



## **BACK RIVER PROJECT**

**Water Licence 2AM-BRP1831**

**Part D, Item 3**

**Rascal Diversion Berm Detailed Report**

**August 2020**

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# 1. Introduction

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During the Type A Water License process for the Back River Project (the Project), Sabina Gold & Silver Corp. (Sabina) proposed the combination of a berm, to redirect some water flowing from the upstream reaches of Rascal Lake, and a culvert crossing under the Goose Property All-weather Airstrip to allow some water to flow to the southern reaches of Goose Lake. At the time, the rationale for the splitting of water was to allow for adequate fish passage in the Gander Pond and Rascal Lake area while still allowing some water to travel the historic paths as normal.

After further discussion with the Department of Fisheries and Oceans Canada (DFO), Sabina is proposing to divert all water to support fish access to Gander Pond and upstream Rascal Lake. A berm, called the Rascal Diversion Berm, is required to direct flow from Rascal Lake towards Rascal Stream West (RSW) and Gander Pond; this berm will also direct flow away from Rascal Stream East (RSE) and the Goose Property Airstrip. As noted, a culvert crossing was previously proposed under the Goose Property Airstrip. Sabina now believes the Rascal Diversion Berm will more appropriately support the Rascal Stream Fishway during Project's Construction and Operations phases. The Sabina's Fish Offsetting Plan (FOP; June 2019) proposed the establishment of the Rascal Stream Fishway at the Goose Property to support fish access to Gander Pond and the upstream Rascal Lake.

Diversions are typically designed to divert the design storm peak flows downstream and away from or around earthworks infrastructure. The design of Goose Property diversions was first considered in the Project Feasibility Study, completed in 2015, and since then additional checks and modifications have been completed, with the focus in 2020 to look at constructability of past feasibility-level designs.

As part of the 2020 work, terrain and permafrost considerations in the Rascal Stream area were reviewed, and various options for these water conveyance structures were re-examined. This re-examination was supported by both desktop studies and from inspections completed by Sabina at site. This report outlines the hydrologic methods and assumptions.

Sabina has been engaged with DFO on the design of the Rascal Diversion Berm and the Rascal Stream Fishway since early July 2020. All recommendations by DFO have been included in the attached design, and Sabina anticipates final DFO approval on or before August 31, 2020.

The text below describes the Rascal Diversion Berm location and associated access infrastructure. Drawings for the Rascal Diversion Berm can be found in Appendix A. The construction of this berm and associated access infrastructure is planned to commence in Q4 of 2020 or Q1 of 2021.

## 2. Rascal Diversion Berm

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The Rascal Diversion Berm Report has been laid out to address each of the requirements of Part D, Item 3 of Sabina Gold & Silver Corp's (Sabina's) Back River Project Type A Water Licence (2AM-BRP1831). For ease of comparison, each subheading corresponds directly with the identically alphabetized subheading of Part D, Item 3 of Water Licence, 2AM-BRP1831.

### A. DESIGN RATIONAL, REQUIREMENTS, CRITERIA, PARAMETERS, STANDARDS ANALYSIS, METHODS, ASSUMPTIONS AND LIMITATIONS

As outlined in the hydrological analysis completed for the 2015 Feasibility Study, and based on the collected hydrometric data at that time, the area around the Rascal Diversion Berm is projected to have 1 in 100-year peak flows in the range of 18.8 m<sup>3</sup>/s. The current Rascal Diversion Berm design is based on a minimum 2.5-m thickness of fill to ensure that headwater depths can be accommodated while the flows are conveyed, and to provide adequate thermal protection to the underlying permafrost foundation. In areas where bedrock is encountered in the field, or if containment for flows can be provided by the natural sloping topography in the area, then the thermal protection thickness of 2.5 m may be reduced. Generally, construction plans and access to this site will be completed with the intent to limit potential permafrost degradation.

The Rascal Diversion Berm will also act as a fish barrier, in addition to conveying flows towards the Gander Pond, and ultimately, out through Rascal Creek to Goose Lake. Additional details on the Golder Associates Ltd. (Golder) fish passage evaluation, mitigation, and proposed monitoring for the Rascal Stream Diversion can be found in the reference below.

*Golder Associates Ltd. 2020. Fish Passage Evaluation, Mitigation, and Monitoring for the Rascal Stream Diversion. Technical Memorandum prepared for Sabina Gold and Silver Corp. Golder project number 8114181-062-TM-RevA. June 2020.*

Golder has also completed additional hydrologic calculations related to the Rascal Stream in the reference above, specifically in terms of flow velocity estimates, and average water depths that are suitable for fish passage.

### B. SITE SPECIFIC DATA AND ANALYSIS TO SUPPORT THE DESIGN AND MANAGEMENT DECISIONS

The area is generally mapped as glacial till, which is typically expected to have a higher sand content. The depth of the active layer around the Rascal Diversion Berm area is expected to range from around 1.2 to 1.9 m deep, with permafrost temperatures ranging between -5°C to -8°C.

The Rascal Diversion Berm is located southeast of the existing Goose Property Airstrip; in this area, flows travel to the north-northwest as well as to the east along local topographic lows. The drainage appears to be dominated by boulders and vegetation, and in some of the lower areas shows evidence of being quite ice rich, based on desktop geomorphologic reviews. Eastward flows have been noted by Sabina site staff to travel a short distance subsurface through broken rubble and boulders before reappearing in the established creek channels. The Rascal Diversion Berm is planned to be constructed upslope and upstream of this 'subsurface' flow area to best capture and direct flows towards Gander Pond. Field observations at the time of construction will be completed to verify that the diversion alignment is placed to best divert flows.

The area downstream of the proposed Rascal Diversion Berm has been noted to be poorly drained terrain, which aligns with the possibility of ice-rich material around this area. Ice-wedges can be inferred to the east in similar terrain, which is consistent with other areas of site. A small thaw bulb (talik), which is anticipated to freeze back in late winter, is expected to be present beneath the existing creek alignment in areas downstream of where flows will be diverted by this berm. The Rascal Diversion Berm is therefore planned to be constructed further upslope from the top of the main creek channel to limit the potential effects from these features. Additional details on the diversion layouts are provided in Appendix A.

### C. GEOCHEMICAL ANALYSIS OF WASTE ROCK AND FILL, DEMONSTRATING THEIR ACID ROCK DRAINAGE AND METAL LEACHING CHARACTERISTICS

Sabina is committed to using only non-potentially acid generating (NPAG) rock for the construction of the Rascal Diversion Berm. A summary of acid rock drainage (ARD) and metal leaching characteristics for potential quarry rock and waste rock sources is provided below, along with the associated geochemical segregation criteria and requisite confirmatory sampling. Additional information can be found in the Type A Water Licence (2AM-BRP1831) associated documentation: Borrow Pits and Quarry Management Plan (QMP; 171002 2AM-BRP----SD03-BorrowQuarryMgmtPlan-IMLE), Mine Waste Rock Management Plan (WRMP; 171002 2AM-BRP----SD08-MineWasteRockMgmtPlan-IMLE), Environmental Management and Protection Plan (EMPP; 171002 2AM-BRP----SD20-EMPP-IMLE), and Geochemical Characterization Report (Main Application Document [MAD] Appendix E-3).

#### C.1 Quarry Rock at the Goose Property

Detailed geochemical characterization studies to assess the metal leaching (ML) and acid rock drainage (ARD) potential of quarry and waste rock sources at the Goose Property was carried out as part of the Final Environmental Impact Statement. Over 700 samples from the Goose Property were analyzed, including acid base accounting (ABA) and trace element analyses, during this characterisation study; details of this sampling program and the subsequent results can be found in the Geochemical Characterization Report (MAD Appendix E-3).

Sabina has identified multiple appropriate NPAG material sources at the Goose Property, including the Airstrip Quarry, Goose Plant Site, as well as others. For any potential quarry source, Sabina will adhere to the same geochemical criteria, sampling requirements, and reporting commitments outlined below.

Consistent with the waste rock classification criteria in the WRMP, the criteria that will be used to classify NPAG material to be used for construction from any quarry source will be an neutralization potential/acid generation potential (NP/AP) ratio of greater than 3, or a sulphur content of less than 0.15% (Table C-1). The classification criteria presented below is supported by the results of ABA, net acid generation (NAG) testing, and kinetic testing, and provides an appropriate level of conservatism; additional details on these testing programs and criteria rationale described in the Geochemical Characterization Report (MAD Appendix E-3).

**Table C-1: Site-Specific Geochemical Classification Criteria**

Acid Generation Potential	Criteria	Comments
Non-Potentially Acid Generating	NP/AP > 3 or total S < 0.15%	These samples are not expected to generate acidity
Potentially Acid Generating	NP/AP < 3	Potentially acid generating or uncertain acid generation potential owing to uncertainty in availability and reactivity of bulk NP

As stipulated in the Project Certificate Terms and Conditions, Sabina will develop site-specific quarry operation and management plans in advance of the development of any potential quarry site or borrow

pit (PC No. 007, TC#16). This plan will be submitted to the Nunavut Impact Review Board (NIRB) and the Kitikmeot Inuit Association (KIA) at least 30 days prior to the use of borrow or quarry sites for review. Information regarding Sabina's fulfillment of this Term and Condition and the identification of any amendments to existing site-specific quarry operation and management plans will also be provided annually in Sabina's annual report to the NIRB. In addition, Sabina will continue to provide site-specific quarry operation and management plans to the NIRB and the KIA at least 30 days prior to the use of borrow or quarry sites for review. Any amendments to existing site-specific quarry operation and management plans shall be provided in Sabina's annual report to the NIRB.

## **C.2 Quarry Monitoring**

The following quarry monitoring activities will be completed during construction to verify the effectiveness of the geochemical segregation criteria outlined in Table C-1:

- Quantities of the NPAG quarry rock produced during quarry operations, and the amounts placed in each of the infrastructure components will be recorded on a daily basis and a monthly summary will be provided in the Annual Report. Quantities of PAG excavated and deposited in the WRSAs will also be recorded.
- Geochemical monitoring will be completed to confirm that all of the quarry rock used for construction is NPAG. Confirmatory samples will be taken at a rate of one sample per 100,000 tonnes of mined material from NPAG areas within the quarries. The collected samples will be sent to an accredited commercial laboratory for ABA tests (with NP determination using the Modified Sobek method) and NAG tests.

Quarry development and results of sampling will be provided in summary form will be reported to the Nunavut Water Board (NWB) through the Water Licence Annual Report (2AM-BRP1831, Schedule B). Additional details on quarry monitoring are outlined in the QMP, and details on other water monitoring related to the quarries are included in the EMPP.

## **D. CONSTRUCTION METHODS AND PROCEDURES REGARDING HOW INFRASTRUCTURE WILL BE PUT IN PLACE, INCLUDING QUALITY ASSURANCE AND QUALITY CONTROL MEASURES AND EQUIPMENT TO BE USED**

Engineered Drawings (RB-01, and RB-02) for the Back River Project Rascal Diversion Berm can be found in Appendix A; construction methods and procedures are outlined in the bulleted design consideration section of these drawings.

## **E. TECHNICAL SPECIFICATIONS FOR SEDIMENTATION, EROSION CONTROL AND BANK STABILIZATION MEASURES, INCLUDING PROPOSED MATERIALS, LOCATION AND EXTENT, PLACE METHODS AND QUANTITIES REQUIRED**

The following management and mitigation measures will be adhered to during the construction of the Rascal Diversion Berm; refer to the Type A Water Licence Road Management Plan (171002 2AM-BRP---SD02-RoadMgmtPlan-IMLE) for additional details.

### **Mitigation by Erosion and Sediment Control**

- The area of landscape disturbance will be minimized, and restoration will occur as soon as possible in order to minimize erosion potential.
- Silt fences will be used in areas of cuts and excavations, downslope from exposed or erodible areas to prevent sedimentation of waterbodies.

- Effective erosion and sediment control measures will be installed before starting work to prevent sediment from entering the waterbody.
- Site isolation measures (e.g., silt boom or silt curtain) will be used to contain suspended sediment where in-water work is required.
- Regular inspection and maintenance of erosion and sediment control measures and structures will be conducted during the course of construction.

#### Mitigation by Shoreline/bank re-vegetation and stabilization

- Clearing of riparian vegetation will be kept to a minimum to avoid disturbance to the riparian vegetation and prevent soil compaction.
- If replacement rock reinforcement/armouring is required to stabilize eroding or exposed areas, appropriately-sized, clean rock will be installed at a similar slope to maintain a uniform bank/shoreline and natural stream/shoreline alignment.
- Exposed landscape surfaces will be protected, where possible, by the installation of covering material like riprap, aggregate, or rolled erosion control products.
- Decommissioning of the roads will involve restoring natural drainages, and stabilizing any slopes where there is potential for erosion; stabilization measures may require pulling back of side-cast fills on locally steep slopes or buttressing and/or re-contouring of steepened slopes using non acid generating material.

#### Mitigation by Operation of Machinery

- All heavy machinery used during construction will stay above the high-water mark to the greatest extent possible.
- Temporary crossings may be utilized if necessary to limit fording of watercourses.
- All machinery will arrive on site in a clean condition and maintained free of fluid leaks, invasive species, and noxious weeds.
- All fueling will be done away from watercourses and water bodies, and a spill protocol will be in place.

Following the installation of the berm and access infrastructure, inspections and monitoring will be performed prior to, and during, the spring freshet. Inspections will include daily visual assessments of ice blockages prior to the spring freshet, followed by visual assessments for erosion and sedimentation for the duration of the spring freshet. For areas of construction that interact with fish-bearing waters, turbidity levels will be monitored weekly during spring conditions or periods of high flow for the first year of operation of crossing structures.

### **F. TIMETABLE FOR SUBMISSION, INCLUDING DATE OF CONSTRUCTION AND PROPOSED DATE OF COMMISSIONING OF INFRASTRUCTURE; AND**

Construction of the Rascal Diversion Berm and associated access infrastructure is planned to occur in Q4 of 2020 or Q1 of 2021, and the berm will take approximately 2-3 weeks to complete construction through commissioning.

Sabina will submit to the NWB for review, within ninety (90) days of completion of the Rascal Diversion Berm, a Construction Summary Report prepared by a qualified Engineer(s) in accordance with Schedule D, Item 1 of the Type A Water Licence (2AM-BRP1831).

**G. WHERE REQUIRED, SIGNATURE AND SEAL BY THE APPROPRIATELY QUALIFIED ENGINEER.**

Engineered Drawings (RB-01, and RB-02) for the Back River Project Rascal Diversion Berm can be found in Appendix A.



## **Appendix A Rascal Diversion Berm Drawings**

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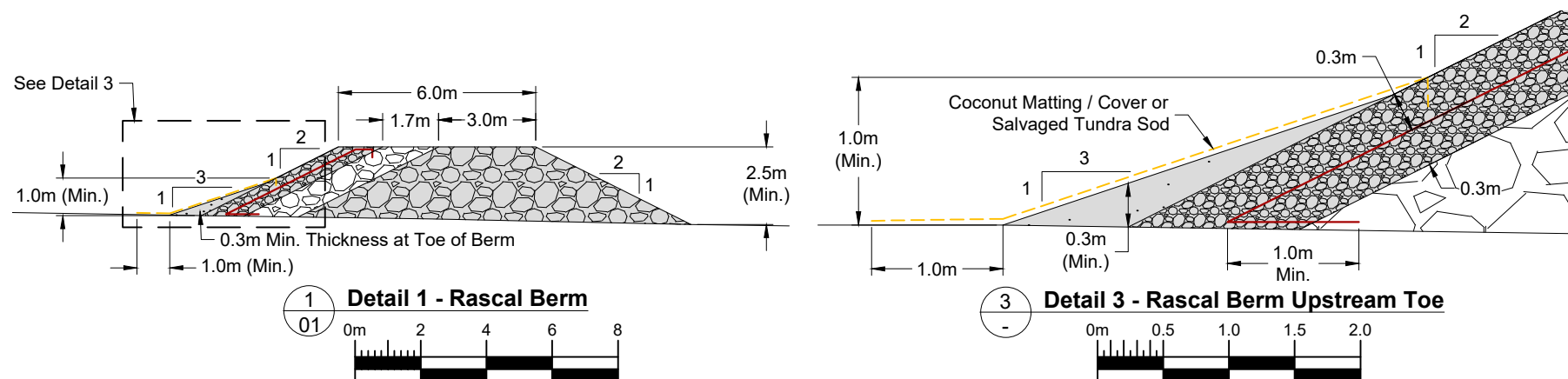
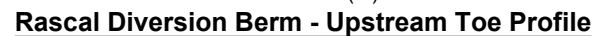
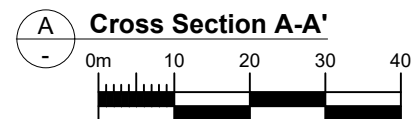
# Engineering Drawings for the Echo and Airstrip Diversion Berms Back River Project, Nunavut, Canada

ACTIVE DRAWING STATUS

SRK DWG NUMBER	DRAWING TITLE	REVISION	DATE	STATUS
RB-01	Rascal Diversion Berm Plan	0	August 18, 2020	Issued for Permit
RB-02	Rascal Diversion Typical Details and Profiles	0	August 18, 2020	Issued for Permit







- a. QC and QA documentation confirming that the material specification has been followed and met. This would include manufacturer certificates for all the non-woven geotextile material, QC documentation and photos of all geotextile seams, manufacturer certificate for each geotextile and coconut matting roll, QC material testing for all crush (bedding) materials, testing on any overburden material placed over the upstream berm toe; as per the site Technical Specifications.
- b. As-Built survey information for all layers and components of the design (i.e. survey data for original ground, stream centerline and
- c. banks, bedding, overburden, all geotextile and coconut matting corners and overlaps, ROQ and surfacing / bedding layers.
- d. Survey information for the as-built placed volumes as well as daily truck load counts.
- e. Engineer site supervision during construction. This would consist of at least one site visit during construction, ideally done around the time fill is being placed in and immediately around the creek/ channel segments that pass through the diversion berms, and photos from the Client and Contractor throughout the entire construction of the Rascal and Airstrip Diversion Berms (on at least a daily basis when construction is progressing around this area).

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