BACK RIVER PROJECT
Landfill and Waste Management Plan

August 2022

BACK RIVER PROJECT
LANDFILL AND WASTE MANAGEMENT PLAN

Table of Contents

List of Figures

FIGURE **PAGE**

List of Tables

TABLE **PAGE**

Revision Log

Date	Section	Page	Revision
October 2017	All	All	Supporting Document for Type A Water Licence Application, submitted to Nunavut Water Board for review and approval
August 2022	All	All	Revision to reflect Construction Phase waste management activities, to align with overall Project waste management approach, and to compliment and remove overlap with related waste management plans.

Acronyms

CCME	Canadian Council of Ministers of the Environment
GN	Government of Nunavut
HMMP	Hazardous Materials Management Plan
ICRP	Interim Closure and Reclamation Management Plan
IMP	Incineration Management Plan
Licence	Water Licence 2AM-BRP1831
LMP	Landfill Management Plan
LWMP or Plan	Landfill and Waste Management Plan
MLA	Marine Laydown Area
NIRB	Nunavut Impact Review Board
NWB	Nunavut Water Board
Project	Back River Project
Sabina	Sabina Gold & Silver Corp.
SOP	Standard Operating Procedures
STP	Sewage Treatment Plant
TMP	Tailings Management Plan
WMP	Water Management Plan
WIR	Winter Ice Road
WROMP	Mine Waste Rock and Ore Management Plan
WRSA	Waste Rock Storage Area
TSF	Tailings Storage Facility

1. Introduction

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

The Project is comprised of two main areas with interconnecting winter ice roads (WIR): Goose Property and the Marine Laydown Area (MLA) situated along the western shore of southern Bathurst Inlet. The majority of annual resupply is completed using the MLA, and an approximately 160 km long WIR interconnects these sites seasonally when needed.

This Landfill and Waste Management Plan (LWMP or Plan) outlines the waste segregation procedures and approach plan for managing waste materials at the Project destined for landfilling and open burning.

This plan is a living document to be updated upon changes in related regulatory requirements, management reviews, incident investigations, changes to facility operation or maintenance, and environmental monitoring results, best practice updates or other Project specific protocols once construction starts through to Project closure activities. Any updates will be filed with the Annual Report submitted under the Type A Water Licence 2AM-BRP1831 (the Licence) and Project Certificate No 007 (the Project Certificate).

2. Scope and Objectives

The overall objective of Sabina's LWMP is to minimize potential effects from the Project on the environment from its waste management activities.

This LWMP is one of the documents that forms part of Sabina's overall Waste Management Program for the Project. This LWMP specifically addresses:

- Sabina's approach to the minimization and management of solid wastes
- An overview of Back River Waste Management Infrastructure
- Primary waste segregation procedures for non-mineral solid wastes, and
- Details the management and disposal procedures of dry non-hazardous solid wastes suitable for landfilling and/or open burning.

Management of incineration wastes, waste rock, and liquid wastes are addressed under other plans. Figure 2-1 provides an overview of Sabina's wastes and associated management plans which address each waste type.

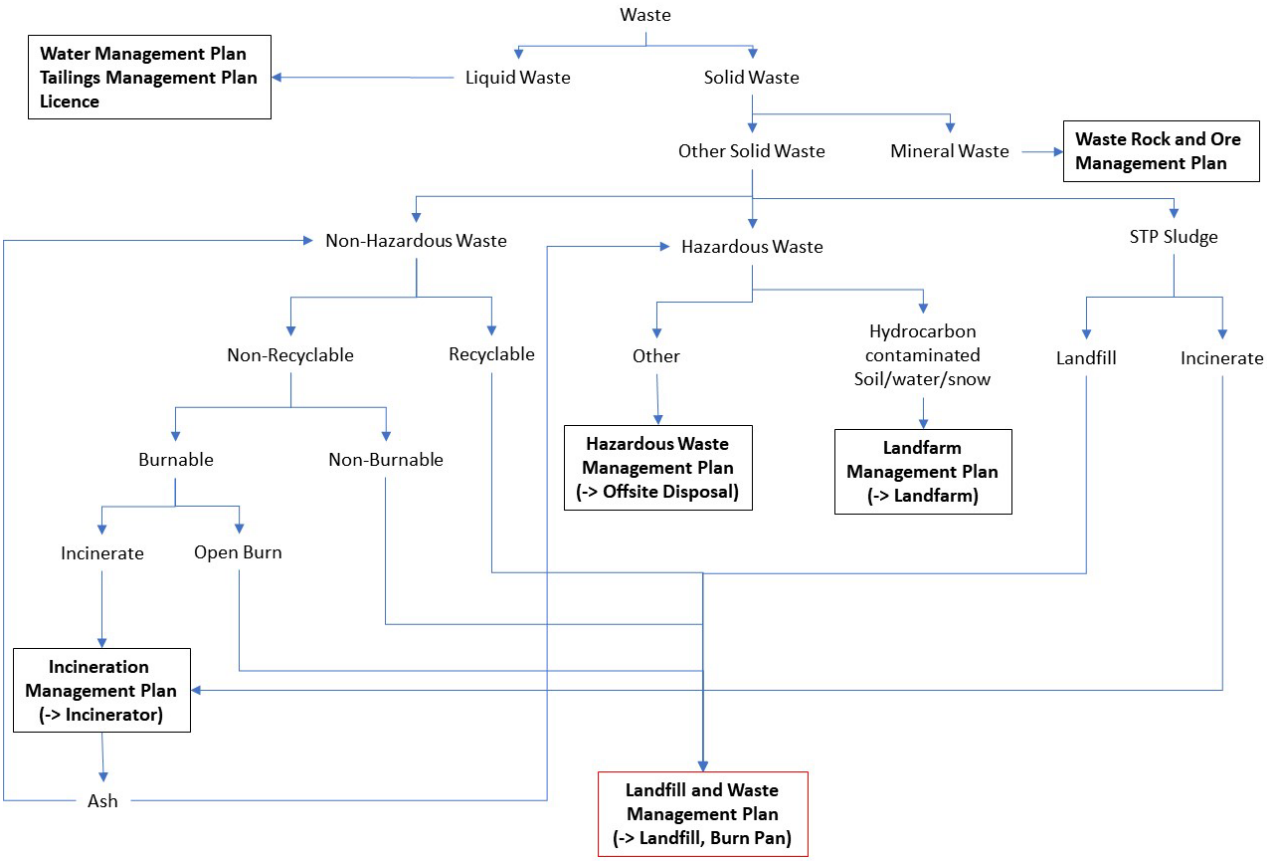

Figure 2-1 Waste Management Overview

2.1 RELATED DOCUMENTS

As illustrated in Figure 2-1, this Plan compliments additional waste management plans which make up the Projects overall Waste Management Strategy. Related waste management plans include:

- Incineration Management Plan (IMP; outlines procedures for incineration of appropriate wastes)
- Hazardous Materials Management Plan (HMMP; outlines procedures for hazardous waste disposal and recycling)
- Landfarm Management Plan (LMP; outlines procedures for remediation of hydrocarbon contaminated materials)
- Tailings Management Plan (TMP; outlines procedures for tailings waste)
- Mine Waste Rock and Ore Management Plan (WROMP; outlines procedures for waste rock management and disposal)
- Water Management Plan (WMP; outlines procedures for management of liquid wastes, including saline water)
- Quarry and Borrow Pit Management Plan (QMP; outline management of quarries, including identification and avoidance of actinolite)

This Plan is also related to the following plans:

- Risk Management and Emergency Response Plan
- Environmental Management and Protection Plan
- Fuel Management Plan
- Interim Closure and Reclamation Plan

3. Applicable Legislation and Guidelines

Specific legislation, regulations and guidelines related to waste management in Canada, and specifically within Nunavut, are summarized in Table 3-1. Waste management in Nunavut is regulated under:

- *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (2002)
- Nunavut's *Public Health Act* (1988)
- *Nunavut Environmental Protection Act* (1988)
- *Canadian Environmental Protection Act* (1999)
- *Federal Transportation of Dangerous Goods Act*, 1992 (TDG 1992)

Sabina is also bound by the terms and conditions of its land use permits issued by Indigenous and Northern Affairs Canada for Crown Lands and the Kitikmeot Inuit Association for Inuit Owned Land, its Type A Water Licence issued by the NWB, and Project Certificate No. 007 issued by the NIRB.

In addition to the mandatory requirements, a number of waste management guidelines have been considered in the preparation of this plan, and/or will be considered in the design and operations of Project waste management facilities:

- The Mackenzie Valley Land and Water Board's (2011) guidelines for developing a waste management plan
- Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the Northwest Territories (Ferguson Simek Clark 2003)
- Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories (Government of the Northwest Territories Department of Municipal and Community Affairs 1996)
- Mine closure guidelines developed by the Department of Indigenous and Northern Affairs Canada (AANDC 2013) were followed regarding specific landfill design and mitigation for potential impacts pertaining to waste
- *Environment Canada's Technical Document for Batch Waste Incineration* (EC 2010)

Table 3-1. Applicable Legislation to Waste Management in Nunavut

Acts	Regulations	Guidelines
Federal		
Canadian Environmental Protection Act (CEPA; 1999)	Schedule 1: List of Toxic Substances Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2002-301)	Environment and Climate Change Canada Technical Document for Batch Waste Incineration (EC 2010) Canada-Wide Standards for Petroleum Hydrocarbons in Soil (CCME 2001).
Transportation of Dangerous Goods Act, 1992 (1992) and Regulations	Regulations Amending the Transportation of Dangerous Goods Regulation (SOR/2012-245)	
Nunavut Waters and Nunavut Surface Rights Tribunal Act (2002)	Nunavut Water Regulations (2013)	
Territorial Lands Act (1985)	Territorial Land Use Regulations (CRC, c.1524) Northwest Territories and Nunavut Mining Regulations (CRC, c.1516)	Implications of Global Warming and the Precautionary Principle in Northern Mine Design and Closure (BGC 2003)
Hazardous Products Act (1985)	Controlled Products Regulations	Workplace Hazardous Materials Information System
Territorial – Nunavut		
Nunavut *Environmental Protection Act* (1988)	Spill Contingency Planning and Reporting Regulations (NWT Reg (Nu) 068-93) Used Oil and Waste Fuel Management Regulations (NWT Reg 064-2003) The removal of hazardous waste materials will require the registration with the Government of Nunavut, Department of Environment as a waste generator as well as carrier (if applicable) prior to transport	Government of Nunavut (GN) Environmental Guidelines for the Management of: ○ General Management of Hazardous Waste in Nunavut (GN 2010a) ○ Waste Paint (GN 2010b) ○ Mercury-Containing Products and Waste Mercury (GN 2010c) ○ Industrial Waste Discharges into Municipal Solid Waste and Sewage Disposal Facilities (GN 2011a) ○ Waste Batteries (GN 2011b) ○ Waste Solvent (GN 2011c) ○ Waste Antifreeze (GN 2011d) ○ Used Oil and Waste Fuel (GN 2012) ○ Biomedical and Pharmaceutical Waste (GN 2014) Canada-Wide Standards for Petroleum Hydrocarbons In Soil (CCME 2008)
Public Health Act (RSNWT (Nu) 1988, c.P12)	Camp Sanitation Regulations (RRNWT (Nu) 1990, c.P-12)	
Mine Health and Safety Act (SNWT (Nu) 1994, c.25)	Mine Health and Safety Regulations (NWT Reg (Nu) 125-95)	
Fire Prevention Act (RSNWT (Nu) 1988, c.F-6)	Fire Prevention Regulations (RRNWT (Nu) 1990, c.F-12)	

4. Planning and Implementation

Responsible waste management begins by minimizing waste generation when practical and economical, either by reducing waste, reusing materials, recycling materials, or recovering materials or energy. These concepts are illustrated in Figure 4-1.

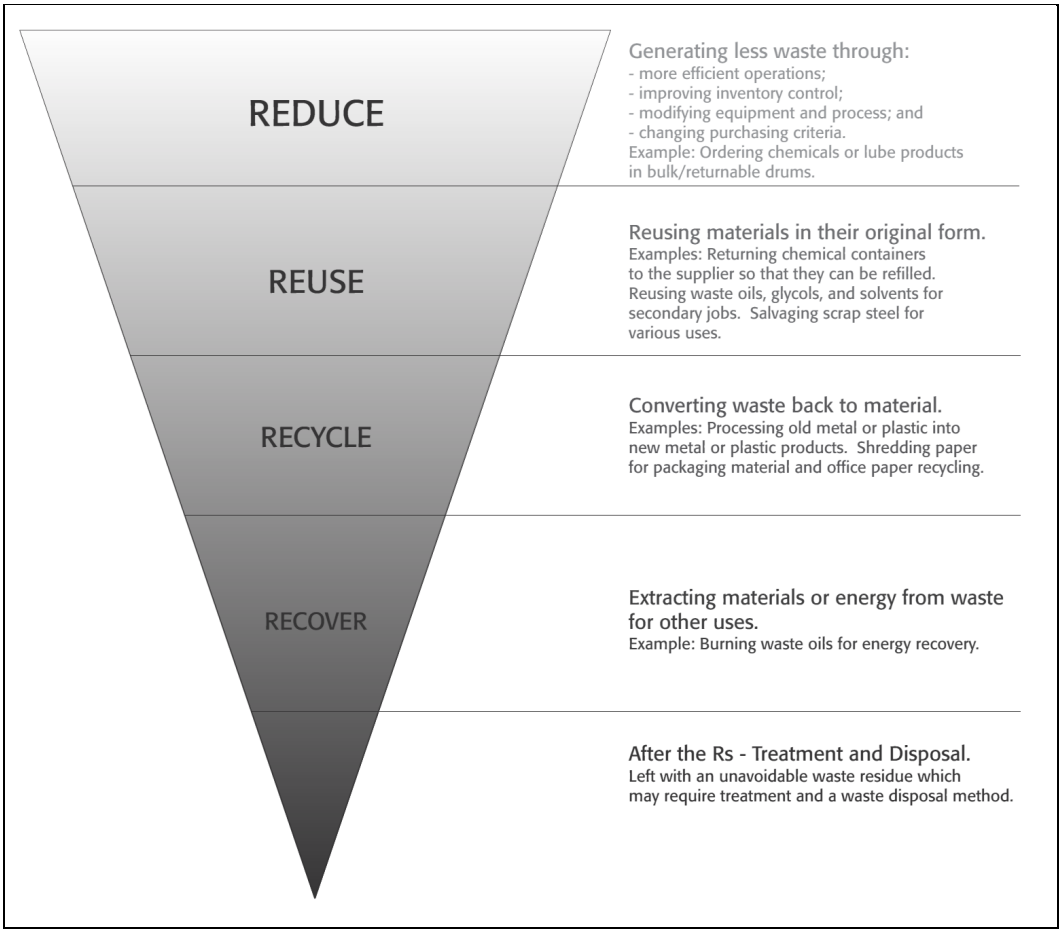

Figure 4-1. Basic Principles of Waste Management

Sabina embraces source reduction as a key means of minimizing the quantities of wastes to be generated. Reducing the amount of waste produced is an environmentally responsible business principle. Team Leaders are empowered to ensure that each area of operations uses materials in an efficient manner and to take the necessary steps to address these waste management principles.

Operating procedures at the mine will be developed to maximize the volume of materials that can be recycled or reused. The basic implementation of this strategy includes eliminating the use of disposable material in everyday use, encouraging the use of personal drink containers, stainless steel cutlery and reusable lunch boxes.

The waste reduction principles described above will be achieved by implementing the following strategies:

- **Pollution Prevention**: Pollution prevention methods to eliminate the generation of waste will continuously be evaluated and where feasible, appropriate improved methods will be implemented. This will be achieved by applying the reduction and minimization, substitution, segregation, reuse, recycling and recovery approaches discussed as follows.
- **Strategic Material Substitution**: At the purchasing stage, the possibility of material substitution with less polluting products is assessed - in particular for materials that are hazardous to handle, generate hazardous waste, or create environmental problems. For example, choosing single sheet paper towel dispensers for paper towels in bathrooms and kitchens instead of rolls of paper towels or installing efficient high velocity hand dryers and promotion of re-usable personal mugs for personnel.
- **Strategic Chemical Substitution**: A policy of using chemicals that are cost effective and accomplish the same results as the original chemicals employed, without or with less hazardous wastes generation in the process, will be adopted. For instance, preferentially using non-toxic propylene glycol instead of toxic ethylene glycol when possible.
- **Waste Segregation**: Segregation of all waste streams by type or category will avoid potentially undesirable combined effects and will facilitate the reuse, recycling, recovery and/or disposal of the various wastes. All waste categories will be evaluated and the principals of the following four 'R's applied:
  - **Reduction and Minimization Initiatives**: Reducing the raw material consumption is the first step to reduce waste generation. To practice this principle, all processes and material used will be evaluated on the basis of possible reduction in raw material usage.
  - **Reuse Initiatives**: Reuse of the material in other applications and /or by other parties is routinely examined by using the waste materials exchange.
  - **Recycling Initiatives**: Recycling is the next option considered for the successful management of the waste streams.
  - **Recovery Initiatives**: Recovery of usable material or energy as a by-product is a part of the four 'R's of the waste minimization process. For example, redistributing waste heat from generators to heat buildings is a process of recovery of energy from waste.
- **Disposal**: Disposal is the final option when the four 'R's are no longer applicable or practical.

5. Roles and Responsibilities

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

The Environmental Superintendent along with his/her direct reports are responsible for the implementation of this plan including overall management of the Plan and internal reporting, as well as for auditing Project performance to ensure compliance and adaptive management.

All other Project personnel involved with waste management activities are responsible for the effective implementation of this plan including: completion of required training, and maintaining compliance with training requirements as set out by this plan or by Sabina's SOPs and Best Management Practices. All employees are to work in compliance with Health and Safety Laws and Regulations.

5.1 TRAINING

As part of orientation, all on-site personnel, including Sabina Personnel and contractors, receive basic environmental and waste management training, including:

- Reducing water use
- Managing food wastes to minimize wildlife attraction
- Reducing waste
- Separating waste (recyclables, dry-cell batteries, food waste, and hazardous waste)

The Sabina Sustainable Development Policy is communicated to all on-site personnel during orientation and it is emphasized that it is everyone's responsibility to properly dispose of waste, including the sorting of waste that can be reused and recycled.

Project personnel responsible for the handling of wastes are fully trained in safe work and sorting procedures, and the identification of misdirected waste. Personnel working with waste materials undertake formal training to ensure compliance with applicable legislation and Sabina's SOPs. Site-specific training is provided by Sabina or work area supervisors and renewed as required according to SOPs, legislative requirements, and as needed. Contractors may be requested to provide copies of safety certificates, including First Aid, Workplace Hazardous Materials Information System, and Transportation of Dangerous Goods. Personal protective equipment appropriate to the activities undertaken will be worn and safe handling procedures will be used.

Hazardous materials management is outlined in the HMMP, however it is noted that all personnel involved in the handling of hazardous wastes receive Workplace Hazardous Materials Information System, Personal Safety and Protection and Emergency Response training. Where applicable, personnel receive Transportation of Dangerous Goods training.

Updated training logs will be maintained to ensure that all on-site staff are in compliance and have been suitably trained for their respective tasks.

6. LWMP Waste Management Infrastructure

Wastes remaining after application of the waste minimization techniques discussed in Section 4 will be managed in a practical and environmentally responsible manner utilizing methods appropriate for each waste type generated. See Figure 2-1 for an overview of Project waste management practices and the various plans which address each waste type.

The Project's overall waste management procedures include:

- Waste sorting at all generation points
- Incineration of non-hazardous combustible wastes
- Open burning of untreated wood and cardboard
- Landfilling of inert wastes
- Treatment of sewage
- Storage of waste rock in designated Waste Rock Storage Areas (WRSAs)
- Discharge of greywater and treated effluent
- Management and storage of waste water
- Temporary storage and off-site shipping of hazardous and recyclable waste materials
- On-site treatment for contaminated soil and oily water from hydrocarbon spills in landfarms

The LWMP specifically focuses on the management of materials which will be landfilled or which are subject to open burning. As such, the LWMP infrastructure includes:

- Project landfills
- Temporary non-hazardous waste storage areas (for the storage of wastes prior to landfilling, open burning or backhauling)
- The burn cage

Other waste infrastructure is addressed in other waste management plans (see Section 2.1), including incinerators, landfarms, water management facilities, tailings management structures, hazardous waste management facilities and WRSAs. As required by the Licence (Part F, Item 7), a site-specific Sewage Treatment Plant Operations Manual will be submitted to the NWB 90 days prior to its construction/installation.

Landfills for disposal of non-hazardous, non-animal-attractant, solid wastes will be located in Project WRSAs, once these areas have been constructed.

During the initial Construction Phase, Goose Exploration Camp facilities or shipping containers will be used. Landfill waste may be temporarily stored in containers or totes or inactive quarries while Operations Phase waste management facilities are constructed. Quarries used would be those with a bedrock base sloped to prevent any runoff. The Operations Phase waste management facilities will be commissioned as early as possible during the Construction Phase. During Active Closure, there will be a migration back to exploration phase type waste management facilities once the main mine facilities are decommissioned. Toward the end of Active Closure, a small closure landfill and camp incinerator will

remain, and a landfarm will likely be in use as part of final closure activities. These facilities will be used through the Passive Closure Phase as well.

A burn cage is available and currently in use at the Goose Property for the burning of appropriate wastes.

During all Project phases, efforts will be made to maximize backhaul capacity to remove hazardous wastes and recyclables and minimize on-site inventories.

6.1 LANDFILL

Landfills will be required for the disposal of non-hazardous, solid industrial wastes that cannot be reused, recycled, or recovered (or incinerated) as per the waste management hierarchy (Section 4), as well as for disposal of no-hazardous ash from the incinerators or burn cage. The landfills will be operated as industrial dry waste landfills and not as municipal solid waste landfills. Inert waste material intended for disposal in the landfills includes unburnable plastics, treated and un-treated wood, fiberglass insulation, roofing, asphalt, concrete, ceramics, small rubber items, clothing, glass, small appliances, ash, bricks, and waste asbestos (according to GN guidelines), and vehicles (liquids, grease, and electronics removed). For additional specifics on materials suitable for landfilling see Section 7.3.4.

6.1.1 Landfill Location

Landfill sites will be developed at the Goose Property with the development of WRSAs, within which the landfills will be located. Siting of landfills has considers distances to sensitive receptors and consideration of transport routes. Water management monitoring criteria are applied to the WRSA, and therefore seepage from the landfills will be managed as part of the overall Water Management Plan.

Throughout the Project life, additional industrial dry waste landfills may be established within Project WRSAs. WRSAs are logical candidate locations since there is road access, adequate cover material available, and since the runoff from these facilities will already be managed and monitored. Non-hazardous waste generated at the MLA that is not suitable for incineration will be stored in containers that will be transported to the landfill at the Goose Property for disposal during each WIR season or backhauled off-site.

6.1.2 Landfill Design Considerations

A landfill design and construction report will be submitted to the NWB for approval at least 60 days prior to construction, as required by the Water Licence, Part D, item 2.

It is anticipated that the landfill sites will be developed using the area fill method as detailed in Ferguson, Simek, Clark (2003). The area fill method is the preferred design method where permafrost and geological rock conditions inhibit the development of trenches. The design allows for the landfill to become fully aggraded into the permafrost over time. Each of the landfill sites will be designed to minimize the area of surface disturbance, stabilize disturbed land surfaces against erosion, and return the land to a post-mining use that is consistent with past traditional pursuits and wildlife habitat.

Landfills will be constructed within WRSAs and will be designed to ensure the maintenance and aggradation of permafrost, as noted in Section 6.1.2. Full details on the WRSA design, including measures in place to ensure permafrost is protected can be found in the Waste Rock Management Plan. These measures including placement of WRSAs in areas covered in less than 2 m of overburden, preferentially laying the first layer waste rock during the winter to encapsulate the existing permafrost, building the WRSA in layers promoting progressive freeze-back, capping landfill waste in cells using waste rock, and placement of a closure capping layer.

The total waste volume generated over the life of the mine will dictate the ultimate dimensions of each landfill. Anticipated waste volumes based on predicted waste tonnages during each phase of the Project (Construction, Operations, and Closure) were used to assist in the design of the landfill cells. The designs will allow flexibility to accommodate layout extension or contraction within the confines of each respective WRSA.

Each of the landfills will be capped and progressively closed as final elevations are achieved. Final grades of the landfill will be graded to a slope of 5% or greater, to minimize ponding and infiltration through the cover, and thus minimize permafrost or cover damage and leachate generation.

The landfills will be monitored both during Operations and Post-Closure to confirm their performance. For details on landfill operation and maintenance refer to Section 7.4.

6.2 TEMPORARY WASTE STORAGE FACILITIES

Solid non-mineral waste may be stored temporarily for the following reasons:

- **Landfill waste:** Prior to construction of the WRSAs, which will be developed during mining activity, landfill waste will be securely stored at designated locations until landfilled.
- **Recyclable non-hazardous, non-combustible waste:** will be routinely stored in designated areas until transported to an appropriate recycling or disposal facility. This includes recyclables such as tires, electronics and electrical materials, and scrap metal.
- **Sewage sludge and pacto waste:** will be transported directly from the STP to the incinerator for incineration (see IMP) or will be placed in sealed containers and be disposed of in the landfill. Sewage generated at the MLA, or sewage sludge removed from the Goose Property may alternatively be added to the landfarm as nutrient amendment or be used for revegetation research and reclamation where appropriate.
- **Wildlife attractant and Food and beverage waste:** including food/beverage containers will be incinerated daily or stored securely (see IMP)
- **Incineration and Open Burn wastes:** will be temporarily stored in dedicated bins near to the incinerators or burn cage until they are ready to be incinerated/burnt. Ash will be contained in drums and stored, until testing results are obtained and reviewed, at which time they will either be disposed of in the on-site landfill (if non-hazardous) or shipped offsite for appropriate disposal (see the HMMP).
- **Hydrocrabon Contaminated Soil/Water/Snow:** see LMP
- **Hazardous Wastes:** see HMMP

Waste stored temporarily will be segregated according to its susceptibility to exposure to the elements and both indoor (e.g. seacans) and outdoor storage options will be available.

The majority of other items will be stored in the laydown yard outdoors, or in shipping containers where appropriate.

6.3 OPEN BURNING

An open burning area is used to burn cardboard packaging and non-preservative-treated wood waste. A metal burn cage is used to minimize escape of large cinders and to promote airflow and burn efficiency.

The burn cage is located on a vegetation-free pad (such as within an inactive quarry or seacan) and burning is not undertaken on high-wind days. Open burning procedures are consistent with authorized open burning practices currently employed at the Goose Exploration Camp under the NWB 2BE-GOO2028 water licence.

In accordance with both Licence 2AM-BRP1831, Part F, Item 14, and Licence 2BE- GOO2028 Part D, Item 6, open burning of plastics, wood treated with preservatives, electric wire, styrofoam, asbestos or painted wood is prohibited.

7. Waste Management

This section provides general guidance for the management of non-hazardous solid waste, recyclable materials, and sewage/sewage sludge at the Project including the Goose Property and the MLA.

The management of each classification of waste at the Goose Property and the MLA considers the type of waste produced, waste storage, waste handling, waste separation and final destination. Waste management options for the various wastes are based on-site operations, site resources and the waste hierarchy (i.e., reduce, reuse, recycle, recovery, residuals disposal). A general overview of waste types and how they are handled is provided below, followed by details on wastes landfilled or subject to open burning.

7.1 OVERVIEW OF WASTE TYPES

The Project operations that will generate the different types of waste include the following major areas:

- Residential areas
- Kitchen and cafeteria
- Administration area
- Plant area
- Maintenance workshops
- Other worksites
- MLA
- Construction areas

The types of non-mineral solid waste[1] anticipated to be generated can be classified into the following general categories:

- Non-combustible solid waste
- Burnable solid waste material (e.g., paper, cardboard, non-treated wood)
- Combustible solid waste for incineration
- Sewage and sewage sludge
- Organics potentially attractive to Wildlife (i.e., food waste)
- Ash from the incinerator
- Recyclable material
- Hazardous waste.

[1] Tailings, waste rock, and overburden are also considered waste materials. The Mine Waste Rock Management Plan (SD-08) and Tailings Management Plan (SD-09) provides details on these wastes.

The LWMP details how waste which are recycled, landfilled, or open burned. These three waste types are discussed further below.

7.1.1 Recyclable Waste

The typical types of waste generated within this category include:

- Beverage containers (plastic, aluminum, glass, tetra packs)
- Tires
- Electronics and electrical wastes
- Higher value metals (e.g., copper, aluminum)
- Dry cell batteries for domestic use (e.g., AAA to D cells, 6 and 9 volt batteries)

Wastes designated for recycling are backhauled to Yellowknife for recycling.

7.1.2 Landfill Wastes

Non-hazardous wastes that include discarded materials in a solid, liquid, or semi-solid form that will not be burned or recycled. Such wastes do not pose a risk to human or environmental health. The types of waste generated within this category include bulky items such as mattresses, waste concrete, and other construction wastes (or demolition waste) such as steel, wire, roofing, concrete, and asphalt. Non-hazardous waste items will be checked and cleaned of any hydrocarbon contamination, electronics removed, and disposed of in the landfill or stored in bulk piles (e.g., some larger scrap metal).

7.1.3 Open Burn Waste

Combustible, dry, non-hazardous wastes that are not a wildlife attractant. The types of waste generated within this category include:

- Cardboard and paper
- (Unpainted or untreated with preservatives) lumber scraps

In accordance with both Licence 2AM-BRP1831, Part F, Item 14, and Licence 2BE- GOO2028 Part D, Item 6, open burning of plastics, wood treated with preservatives, electric wire, styrofoam, asbestos or painted wood is prohibited.

7.2 OVERVIEW OF WASTE HANDLING AND SEPARATION

Wastes are separated at their source to the extent possible to minimize double-handling as well as cross-contamination of wastes.

The waste handling system includes appropriate bins at designated collection areas to promote separation of materials in the residences, administration and plant buildings, and each work area. The categories of waste receptacles available at each location will be periodically reviewed to ensure receptacle types and quantities are suited to the routinely generated wastes for that area. Any wastes which may be attractive to wildlife are stored in a manner inaccessible to wildlife (such as within a building or shipping container).

As Project development progresses, standard operating procedures will be developed or updated to ensure new waste types are addressed as needed. Volumes of waste and recycling materials collected at each collection station and delivery to its final destination will be tracked. This system will allow auditing of waste streams and identification of areas requiring adaptive management or re-education of staff on Project waste segregation and management practices.

7.2.1 Dining Areas

Clearly labelled waste sorting bins available in each dining area include:

- Food Waste
- Paper/cardboard waste
- Recycling (returnable drink containers only at present)
- Used Batteries
- Other non-hazardous and household/office waste

The installation of a de-watering system may be considered in the kitchens to reduce water content of kitchen waste prior to incineration.

7.2.2 Accommodation and Administration Areas

Clearly labelled waste sorting bins available in each accommodation and administration area will include:

- Food Waste
- Paper/cardboard waste
- Recycling (returnable drink containers only at present)
- Used Batteries
- Other non-hazardous and household/office waste (e.g. plastics, office supplies)

7.2.3 General Work Areas

Depending on work activity, work areas may a have clearly-labelled receptacles for:

- Paper/cardboard waste
- Used Batteries
- Oily rags (metal can with lid)
- Waste oil (to be located within spill containment)
- Hazardous waste materials (within lined containment and per SDS requirements)
- Untreated wood (may be consolidated in a designated laydown area)
- Non-hazardous non-burnable construction/industrial waste (drywall, roofing, plastics etc)

No food waste may be disposed of in any areas apart from designated secure dining, accommodation or administration areas. All food waste (including wrappers and recyclable drink containers) must be brought into the main dining area at the end of each shift for appropriate management and disposal of these wildlife attractants.

7.2.4 Waste Management Area

Bulky or non-routine wastes may be consolidated within designated waste management temporary storage and/or sorting areas as they are generated. These may include:

- Empty large containers (e.g. fuel drums, totes of lubricants, coolant, paints etc)
- End-of-life vehicles and equipment are to be stored in the designated 'bone-yard' area (pending reuse or to be salvaged for parts)
- Discarded large tires (e.g., those for ore trucks) will consolidated (pending use as roadside barriers)
- Contaminated soil, snow or water may either be sipped off site for appropriate remediation or disposal or may be land farmed on site.

All wastes will be segregated by type and stored as appropriate given their potential risks (e.g. wildlife attractants will be secured from wildlife, hazardous waste materials will be located in lined areas/spill containment).

Collection and management of recyclable materials may be expanded in future to include cardboard, paper and metals once off-site recycling options are confirmed, which will be determined based on the available markets and economic considerations. Recyclable materials will be baled and stored in a designated area until a sufficient volume is obtained to for transport.

7.2.5 Medical wastes

The handling of medical waste generated from the health centre and sharps collected in the residential, plant and administrative bathrooms is considered biomedical waste and will be managed in accordance with applicable territorial and federal guidelines under the HMMP.

7.3 LANDFILL OPERATION AND MAINTENANCE

Landfill operation will be performed under the guidelines referenced in Section 3. Landfills will be operated by trained personnel who will carry out regular inspections and monitoring of the facility.

Only authorized personnel may deposit material in the landfill to ensure that only permitted waste is deposited in the landfill. Permitted wastes are listed in Section 7.3.4 of the Plan. The landfill operator shall ensure the material being landfilled is inspected and that all tickets relating to incoming waste are maintained as described in the below section detailing records management.

The landfill is to be operated as an area-fill landfill within a WRSA. Waste is to be deposited in which are compacted and capped with waste rock. Ash meeting the testing requirements for disposal at the landfill should be placed within its' container, sewage and sewage sludge will also be landfilled within containers.

Compaction and covering of the waste will occur as needed and waste placement occurs in a limited area minimizing the size of the working face. Compaction is undertaken using 4 to 6 passes of a suitably sized bulldozer over the active area of the landfill, prior to the placement of a minimum of 300 mm of cover. Prior to placing additional lifts of waste, existing intermediate cover can be set aside and reused, where practical. Care is to be taken during compaction to ensure that containers of ash and sewage are not ruptured and that areas containing waste asbestos are not disturbed.

Asbestos may be deposited in the landfill according to the regulations outlined in the LWMP; however, prior to acceptance of asbestos at the landfill the Government of Nunavut is to be notified. The waste asbestos is to be placed in labelled bags and burial is to occur immediately, using a minimum of 500 mm of cover material and temporary signage placed to ensure it is not disturbed. Records are to be maintained detailing the location of the asbestos burial and shall include coordinates, photographs and volume. Permanent signage is to be placed in the area of the landfill to ensure it remains undisturbed.

Annual surveys will be undertaken to determine the volume of material placed within the landfill and assist in future planning of landfill cells during operation of the facility.

7.3.1 Permafrost Management

Landfills will be constructed within WRSAs and will be designed to ensure the maintenance and aggradation of permafrost, as noted in Section 6.1.2, as well as the operations methods described above. Full details on the WRSAs design, including measures in place to ensure permafrost is protected can be found in the Waste Rock Management Plan. The design of the waste rock storage areas (inclusive of the landfills) is for permafrost to aggrade back up and into the infrastructure. Waste rock storage areas (WRSAs) will be built up gradually in lifts allowing the permafrost to aggrade while the WRSAs are being built. Waste rock, and any landfill items, will be at ambient temperate when placed in the WRSAs; not at elevated temperatures capable of impacting the existing thermal regime.

Measures used to protect and promote aggradation of permafrost include: placement of WRSAs in areas covered in less than 2 m of overburden, preferential placement of the first layer waste rock during the winter to encapsulate the existing permafrost, building the WRSA in layers, laying landfill waste in 1 m thick layers which are compacted and capped daily, encapsulation of landfill cells with waste rock, placement of closure and capping layers. Final grades of the landfill will also be graded to a slope of 5% or greater, to minimize ponding and infiltration through the cover, and thus minimize permafrost or cover damage and leachate generation.

Thermal analysis of the WRSAs has been modelled for operations and after closure and is summarized in the Waste Rock Management Plan and the WRSA Design Report (Sabina 2017, Appendix F-3). Results indicate that freezeback of the WRSAs and associated landfills will occur within 2.5-5 years. Project landfills will be operated as a dry waste landfills of non-hazardous solid industrial wastes.

7.3.2 Leachate Management

The leachate from the landfill is anticipated to be of very low ionic strength (dilute) due to controls on materials to be placed in the landfill, and, as a result, site-specific landfill leachate management is not considered necessary.

In the event there is leachate from the landfill during periods of heavy rainfall or spring freshet, the runoff will be collected and addressed as outlined in the WMP and per Licence requirements. However, in the event that greater volumes of leachate or leachate with high ionic strength are found coming from the landfill, an investigation would immediately be undertaken to determine the cause. This could lead to changes in the configuration and/or management of the landfill to further limit water coming in contact with landfill materials and/or modify water management strategy in this area.

The WRSA will also have an annual seep survey complete during freshet (see the WMP).

Because the landfill will be located in an area covered by permafrost, deep groundwater contamination from landfill potential leachate is not anticipated.

7.3.3 Surface Water and Erosion Control

The slopes of the landfill will be constructed of waste rock and should not be subject to erosion. Should it prove necessary, surface water and erosion control will be incorporated into the landfill design. Final grades of the landfill will be graded to a slope of 5% or greater, to minimize ponding and infiltration through the cover, and thus minimize cover damage and leachate generation.

7.3.4 Waste Acceptable for Placement in Landfill

The following materials will be acceptable for disposal in the proposed landfill:

- plastic;
- wood;
- steel, copper, aluminum, iron;
- white goods; (major household electrical appliances)
- wire;
- bricks;
- fiberglass insulation;
- Paper and cardboard;
- fiberglass;
- ceramics;
- roofing;
- asphalt;
- concrete;
- Sewage sludge (in sealed drums);
- carpet;
- mattresses;
- wood;
- household alkaline and carbon zinc batteries;
- rubber;
- empty caulking tubes;
- hardened caulk;
- clothing;
- glass, including light bulbs (fluorescent bulbs will require special handling, see below for more details);
- waste Asbestos (see below for more details);
- small appliances (with batteries removed);
- gyproc;
- ash, provided it has cooled to 60 degrees Celsius or less and is in sealed drums;
- vehicles and machinery provided all liquids, grease, batteries, and electronics have been removed;
- treated soils from landfarm;

7.3.4.1 Waste Asbestos[2]

Waste asbestos includes any type of material with greater than 1 % asbestos by weight (GN 2011b). Asbestos that has been immersed or fixed in a natural or artificial binder or included in a manufactured product is not considered waste asbestos; it is considered a hazardous waste and will be disposed of accordingly. Waste asbestos can either be backhauled off-site for disposal in an approved facility or it can be landfilled. The following are guidelines for landfilling waste asbestos:

[2] It is unlikely that asbestos waste will result from mine operations. Sabina will avoid using asbestos wherever possible. For further details, see Sabina's Waste Rock Management Plan and Quarry and Borrow Pit Management Plan.

- immediate burial and cover with 0.5 m of cover material;
- bury where it will not be disturbed; and
- the location should be maintained on a map or diagram for future reference.

In addition to following the *Environmental Guideline for the General Management of Hazardous Waste* (GN 2010a), Sabina will adhere to the GN's *Environmental Guideline for Waste Asbestos* (GN 2011b). Before landfilling waste asbestos, Sabina will review the steps in this guideline with the GN.

All Government of Nunavut environmental guidelines publicly available and can be accessed online at http://env.gov.nu.ca/programareas/environmentprotection/legislation.

7.3.5 Waste Unacceptable for Placement in Landfill

Materials not listed in the previous section will be unacceptable for placement in the landfill, unless approved in writing by the Sabina Environment Department. These materials include the following:

- organic matter attractive to wildlife, including, food and dead animals
- food containers and wrappings, unless cleaned
- hazardous wastes including mercury, batteries, solvents, glues, ethylene glycol antifreeze, adhesives (except empty caulking tubes)
- electronics
- materials that can economically be recycled
- petroleum products, including materials contaminated with petroleum products
- expanded polystyrene

7.3.5.1 Fluorescent Lamp Tubes

Fluorescent tubes contain mercury phosphorus powder and traces of lead and cadmium, which are considered environmental contaminants under the Nunavut *Environmental Protection Act* (GN 2010b). The only disposal method for fluorescent tubes is through an approved hazardous waste recycling or disposal facility (GN 2003). Sabina followed the Government of Nunavut guidelines on *Mercury-Containing Products and Waste Mercury* (GN 2010b) and E*nvironmental Guideline for the General Management of Hazardous Waste* (GN 2010a). Waste having mercury will be sent to a certified waste management company for treatment, recycling, and/or disposal.

7.3.5.2 Ozone Depleting Substances

Ozone depleting substances include chlorofluorocarbons or halons. Common sources include refrigeration equipment, air conditioning equipment, motor vehicle air conditioners, and fire extinguishing equipment (GN 2011c). These materials are hazardous in nature; consequently, all disposal of ozone depleting substances will take place at an approved facility.

Any non-salvageable equipment containing ozone depleting substances will have the ozone depleting substances removed by a certified technician prior to disposal in the proposed landfill. The *Environmental Guideline for Ozone Depleting Substances* was followed by Sabina.

7.3.6 Maintenance

Waste material control tickets will be utilized as a material management tool and will be recorded for all material accepted at the final destination. The ticket will include information including the material source, type quantity and designated storage or disposal location of the material where it is delivered.

Regular maintenance is required, on an as-needed basis, of the following:

- Storage containers/areas;
- Equipment;
- Buildings;
- Fencing; and
- Service road to the landfill.

Regular inspections of the waste management facilities shall be carried out as per the LWMP and shall include waste collection, storage, processing, and final destination facilities.

7.4 BURN CAGE OPERATION AND MAINTENANCE

Open burning will be conducted within a burn cage to reduce risk of escape of larger cinders and is not undertaken on high wind days. Burning will only include the burning of cardboard, paper and wood which is not treated with preservatives. These materials may alternately be landfilled.

No plastics, wood treated with preservatives, electric wire, styrofoam, or asbestos will be burned.

Accumulated ash is periodically cleared out into drums for disposal in the landfill.

The burn cage is inspected for structural integrity and may be repaired or replaced as needed.

8. Environmental Protection Measures and Monitoring Program

Sabina is committed to general monitoring of any facility designed for the treatment of waste and or disposal of waste. A summary of general monitoring requirements is provided in the Environmental Management and Protection Plan.

Waste is directed to its final destination as indicated in Figure 2-1. Waste types, quantities, and location of disposal will be documented for all site wastes. Records of wastes landfilled and locations will be maintained, as well a burn log recording for each burn. Material tracking logs will be stored digitally and available for review by on-site personnel and inspectors on an as-needed basis.

LWMP monitoring includes:

- Visual inspections, as applicable, of the integrity of landfill cover, the effectiveness of containment/storage systems, the presence of litter and wildlife, and the appropriate separation of waste categories.
- Quantity (weight) and type of materials deposited in the landfill.
- Record of location of asbestos waste disposed of in the landfill.

In addition the above LWMP-associated monitoring, related waste management plans include additional monitoring activities, such as:

- Collection of samples and analysis of runoff quality (surface runoff or shallow groundwater seepage, as appropriate) downstream of the landfill.
- Testing of incinerator ash at an accredited off-sire laboratory to determine if it is suitable for landfilling.
- Inspections of the landfarm, records of soil and water management activities, and laboratory testing of soils and contact water.
- Testing of treated sewage effluent quality from the STP.

Sabina's Spill Prevention and Contingency Plan outlines measures to prevent and reduce the occurrence of spills, and for eliminating and ameliorating adverse effects to human health and the environment that may result from spills.

Internal audits and inspections are conducted as required by permit and other regulatory requirements on all components related to the LWMP. Appropriate personnel will perform regular inspections of the storage areas, landfarms and landfills to ensure that waste segregation and inventory are being undertaken correctly.

9. Environmental Reporting

Sabina will report on the volumes of waste generated and disposed of in the Annual Report for the Licence per Licence requirements.

The NWB will be notified of any modification associated with any planned changes to waste facilities as needed.

Updates to this Plan will be filed with the NWB and NIRB.

10. Adaptive Management

Monitoring will be the principal mechanism used to provide feedback on the effectiveness of environmental performance. Sabina will periodically assess waste streams to identify areas for improvement related to waste reduction, risk minimization, and waste categorization and segregation.

Sabina will retain all raw data records and annual reporting for at least two years in digital format. The updated LWMP, raw data, and annual reporting will be made available to the lands and waters inspectors, the NWB, and Environment and Climate Change Canada.

11. Reclamation

Final closure of the WRSAs and associated landfills is described in Sabina's Interim Closure and Reclamation Plan.

12. References

1985. *Hazardous Products Act*, RSC. C. H-3.

1985. *Territorial Lands Act*, RSC. C. T-7.

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

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

1988. *Public Health Act*, RSNWT (Nu). C. P-11.

1992. *Transportation of Dangerous Goods Act*, 1992, SC. C. 34.

1999. *Canadian Environmental Protection Act*, SC. C. 33.

Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations, SOR/2002-301.

Northwest Territories and Nunavut Mining Regulations, CRC, c.1516.

Territorial Land Use Regulations, CRC, C.1524.

Transportation of Dangerous Goods Regulation, SOR/2012-245.

Used Oil and Waste Fuel Management Regulations, NWT Reg. 064-2003.

AANDC (Aboriginal Affairs and Northern Development Canada). 2013. *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories*.

BGC. 2003. Implications of Global Warming and the Precautionary Principle in Northern Mine Design and Closure. Prepared for Indian and Northern Affairs Canada by BGC Engineering Incorporated: Calgary, AB.

Canadian Council of Ministers of the Environment (CCME). 2000. Canada-Wide Standards for Mercury.

Canadian Council of Ministers of the Environment (CCME). 2001a. Canada-Wide Standards for Dioxins and Furans.EC (Environment Canada). 2003. State of the Environment InfoBase, Environmental Indicator Series 2003. Available online: http://www.ec.gc.ca.

EC. 2010. Technical Document for Batch Waste Incineration. http://www.ec.gc.ca/gddmw/default.asp?lang=En&n=F53EDE13-1.

Ferguson Simek Clark Engineers and Architects. 2003. *Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the NWT*. Report prepared for the Department of Municipal and Community Affairs, Government of Northwest Territories, April 2003.

Government of the Northwest Territories. 1996. *Guidelines for the Preparation of and Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories*. Prepared by Diep Duong and Ron Kent, for the Department of Municipal and Community Affairs. October 1996.

GN. 2010a. *Environmental Guideline for General Management of Hazardous Waste*. Government of Nunavut, Department of Environment, Environmental Protection Service. http://www.nwb-oen.ca/sites/default/files/cms_uploads/techguides/Guideline%20-%20General%20Management%20of%20Hazardous%20Waste%20%28revised%20Oct%202010%29.pdf

GN. 2011a. *Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities*. Government of Nunavut, Department of Environment,

Environmental Protection Service. http://env.gov.nu.ca/sites/default/files/industrial_waste_discharges_2011.pdf.

GN. 2011b. *Environmental Guideline for Waste Asbestos. Nunavut Department of Environment, Environmental Protection Service*. http://env.gov.nu.ca/sites/default/files/waste_asbestos_2011.pdf.

GN. 2011c. *Environmental Guideline for Ozone Depleting Substances. Nunavut Department of Environment, Environmental Protection Service*. http://env.gov.nu.ca/sites/default/files/ozone_depleting_substances_2011.pdf.

GN. 2012. *Environmental Guideline for the Burning and Incineration of Solid Waste*. Government of Nunavut, Department of Environment, Environmental Protection Service. http://env.gov.nu.ca/sites/default/files/guideline_burning_and_incineration_of_solid_waste_2012.pdf.

MVLWB (Mackenzie Valley Land and Water Board). 2011. *Guidelines for Developing a Waste Management Plan*. March 31, 2011. Available at: http://mvlwb.com/sites/default/files/documents/MVLWB-Guidelines-for-Developing-a-Waste-Management-Plan-Mar-31_11-JCWG.pdf.

Nunavut Impact Review Board (NIRB). 2013. Guidelines for the Preparation of an Environmental Impact Statement for Sabina Gold & Silver Corp.'s Back River Project. NIRB File No. 12MN036).

NWB (Nunavut Water Board). 2010a. Mining and Milling Supplemental Information Guideline (SIG) for Mine Development (MM3). February 2010.

NWB. 2010b. Miscellaneous Supplemental Information Guideline (SIG) for General Water Works (including crossings, flood control, diversions, and flow alterations) (M1). February 2010.

Sabina. 2017. Revised Type A Water Licence Application for Sabina Gold & Silver Corp. Back River Project. Submitted to the Nunavut Water Board. October 4, 2017.