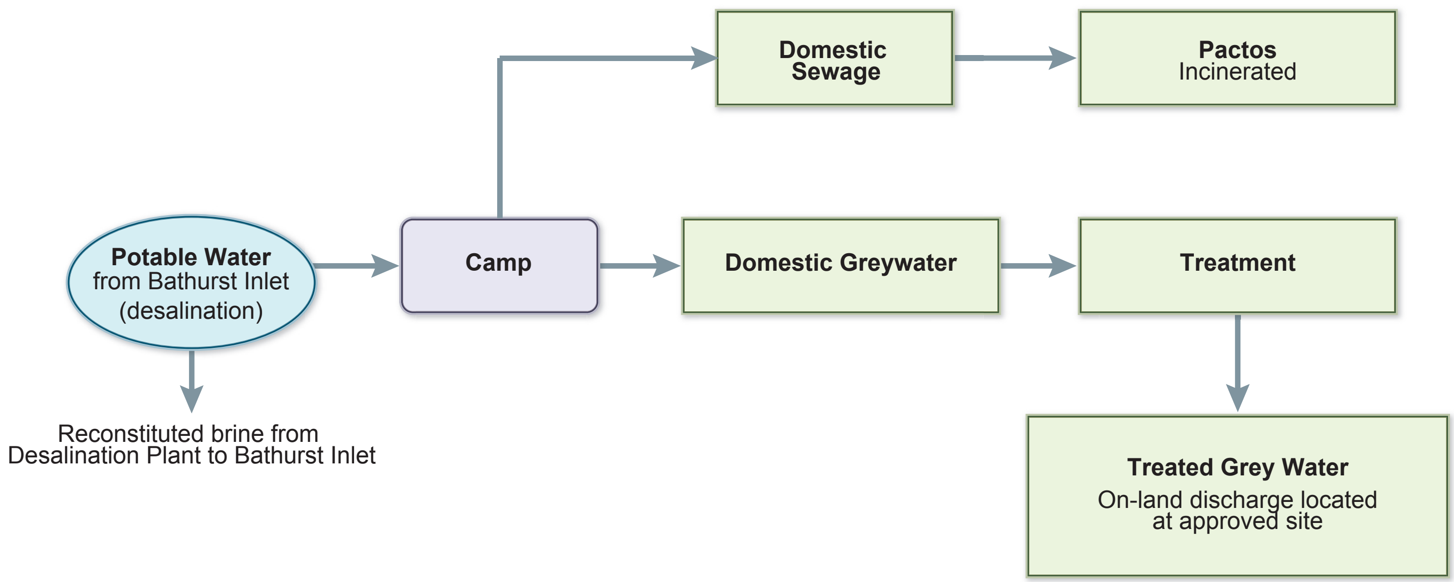

Figure 7.10-2

Conceptual Water Management - Marine Laydown Area

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Table 7.12-1. Summary of Goose Property Mining Operations

General	
Umwelt Open Pit (Year -2 to 2)	Pit Surface Area Projection: 161,800 m^2 Maximum Pit Dimensions: 550 m x 330 m Maximum Depth: 135 m below ground surface Pit limits do not impact on waterbodies. Segregation of PAG and NPAG waste rock in WRSA adjacent to Umwelt open pit – see following section, "Waste Rock Management". Open pit will be backfilled with processed tailings and water.
Llama Open Pit (Year 1 to 3)	Pit Surface Area Projection: 129,700 m^2 Maximum Pit Dimensions: 500 m x 300 m Maximum Depth: 135 m below ground surface Pit limits impinge on Llama Lake. Llama Lake must be isolated and drained for mine workings. Dewatering to be finished in Year -1. Llama Lake will store saline water into closure and be recharged with fresh water on surface. Segregation of PAG and NPAG waste rock in WRSA adjacent to Llama open pit – see following section, "Waste Rock Management". At closure, mined out open pit is allowed to fill with water from adjacent stream/waterbodies.
Goose Main Open Pit (Year 2 to 6)	Pit Surface Area Projection: 237,400 m^2 Maximum Pit Dimensions : 700 m x 300 m Maximum Depth: 150 m below ground surface Pit limits impinge on an inflow stream to Goose Lake. This watercourse will be diverted upstream of the pit to flow around the pit and reconnect with the same Goose inflow waterbody. Segregation of PAG and NPAG waste in WRSA areas south to Goose Main open pit and on top of TSF – see following section, "Waste Rock Management". Open pit will be backfilled with processed tailings and water.
Echo Open Pit (Year 4 to 5)	Pit Surface Area Projection: 32,900 m^2 Maximum Pit Dimensions : 260 m x 120 m Maximum Depth: 45 m below ground surface Pit limits impinge on an inflow stream to Goose Lake. This watercourse will be diverted upstream of the pit to flow around the pit and reconnect with the same Goose inflow waterbody. Segregation of PAG and NPAG waste in WRSA adjacent to Echo open pit – see following section, "Waste Rock Management". At closure, mined out open pit is allowed to fill with water from adjacent stream/waterbodies.
Umwelt Underground (Year 2 to 10) Method: Post pillar cut and fill	Decline/Ramp: portal located at surface next to Umwelt Open Pit Mine Workings: trend downward ~30° from horizontal for ~1000m southeast of the Umwelt Open Pit Maximum Depth: 650 m below ground surface No segregation of PAG and NPAG waste rock from underground development; all underground development waste rock will be used as backfill to fill mined out stopes – see following section, "Waste Rock Management".
Llama Underground (Year 1 to 4) Method: Drift and fill	Decline/Ramp: portal located at surface next to Llama Open Pit Mine Workings: trend downward ~30° from horizontal for ~500 m southeast of the Llama Open Pit Maximum Depth: 380 m below ground surface No segregation of PAG and NPAG waste rock from underground development; all underground development waste rock will be used as backfill to fill mined out stopes – see following section, "Waste Rock Management".

(continued)

Table 7.12-1. Summary of Goose Property Mining Operations (continued)

General *(cont'd)*		
Goose Main Underground (Year 5 to 9) Method: Drift and fill	Decline/Ramp: portal located at surface next to Goose Main Open Pit Mine Workings: to a planned depth of ~200 m located directly below the Goose Main Open Pit Maximum Depth: 390 m below ground surface No segregation of PAG and NPAG waste rock from underground development; all underground development waste rock will be used as backfill to fill mined out stopes – see following section, "Waste Rock Management".	
Echo Underground (Year 6 to 9) Method: Longitudinal open stoping	Decline/Ramp: portal located at surface next to Echo Open Pit Mine Workings: trend downward ~60° from horizontal for ~350 m southeast of the Echo Open Pit Maximum Depth: 325 m below ground surface No segregation of PAG and NPAG waste rock from underground development; all underground development waste rock will be used as backfill to fill mined out stopes – see following section, "Waste Rock Management".	
Run of Mine (ROM) Ore Stockpile and Primary Crushing Facilities		
ROM Stockpiles	Ore stockpile maximum capacity of 3.1 M tonnes in area of crushing/milling facilities. Three designated ore stockpiles: low grade stockpile maximum 2.0 Mt; medium grade stockpile maximum 0.7 Mt; and high grade stockpile maximum 0.4 Mt (maximums not concurrent periods of time).	
Primary Crushing	Located at process plant site with 6,000 tpd capacity Size: 4-inch (120 mm) minus	
Waste Rock Management		
Umwelt Waste Rock Storage Area (WRSA)	Surface area = 394,800 m^2 Umwelt Waste Rock: • PAG Rock: 11,607 kt • NPAG Rock: 3,390 kt	Segregation of PAG and NPAG waste rock; stockpile adjacent to Umwelt open pit. A 5 m buffer of NPAG will be placed around and on PAG during and after construction to accommodate freeze back. Some waste rock from the open pits will be repurposed and reclaimed for use as backfill for Umwelt, Llama, Goose Main, and Echo underground workings.
Llama WRSA	Surface area = 375,500 m^2 Llama Waste Rock: • PAG Rock: 10,546 kt • NPAG Rock: 5,459 kt	Segregation of PAG and NPAG waste rock; stockpile adjacent to Llama open pit. A 5 m buffer of NPAG will be placed around and on PAG during and after construction to accommodate freeze back. Some waste rock from the open pits will be repurposed and reclaimed for use as backfill for Umwelt, Llama, Goose Main, and Echo underground workings.
TSF WRSA	Surface area = 1,751,900 m^2 Goose Main Waste Rock: • PAG Rock: 10,685 kt • NPAG Rock: 17,527 kt	Segregation of PAG and NPAG waste rock; stockpile adjacent to and on TSF. A 5 m buffer of NPAG will be placed around and on PAG during operations. Some waste rock from the open pits will be repurposed and reclaimed for use as backfill for Umwelt, Llama, Goose Main, and Echo underground workings.
Echo WRSA	Surface area = 13,800 m^2 Echo Waste Rock total: • PAG & NPAG Rock: 122 kt	Segregation of PAG and NPAG waste rock; stockpile adjacent to Echo open pit. A 5 m buffer of NPAG will be placed around and on PAG during and after construction to accommodate freeze back. Some waste rock from the open pits will be repurposed and reclaimed for use as backfill for Umwelt, Llama, Goose Main, and Echo underground workings.

(continued)

Table 7.12-1. Summary of Goose Property Mining Operations (completed)

Ore Stockpile at Goose Plant Site	
Ore Stockpile	Low grade stockpile maximum 1995 kt Medium grade stockpile maximum 749 kt High grade stockpile maximum 404 kt
Progressive Reclamation	Progressive reclamation comprises the opportunistic activities executed during the construction and operational phases. Such activities can be undertaken as material becomes available. Among other opportunities, the large reclamation efforts will be focused on any final earthworks including: • Open Pits; • Establish partial or full boulder fences around open pits and TSF; • Install proper signage around mine openings and TSF; • Construct open pit spillways; • WRSAs; • Buildings and infrastructure will be removed as they become unnecessary during the LOM and the sites will be reclaimed as much as practicable; • Contaminated Materials and Waste Disposal; • Contaminations of soil, snow, and ice will be cleaned up immediately following the spill. Soil will be remediated and disposed of on site in accordance with Spill Contingency Plan; and • Hazardous wastes will be shipped off-site periodically to minimize the amount of waste requiring removal at closure.
Site Water Management Features for Goose Property	
Drainage from mine workings	Most open pits will be in permafrost throughout their depth, except for pits that are influenced by local lake talik. Most undergrounds will reach below the basal permafrost. Groundwater can be expected from open pits that are influenced by local lake taliks and from undergrounds that extend below the basal permafrost at depth. Groundwater inflows into the underground mines below the permafrost are estimated as follows: Umwelt at 550 m^3/day, Llama at 350 m^3/day, and Goose Main at 80 m^3/day. Short term peak inflows of 1,000 m^3/day may be encountered. Water seepage into the underground workings will be pumped to the surface for collection in the Saline Water Pond or other temporary reservoir. Water seepage from the open pits will be directed to the current tailings facility via pipe or truck for reuse.
Drainage from WRSAs and open pits	Collection/diversion channels and ponds will be established around waste rock storage areas. Runoff directed to open pits or directly to current tailings facility. Open pit water will be transported to the current tailings facility via pipe or trucked for reuse in milling process.
Tailings Storage Facility	No discharge during operations, and controlled release during closure. Consolidated tailings contain 49% solids (by weight). Tailings Storage Facility is lined on upstream berm face with Geosynthetic clay liner with ROM NPAG material to protect the liner from freeze/thaw action.
Drainage from Ore Stockpile	Runoff directed to collection/diversion network will be collected and pumped or trucked to current tailings facility.
Milling & Processing	Water from the TSF will be recycled and reused, however, make-up water is required due to losses of water entrapped in tailings. This water will be sourced from Goose Lake.
Sewage Treatment	Treated effluent will be discharged to receiving environment during construction and closure. Directed to the current tailings facility as make-up water during operation.
Maintenance buildings	Oily water treatment units and treated water is recycled for use in maintenance shop. Discharge, when required, is directed to the current tailings facility during operation. Oil to be collected and either burned in an approved waste-heat generator or drummed and removed from site as hazardous waste.
AN Facility	No discharge of waste water from AN facility. Explosive truck wash water is treated in an evaporator.
General site drainage	Site drainage designed to: • contain potentially contaminated runoff; and • divert non-contact catchment water from mine facilities.

8. Detailed Project Description - Reclamation and Closure

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8. Detailed Project Description – Reclamation and Closure

8.1 OVERVIEW AND SCHEDULE

Mine closure is expected to take eight years and consist of two stages:

- Phase 3, Stage 1 (Active Closure) - Approximately two years to complete and entails the bulk of the physical closure activities.
- Phase 3, Stage 2 (Passive Closure) - Approximately six years of water treatment followed by final decommissioning of the remaining elements of the Property.

A minimum of five years of post-closure monitoring will follow the above phases of mine closure during which confirmation monitoring will occur.

Achieving physical and chemical stability will be a key focus of mine closure. Encapsulation of mine wastes (PAG waste rock and tailings) with NPAG waste rock will mainly occur during the Operations phase, with final slope grading of these areas completed during the Active Closure stage. Permanent water covers on Umwelt and Goose Tailings Facilities, and the flooding of open pits will be completed during the Active and Passive Closure stages.

WRSAs and the TSF will be covered with NPAG to promote the aggregation of permafrost to encapsulate PAG materials. WRSAs containing PAG surrounded with NPAG will be constructed during Operations so that the waste rock stockpiled is allowed to freeze. This is expected to reduce the generation of adverse water quality runoff. The NPAG cap will raise the height of the active layer in the permafrost to ensure that the PAG waste rock remains permanently frozen. The closure of both the Umwelt and Goose Main Tailings Facilities will entail a permanent water cover of 5 m which has been deemed sufficient to prevent resuspension of tailings solids due to wave action, surge, and ice scour.

A portion of the open pits walls will be comprised of materials expected to generate acid and leach metals. In order to reduce water treatment measures, the open pits will be filled with lake water to mitigate the generation of acid and the leaching of metals. This is expected to limit acid generation and metal leaching so that the pit water will meet applicable discharge criteria and can be passively discharged to nearby watercourses. In the case that the pit water does not meet discharge criteria, it would be necessary to treat the pit waters before discharging to local receiving waters.

Industry standard reclamation methods will be employed to close out the two sites (Goose and the MLA). Hazardous materials will be collected for off-site disposal including hazardous components of vehicles and equipment (i.e., fuel tanks, gear boxes, and hydraulic oil). Equipment stripped of hazardous components will be disposed of in an open pit or within a closure landfill constructed in one of the WRSAs. Buildings will be demolished and disposed of in the same closure landfill. Culverts will be removed from roads and the natural drainage restored, but the roads will otherwise remain intact. The Goose Airstrip will remain functional to support ongoing closure and post-closure monitoring activities.

Equipment and materials at the MLA will be following the same decontamination procedures as at Goose. Equipment and materials from the MLA will either be backhauled to Goose Property for landfilling, or shipped off site.

The winter ice roads associated with the Project are not expected to require any reclamation, but will be inspected prior to completion of the Active Closure phase to identify any areas of potential physical instability (i.e., erosion).

Logistics is an important consideration in the closure and reclamation of the Project. Due to the relatively high cost to construct and operate the Project's winter ice roads, the closure strategy involves minimizing winter ice road use during Active Closure to the extent possible. Equipment and materials required for mine closure, including the fuel required for the first two years (during which the bulk of earthworks will be carried out), will be brought to site by winter ice road during the final year of Operations or at the start of the Closure phase. Sabina will not look to bring salvageable equipment off-site for resale, as it is expected that the cost of removal will exceed salvage value. Instead, equipment and materials will be landfilled on-site.

From this point, a smaller crew will occupy a fully functional modular 20-person camp at the Goose Property to accommodate the Passive Closure phase. This camp will be supported entirely by airlifts, including the delivery of fuel. When pit filling has been completed, it will be necessary to dispose of the pumping equipment, pipelines, the small fleet of mobile equipment, and the small camp.

Additional detail regarding mine closure and reclamation measures is provided below. The Mine Closure and Reclamation Plan, with figures referenced in this chapter, is provided in Volume 10, Chapter 29.

8.2 REGULATORY FRAMEWORK REGARDING MINE CLOSURE

Reclamation and closure of the mine will be carried out in accordance with a Mine Closure and Reclamation Plan (MCRP) to be approved under Sabina's future Type A Water Licence to be issued by the NWB. Planning for mine closure in Nunavut is guided by the following:

- Mine Site Reclamation Policy for Nunavut (INAC 2002); and
- Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories (MVLWB/AANDC 2013).

Financial security is required under Type A Water Licences and is typically posted to AANDC (previously INAC) for water-related closure costs, and the landowner(s) for land-based reclamation activities. The majority of financial security will likely be held by the KIA as the majority landowner for the Project.

8.3 CLOSURE OBJECTIVES

The Preliminary MCRP is based on the following objectives.

<u>Objective 1: Design the Mine for Closure</u>

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 extreme natural 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 re-vegetation so that the land returns to productive use by wildlife. Active re-vegetation of the site 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.

Objective 3: Achieve Chemical Stability

Mine design will ensure that all 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 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.

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 licensing processes.

In the short term, community perspectives are expected to be gathered during the permitting phase through the public environmental review and water licensing 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, TF 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 9.2.7).

8.4 OPEN PITS

Boulder fences will be placed around each open pit as it is mined out. Boulders will be minimum 1 m in diameter, placed 3 m from the final pit crest, and will be spaced no more than 3 m apart. The intention is not to prevent access but to be a significant visual aid suggesting a change in landscape that will act as a warning sign to both humans and animals.

Pit sumps and associated pumps and pipelines are to be removed as each open pit is mined out. If the pumps are not to be re-purposed, hazardous material will be removed from the pumps and disposed of at an off-site licensed facility. The pumps will be landfilled on site. Pipelines, if not being reused, will be cleaned if necessary and landfilled.

Any mobile equipment used in the open pits that is past its service life will have all hazardous materials removed and disposed of at a licensed facility, and the equipment will be landfilled on site.

As described in Section 8.1, a portion of the walls of the open pits will consist of materials expected to generate acid and leach metals. The open pits will be flooded with lake water to restrict the generation of acid and the leaching of metals, and the pit water is expected to meet applicable discharge criteria and can be passively discharged to nearby watercourses. The pit flooding rates are listed below in Table 8.4-1. At the Goose Property, all open pits and reservoirs will be flooded at the end of Operations and will reach an overflow point by the time of closure. Once the outflow water quality requirements have been met, the open pits will be allowed to overflow and discharge to the environment. Appropriate erosion protection measures will be constructed at the overflow locations to ensure management of suspended sediments. The Llama open pit will also contain about 1 million cubic meters of saline water at its base, making it a meromictic lake. The fresh water cover over the saline water will be sufficient to prevent any turnover or mixing.

Table 8.4-1. Goose Property Open Pit and Reservoir Fill Times

Facility	Result	5th Percentile	50th Percentile	95th Percentile
Umwelt TF	Fill Date	Yr15, Q3	Yr14, Q2	Yr13, Q2
	No. days	1,828	1,443	1,083
Llama Reservoir	Fill Date	Yr15, Q2	Yr13, Q2	Yr12, Q2
	No. days	1,797	1,075	721
Goose Main TF	Fill Date	Yr21, Q3	Yr18, Q3	Yr16, Q3
	No. days	4,018	2,982	2,279
Echo Pit	Fill Date	Yr15, Q2	Yr14, Q2	Yr13, Q2
	No. days	1,824	1,449	1,080

8.5 UNDERGROUND

The Goose Property mobile equipment will have the hazardous material removed and disposed of at a licensed facility, and the equipment will be landfilled.

Mine dewatering pipelines, electrical transmission wires, substations, and pumping stations not suitable for reuse are to be cleaned, disposing of any hazardous waste off site, and the remaining equipment either dismantled and landfilled, or left in place upon closure.

All underground void space at the Goose Property, with the exception of Echo underground mine, will be flooded with saline groundwater from the Saline Water Pond at cessation of mining. The underground mine portals and ventilation raises daylight at surface. Therefore, no hydrostatic pressure on the closure plugs from water in the underground mines is expected. The mine portals will be sealed with a NPAG waste rock plug approximately twice as long as the opening is wide. The portal opening will be flush with the original topography or, if required, graded at a slope angle of 3H:1V. All underground ventilation raises will be closed using engineered concrete caps or NPAG rock fill with a plug height approximately twice the width of the opening or such that the fill is flush with the surrounding ground surface. If hydrostatic conditions encountered are different than expected, alternative closure plug designs for portals and ventilation raises will be considered.

8.6 WASTE ROCK STORAGE AREAS

Waste rock storage areas will be covered with a 5 m cap of NPAG material to promote the aggregation of permafrost and encapsulate PAG material. A disposal plan has been developed that maximizes the placement of NPAG waste rock over final PAG lifts as part of mine operations (i.e., by using NPAG waste rock coming directly from the pits) in order to minimize the amount of dedicated capping effort required in the Closure phase. Overburden will be co-disposed in the WRSAs and a portion may also be used for capping material. The all WRSAs will be re-graded with appropriate slopes to maintain geotechnical stability.

Once capped, waste rock cover runoff will need to be treated until the waste rock storage area is frozen. All WRSAs are designed to freeze back within a period of 8 to 10 years. The active layer is expected to remain within the outer 5 m cap of NPAG, thus mitigating any risk of ML/ARD. Additional details on WRSA thermal modelling can be found in Appendix V2-7E: WRSA Design Report.

8.7 TAILINGS STORAGE FACILITY

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. The entire tailings surface will be covered, including a zone 25 m wide zone downstream of the TSF containment dam. The entire covered surface, whether waste rock or tailings, will receive an NPAG waste rock cover at least 5 m thick. This cover will ensure that the tailings surface will freeze.

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 until the Post-Closure phase. At that time, the west limb of the TSF containment dam will be breached to allow for any surface runoff to flow unimpeded towards Goose Lake.

Sediments remaining in the TSF pond area will be tested and if not within industrial soil limit criteria, will be excavated and disposed of in the Goose Main open pit.

8.8 TAILINGS FACILITIES

Following the first two years of Operations, the mined-out Umwelt pit will become available, and tailings deposition will transition from the TSF to in-pit disposal for at the Umwelt tailings facility (TF) the next four years. The remaining four years of the mine life, tailings deposition will transition to the mined-out Goose Main open pit (Goose Main TF). Once tailings deposition within the Umwelt TF ceases, a permanent water cover of 5 m will be maintained, which has been deemed sufficient to prevent resuspension of tailings solids due to wave action, surge, and ice scour. Water discharged from the closed Umwelt TF will be treated in accordance with the Project water management plan until such time as the discharge criteria are met.

The closure plan for the Goose Main TF is similar to the Umwelt TF; however, once tailings deposition is complete, there will be a much greater water cover. The Goose TF may also be used to store non-hazardous waste from the final mine closure activities.

Similar to the Llama open pit, both Umwelt and Goose Main TFs will be closed with permanent outflow measures once appropriate water quality criteria to the environment have been met. The time to completely flood the TFs are presented in Table 8.4-1.

8.9 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 licensed facility. Concrete foundations for any structures will be demolished and disposed of in the landfill. At the MLA, surface infrastructure will be similarly handled; however, all elements designated for landfilling will be shipped off-site for disposal as a designated landfill near the port of destination, or transported to the Goose Property landfill.

8.10 ROADS AND AIRSTRIP

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.

The airstrip 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.

Winter ice roads are not expected to require any reclamation but the route will be inspected prior to completion of closure to identify any areas of potential physical instability (e.g. erosion). These areas will be remediated as required.

8.11 PIPELINES AND POWER DISTRIBUTION LINES

Pipelines and distribution lines (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.

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.

8.12 WASTE MANAGEMENT SITES

Inert landfills will be established within waste rock storage areas 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. The closure schedule will allow for substantial closure of landfills and removal of most hazardous materials off site during the Active Closure phase.

8.13 WATER MANAGEMENT SYSTEMS

8.13.1 Goose Property Water Management during Closure

Project infrastructure elements and their associated water management structures will be decommissioned throughout the mine life as they are no longer required. Details on these decommissioned elements can be found in the Water Management System Design Report (Appendix V2-7I). Details on water management structures closed near the end of Operations and during the Closure phases are summarized below.

In Year 10, the diversion berms around Echo Pit, the Ore Stockpile Pond near the Goose Plant Site, and the Primary Pond near Umwelt WRSA are breached. The Echo Pit will be allowed to fill with non-contact water, and will eventually discharge into Echo stream and Goose Lake. Umwelt TF will be allowed to fill with water and will be breached at the northern extent of the pit in Year 10, discharging into the Umwelt Lake system.

The Saline Water Pond is decommissioned once dewatering is complete in the Active Closure phase, with all dams and berms being breached. After the Saline Water Pond closure and reclamation is complete, the diversion berms around the Llama Reservoir are breached, and the reservoir is allowed to fill with non-contact water.

Diversion berms around the Umwelt and Llama WRSAs will remain in place, routing runoff to the Umwelt TF and Llama Reservoir, respectively.

Water treatment will continue during the open water season months only, with clean water being recirculated back into Goose Main TF. Runoff collected in the TSF WRSA Pond will be pumped to the Goose Main TF.

Llama Reservoir will overtop in Year 13 under average hydrologic conditions, discharging towards the south and into the reclaimed Saline Water Pond catchment.

In Year 18, water treatment from Goose Main TF will be decommissioned. The Goose Diversion berm, south of the Goose Main TF, will be breached, allowing the Rascal Stream East to discharge into the Goose Main TF. The Goose airstrip culvert will also be removed at this time, and the Goose Airstrip will be breached. The Goose Main TF will be allowed to fill with non-contact water, and will be breached to discharge towards the tributary to Goose Lake, along the historical Rascal Stream East alignment.

The TSF WRSA Pond is also breached in Year 18, allowing runoff to flow into Goose Main TF. At this time, all dams and berms on site will be breached, and all culvert crossings removed.

8.14 CHEMICALS AND EXPLOSIVES

Hazardous materials will be collected for off-site disposal. Hazardous material 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 licensed facility for disposal. Fuel tanks will be steam cleaned, cut up, and landfilled. The rinse water will be treated before disposal.

8.15 CONTAMINATED SOIL

Soil found to exceed applicable Nunavut site remediation criteria will be bio-remediated on site within landfarms at the Goose Property and MLA. These landfarms will be established during the Construction and Operations phases. A site investigation will be undertaken during Closure 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.

8.16 PROGRESSIVE RECLAMATION

8.16.1 Definition of Progressive Reclamation

Progressive reclamation is defined as the opportunistic reclamation activities completed during the operational phase of a project (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 as well as the timeframe for achieving closure objectives.

8.16.2 Candidate Facilities/Areas and Reclamation Activities

Progressive reclamation activities can take place during either the Construction or the Operations phases. At both sites, reclamation efforts will be focused on any final earthworks opportunities that present themselves, including:

<u>Open Pits</u>

- Establish partial or full boulder fences around open pits, TFs, and TSF.
- Install proper signage around mine openings and TSF; and
- Construct open pit outflow structures.

WRSAs

PAG waste rock within the WRSAs will be progressively capped using NPAG waste rock sourced from adjacent or nearby active open pit operations. The 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. This capping effort represents the most substantial progressive reclamation effort proposed. Final closure measures for the WRSAs are described further in Section 7.2.7.

Buildings and Infrastructure

If any 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 (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 as part of the preliminary MCRP. Several of these were addressed during the Feasibility Study and development of the FEIS, while others will take longer to conclude. A complete summary of previously proposed reclamation studies, their completion status, and updated proposed reclamation studies is included in the MCRP. Table 18.16-1 summaries the updated proposed reclamation studies going forward.

Table 8.16-1. 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 previous study 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 previous study 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 previous study 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

(continued)

Table 8.16-1. Updated Proposed Reclamation Studies (completed)

Study No.	Description	Status and Schedule for Completion
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 following Closure.	Ongoing.

8.16.3 Progressive Reclamation Schedule

Progressive reclamation activities will begin as soon as mining at the Umwelt pit has been completed in Year 2 (Phase 2, Stage 1) and will continue through the rest of the 10-year operating mine life.

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.

8.17 CLOSURE AND POST-CLOSURE MONITORING PROGRAMS

Monitoring will be carried out during the Closure phase and during the 5-year Post-Closure phase to ensure that closure activities are being undertaken as identified in the Final Approved MCRP and closure objectives are being met. Specific monitoring will include:

- Supervision of closure activities to confirm conformance with the Final MCRP.
- Temperatures within the WRSAs will be monitored to confirm that the piles are frozen throughout except for the predicted active layer thickness.
- Geotechnical inspections of TSF embankments, WRSAs, pit walls, and other areas for physical stability.
- Water quality and aquatic effects monitoring to confirm that discharge water quality meets MMER requirements and water licence discharge and receiving waters criteria. Sabina will seek status as a recognized closed mine from Environment Canada.

9. Detailed Project Description - Environmental Management

Sabina
GOLD & SILVER CORP.

9. Detailed Project Description – Environmental Management

9.1 SABINA 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.

9.2 SCOPE OF BACK RIVER PROJECT MANAGEMENT PLANS

The Guidelines for the development of the EIS require that Sabina present an “overall development plan describing the Project development phases (construction, operation, maintenance, potential modifications, temporary closure, final closure, and post-closure), relevant timeframes, works, and undertakings associated with each of these phases. The EIS must include consideration for temporary closure, or care & maintenance, in the possibility that operations are unexpectedly suspended. The Proponent should also identify associated monitoring and/or mitigation plans to be implemented in each of the development phases to eliminate or minimize adverse effects that might occur at various project stages for each Project element” (NIRB Guidelines Section 6.2).

In order to satisfy this requirement, Sabina’s Environmental Management System (EMS) is described in Volume 10 of the EIS. Sabina’s EMS defines the sequence of “***Policy – Planning – Implementation and Operation – Checking and Corrective Actions – Management Review Process***” that must be in place to ensure that the Back River Project is executed in an environmentally and socially acceptable manner and in a spirit of **continuous improvement** and employs adaptive management principles.

The EMS and its associated management plans contain *“Life of Project”* monitoring and mitigation measures. They apply from the onset of the exploration, through the construction, operations and site closure phases of the Project. The application of the continuous improvement principle and adaptive management (***Policy – Planning - Checking and Corrective Actions – Management Review Process)*** ensures that the environmental management plans are appropriate for the level of activities on site at all times. Adaptive management is the application of mitigation measures when review processes identify potential adverse effects. The application of adaptive management measures could require the approval of a regulatory authority.

Management plans are the tools used by Sabina to ensure that the Company’s objectives and environmental commitment are achieved. The Company acknowledges that the Management Plans will require updating on a regular basis to ensure that these plans capture/incorporate the requirements outlined in the terms and conditions of the Project Certificate and Type A Water Licence, as well as other commitments made by the Company.

Key elements of these plans are execution and accountability within the Company’s organization to ensure that the objectives of the plan are met. As the Project advances though its various phases of development (Construction, Operations, and Closure), the on-site organizational structure of the site management team will change. However, the fundamental commitments made by the Company as embodied in the management plans will remain. Furthermore, the process of continual improvement (review and adaptive management) may also introduce occasional changes for some components of the management plans. In essence, the management plans are tools designed to manage change while ensuring that the Company’s objectives and environmental commitments are achieved.

A list of the monitoring and/or mitigation management plans required for the Back River Project and there applicability is presented in Table 9.2-1. Preliminary discussion is presented in the following sections of particular management and monitoring plan.

9.2.1 Surveillance Network Program

As a requirement of the Type A Water Licence, a Surveillance Network Program (SNP) will be established for each Project site. The SNP focuses on monitoring water quality at end of pipe discharges as well as water quality in the receiving environment. Potentially poor water quality will be retained within appropriate sumps/containment areas and will only be released at a designated terrestrial location approved by the appropriate regulatory authority. Only water that meets criteria set out in water licences will be released.

Table 9.2-1. Monitoring and/or Mitigation Plans for the Back River Project

Chapter	Document	Construction	Operations and Ongoing Maintenance	Temporary Closure / Care and Maintenance	Final Closure	Post-Closure
1	Environmental Management Plan	x	x	x	x	x
2	Environmental Protection Plan	x	x	x	x	x
Biophysical Monitoring and Mitigation 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	
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 and 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
Socio-economic Management Plans						
23	Socio-economic Monitoring Plan	x	x	x	x	
24	Business Development Plan	x	x	x	x	
25	Occupational Health and Safety Plan	x	x	x	x	
26	Community Involvement Plan	x	x	x	x	
27	Cultural and 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

9.2.2 Water Management and Monitoring

Site-specific drainage plans will be developed and implemented to monitor the quality of collected mine water and seepage from sediment ponds, waste rock storage areas, and the TSF. These drainage plans will:

- indicate the locations of mine water and seepage sampling stations and mine waste areas;
- provide water sampling, handling and analysis protocols; and
- provide a seepage/runoff water database that is updated as sampling is undertaken.

The hydrological models used in planning the water management system will be updated on the basis of:

- precipitation and temperature;
- lake levels and snow pack thickness; and
- stream flow and effluent discharge rates.

Water management activities during the Operations phase will include:

- monitoring to check and report on the performance, status and safety of water management facilities;
- inspection of pipelines (tailings and return water) for flow and hydraulic integrity;
- monitoring of water quality and level of retention in tailings management facilities, collection ponds and polishing ponds;
- inspection of drainage ditches, berms, and dikes for sediment accumulation and bank erosion and damage; and
- efforts to identify and implement ways to recycle water and reduce the use of fresh water as much as possible.

Drainage from haul roads would be released after removal of suspended solids provided it is sampled and shown to meet water quality guidelines for discharge.

Monitoring will consist of daily visual inspections during construction activity, spring freshet and after remarkable rainfall events with sampling of runoff where turbidity is evident. Construction activities will be conducted in such a way as to minimize impacts on surface drainage. Where construction activities necessitate temporary structures, Sabina will undertake corrective measures to minimize impacts on surface drainage. Guidelines for construction will be described in the Site Water Monitoring and Management Plan which will include master drainage plans for each site.

For berm contact water, this includes containing the water, treating with an oil/water separator, and analyzing for hydrocarbons. If it meets current licence terms and conditions, then it is released. If it does not, then it will be backhauled for treatment and/or disposal at an appropriate facility.

9.2.3 Ammonia Management

Sabina and the explosives supplier will adopt best management practices for transport, storage and use of explosives. Together with spill prevention and spill response these measures lower the potential for ammonium contamination in the receiving environment. More information on explosives use and handling can be found in the Explosives Management Plan. More information on spill response can be found in the Spill Contingency Plan and the explosives supplier ERAP.

The Site Water Monitoring and Management Plan will be developed and implemented to assist in ensuring that runoff does not have an adverse impact on the receiving environment. The management plan will include:

- potential sources of ammonia; and
- estimates of ammonia loading.

9.2.4 Chemical and Hazardous Materials Other than Fuel and Explosives

A variety of supplies and materials classified as potentially hazardous will be required at the Project. The hazardous materials to be handled may include:

- Petroleum Products (Fuel/Lubricants/Oils/Greases);
- Contaminated Snow/Water/Soil (Oil/Fuel);
- Oil and Fuel Filters;
- Used Sorbents and Rag;
- Hydraulic Fluid;
- Glycol;
- Empty Petroleum Hydrocarbon Containers and Drums;
- Process Reagents;
- Laboratory Reagents;
- Solvents;
- Paints;
- Fluorescent Light Tubes;
- Waste Equipment Batteries;
- Electronics and Electrical Materials; and
- Hazardous Medical Waste / Biomedical Waste.

As discussed in Sections 6.6 and 6.7, designated areas for storage and handling of these materials will be included in the infrastructure developed at each site. Transportation, storage, use, and disposal will be considered for each stage of Project life. Safety to the workers and the surrounding communities will determine each stage of materials handling. More information can be found in the Hazardous Materials Management Plan (V10-12).

9.2.5 Closure Monitoring

Monitoring programs will be designed and implemented during mine closure to ensure that closure activities and associated environmental effects are consistent with those predicted in the Mine Closure and Reclamation Plan and to ensure that the objectives of mine closure are being met. Monitoring activities will include many of the monitoring activities conducted during the mine operations phase. Monitoring of aquatic and terrestrial ecosystems will continue until work associated with mine closure is complete. Monitoring will also be conducted after closure to ensure that closure and rehabilitation measures are functioning as designed in accordance with applicable regulatory requirements.

References

References

Definitions of the acronyms and abbreviations used in this reference list can be found in the Acronyms and Abbreviations section.

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