

APPENDIX B SALINE WATER MANAGEMENT PLAN



GOOSE MINE

SALINE WATER MANAGEMENT PLAN V.4.0

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DOCUMENT DETAILS

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1	June 2018	N/A	Addition of Appendix C: Saline Water Management
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3	October 2020	N/A	Submitted as a Supporting Document for the Type A Water Licence Amendment Application to the Nunavut Water Board (NWB).
4	June 2026	N/A	Updated to reflect changes in operations in WRSAs and stockpiles, removal of TSF WRSA, updated geochemical criteria for some deposits, and minor adjustments to roles and responsibilities; submitted to the NWB.

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ACRONYMS AND ABBREVIATIONS

Acronym	Definition
B2Gold Nunavut	B2Gold Back River Corp.
CCME	Canadian Council of Ministers of the Environment
MDMER	Metal and Diamond Mining Effluent Regulations
NIRB	Nunavut Impact Review Board
NWB	Nunavut Water Board
Project	Goose Project
Sabina	Sabina Gold & Silver Corp. (previous Licensee)
RO	Reverse Osmosis
SWMP	Saline Water Management Plan
SWP	Saline Water Pond
TF	Tailing Facility
WMP	Water Management Plan

1. INTRODUCTION

The Goose Project is a gold project owned and operated by B2Gold Back River Corp. (B2Gold Nunavut), formerly Sabina Gold and Silver Corp. (Sabina), within the West Kitikmeot Region of southwestern Nunavut. Additional details on the Goose Project location are provided in the Water Management Plan (WMP).

The Saline Water Management Plan (SWMP or the Plan) is developed as an appendix to the Water Management Plan (WMP) to provide additional details related to the management of saline groundwater at the Goose Mine in compliance with the Type A Water Licence, 2AM-BRP1831 Amendment No. 1.

The SWMP outlines the procedures required to manage the quantity and quality of saline groundwater interacting with Project components throughout the mine life, and characterization of saline water inflows into the underground mine workings and the Llama Open Pit. The SWMP also includes monitoring of thermal conditions, monitoring of saline water at the Goose Mine, mitigation measures designed to address the potential for higher-than-predicted volumes of saline water inflows into the open pits and the underground mine, and potential water treatment and disposal methods.

2. SCOPE AND OBJECTIVES

The SWMP is provided as an addendum to the WMP with the objective of further detailing the saline water management strategies and designs for the Project, including considerations about contingencies, monitoring, and potential adaptive management strategies. The SWMP applies to all phases of the Project during which saline water will be managed. The SWMP has been written to meet requirements of the Project Certificate (No. 007) as well as Part B, Item 13m of the Type A Water Licence (2AM-BRP1831 Amendment No. 1).

The purpose of the SWMP is to:

- ◆ Outline procedures and processes specific to management of saline water through all phases of the Project, as proposed in the WMP;
- ◆ Summarize designs of infrastructure dedicated to management of saline water;
- ◆ Meet relevant laws and regulations;
- ◆ Detail mitigation (adaptive management) strategies to manage potential adverse environmental effects; and
- ◆ Define steps that will be taken to monitor potential mitigation measures for success.

The WMP incorporates strategies for saline water management that allow full containment of saline water within the Project site throughout the various phases of the Project. Additional details related to the closure and reclamation of saline water management structures can also be found in the Interim Closure and Reclamation Plan (2AM-BRP1831 Amendment No. 1 Part J, Item 1).

The SWMP, as part of the WMP, will be updated as needed to reflect changes in operations and technology. Any updates will be submitted as an addendum to the Annual Report in accordance with the NIRB Project Certificate (PC No. 007), or as directed by the NIRB (NIRB 2020). Any further revisions will be subject to the direction of the NWB following regulatory review of the amendment application.

The SWMP is divided into the following sections:

- ◆ Applicable Legislation and Guidelines (Section 3);
- ◆ Saline Water Management Strategy (Section 4);
- ◆ Monitoring and Reporting Program (Section 5);
- ◆ Quality Assurance/Quality Control Procedures (Section 6);
- ◆ Adaptive Management (Section 7); and
- ◆ Reclamation (Section 8).

2.1 RELATED DOCUMENTS

The SWMP should be read in conjunction with the following key plans, which have been approved for implementation by the NWB in accordance with the Type A Water Licence, 2AM-BRP1831 Part B, Item 13 and Item 15. Additional documents and studies that support the SWMP has also been listed.

- ◆ Water Management Plan (Part B, Item 13q);
- ◆ Environmental Management and Protection Plan (Part B, Item 13c);
- ◆ Aquatic Effects Management Plan (Part B, Item 13a);
- ◆ Quality Assurance/Quality Control Plan (Part B, Item 14a);
- ◆ Interim Closure and Reclamation Plan (Part B, Item 13g);
- ◆ Hydrogeological Characterization and Modelling Report (Sabina 2017, Appendix F-5);
- ◆ Hydrology Report (Sabina 2015, Appendix V2-7B); and
- ◆ Water and Load Balance Report (Appendix C of the WMP).

3. REGULATORY REQUIREMENTS AND COMMITMENTS

Specific legislation, regulations, and guidelines related to water management in Canada, and specifically within Nunavut, that B2Gold Nunavut will have to comply with are also summarized in Table 3-1.

The Project is also bound by the requirements of the Back River Project Certificate, No. 007, the Type A Water Licence, 2AM-BRP1831, and various permits, including the land use permits issued by the Kitikmeot Inuit Association for Inuit Owned Land.

4. SALINE WATER MANAGEMENT STRATEGY

As defined in the WMP, saline water for the Project is the groundwater that flows into Llama Open Pit (only pit located within a through talik) and the underground workings (Figure A-01 of the WMP). A small volume of brine water may be used for drilling in the underground mine workings. This brine water would be recirculated during drilling as much as feasible, with any excess managed synonymously with other saline water from the Project as described below.

This section provides a description of the saline water management strategy throughout the Construction, Operations, and Closure phases of the Project. In summary, the saline water management strategy consists of collecting saline water from Llama Open Pit and the underground mine workings, and temporarily storing this saline water in a dedicated storage facility until it can be pumped into the exhausted Goose Main Open Pit and/or the mined-out underground workings.

The Construction phase for the Project has been completed. No saline water was encountered in any of the activities conducted during the Construction. The brine used for drilling during the Construction phase was managed locally and recirculated. Additional details are available in the annual reporting. The Construction phase is not further discussed in this document.

4.1 PERMAFROST CHARACTERISTICS AND GROUNDWATER INFLOWS

The Goose Mine is located in the continuous permafrost region of the Canadian Arctic. While permafrost may extend in excess of 400 metres below the ground surface (mbgs), it is expected that some of the underground development will extend below this depth into unfrozen rock and soil. In addition, Llama Open Pit will be located within a through talik underneath Llama Lake.

As part of the Project, a groundwater model was completed to predict potential groundwater inflows during mining at the Goose Mine; this model was employed in both the Final Environmental Impact Statement (FEIS) (Sabina 2015) and the Type A Water Licence Application (Sabina 2017). The last groundwater model update to predict revised groundwater inflows was completed in 2022 as part of the 2020 Modification Package (WSP Golder, 2022). For the purpose of the update of the WMP presented herein, the predictions of groundwater inflows included in WSP Golder (2022) were scaled to reflect the updated mine schedule and depth of mine openings (Appendix C of the Water Management Plan). A summary of the estimated annual groundwater inflows is summarized in in Table 4.1-1 for the developments extending into unfrozen rock. The estimated concentrations of dissolved solids in the groundwater flows are provided in Appendix C of the Water Management Plan.

At the Goose Mine, groundwater modelling and analysis determined that inflows are expected from Llama Open Pit, and all of the undergrounds. Llama open pit mining will be developed below Llama Lake within a through talik that is connected to the groundwater system. It is also expected that Umwelt, Llama, Echo, and Goose underground workings will intercept the groundwater system below the basal permafrost layer. The remaining developments (Umwelt Open Pit, Echo Open Pit, and Goose Main Open Pit) are not expected to have notable groundwater inflows.

Groundwater inflows predicted by the groundwater model and the scaling presented in Appendix C of the Water Management Plan (WMP) considered the uncertainty in the assumed hydraulic properties for the bedrock based on the field investigation program results. The Scenario 1 of the groundwater inflows (Appendix C, WMP) was used as the base case for the Water and Load Balance Model (Appendix C, WMP). A sensitivity analysis of the Water and Load Balance Model was completed considering Scenario 2 groundwater inflows. The model sensitivity results showed that the proposed saline water management strategy would remain suitable for the Project.

Table 4.1-1. Goose Mine Groundwater Inflows

Mine Year	Predicted Groundwater Inflow (m ³ /day)				
	Umwelt Underground	Llama Open Pit	Llama Underground	Echo Underground	Goose Main Underground
Y1	0	n/a	n/a	n/a	n/a
Y2	130	75	n/a	n/a	n/a
Y3	160	<50	n/a	n/a	n/a
Y4	160	<50	0	n/a	n/a
Y5	170	<50	120	n/a	n/a
Y6	170	<50	110	n/a	n/a
Y7	160		160	n/a	n/a
Y8	140		160	<50	10
Y9	130		170	<50	50
Y10	130		160	<50	<50
Y11	130		160	<50	<50
Y12			160	<50	<50
Y13				<50	<50

4.2 SALINE WATER MANAGEMENT STRATEGY AND ASSOCIATED CONTROL STRUCTURES

B2Gold Nunavut recognizes that there is a chance that groundwater flow in the mine workings may be dominated by specific fractures or features that are intercepted. This uncertainty exists for all mining projects and is never completely alleviated, which is the reason why structural geology and hydrogeology data are regularly collected from mining operations. The influx of groundwater into a mine is a normal and well understood phenomenon and is regularly managed by standard operating procedures in operating mines. B2Gold Nunavut is aware of the uncertainty related to fault zones and will take advanced actions where feasible to help safely and appropriately manage groundwater inflows reporting to the mine workings. These actions may include use of surface and underground exploration information to identify enhanced permeability that may be intercepted by the mine workings, advancing cover and probe drilling (i.e., exploration drainage holes), and interpretation of groundwater pressure and inflow data when high permeability formations are encountered.

A series of options to manage saline water as it reports to the mine workings was identified and assessed during the development of the WMP. These options included, but were not limited to, physical barriers to cut off inflow, temporary and/or permanent storage in dedicated storage facilities, and an array of pumps and sumps to collect and transfer saline water. Potential saline water management options are listed in order of preference (from most preferred or applicable to least preferred or applicable) in Table 4.2-1, along with a discussion of the applicability of each option given the current mine plan.

Table 4.2-1. Saline Water Management Options Considered

Management Option/Location	Discussion of Applicability
Exhausted open pits (Umwelt, Llama, Echo, Goose Main)	A possible option if the future pit lake could be managed to support meromictic conditions, resisting turnover due to pit lake geometry, and therefore unlikely to result in a discharge of saline water to local freshwater streams. Currently, Goose Main Open Pit is expected to be developed as meromictic, but depending on the developing mine plan, all pits could be considered for the possibility of temporary or permanent saline water storage. In-pit tailings disposal in all pits would be prioritized over disposal of saline water. The use of exhausted open pits, along with mined-out underground workings, provide the most suitable permanent saline water disposal locations; however, the timing of saline water discharges, relative to the availability of the pits as permanent storage, may not match.
Closed U/G workings (Umwelt or other underground workings)	A possible temporary or final disposal option. It is noted that underground workings are the main source of saline water and could not be used for disposal until mining is completed. The use of mined-out underground workings, along with exhausted open pits, provide the most suitable permanent disposal locations; however, the timing of saline water discharges, relative to the availability of the underground workings as temporary or permanent storage, may not match.
Modified natural containment area (Llama Lake or Umwelt Lake)	A modified natural containment area (for example, Llama or Umwelt lakes) could be suitable as a temporary saline water storage area and could be used for permanent saline water storage as long as any overflow meets appropriate discharge criteria. A modified natural containment area is technically feasible and economically viable. Impacts to fish

Management Option/Location	Discussion of Applicability
	<p>and fish habitat for use of Umwelt Lake and dewatering of Llama Lake have already been assessed (refer to the Back River Project Fisheries Act Authorization for details). No additional impacts to fish or fish habitat would be realized as a result of using Llama or Umwelt lakes as modified natural containment areas. Llama Lake would provide significant storage capacity for saline water with limited need for containment structures. However, the development of Llama Open Pit makes this option unsuitable. Current water management planning identifies Umwelt Lake as the Saline Water Pond; it is the preferred temporary saline water storage area and will be used for temporary saline storage in early years of the Operations Phase. Throughout the rest of the Operations Phase, the Saline Water Pond will provide contingency storage for saline water if inflow volumes are greater than anticipated.</p>
<p>Tailings Storage Facility / Tailings Facility (any mined-out open pit)</p>	<p>Supernatant pond water from the active Tailings Facility (TF) will be reclaimed for the Process Plant. The Process Plant cannot easily tolerate the expected high salinity levels in the saline water, and as such, storing saline water in the active TF is not the preferred option. However, saline water may be sufficiently diluted in the supernatant pond to temporarily provide storage for limited periods (i.e., months), if required, and not upset the process. In addition, if the groundwater is of better quality than currently predicted, or salinity tolerances in the Process Plant are higher, saline water could be permanently stored with the supernatant pond. Once a TF is no longer used for Process Plant reclaim (i.e., tailings deposition moved to the next TF), the facility could be used to store saline water as long as an appropriate freshwater cover was maintained over existing tailings, and discharge criteria are met for overflows.</p>
<p>Man-made surface containment ponds</p>	<p>Similar to the modified natural containment area, man-made surface containment ponds could be constructed (or a current water management pond could be utilized) to temporarily or permanently store saline groundwater; this would be at a higher (than other options) cost and could increase the footprint of the surface disturbance within the Goose Mine. The man-made surface containment ponds would be designed and constructed to avoid additional impacts to fish or fish habitat.</p>
<p>Local watercourses following treatment</p>	<p>Saline groundwater could be processed in a reverse osmosis (or similar) water treatment process for discharge to the environment. Saline water treated to meet effluent discharge criteria acceptable to the NWB could be released to a local watercourse. However, such treatment produces a small volume of high salt brine that would require management and disposal.</p>
<p>Transport and disposal to Bathurst Inlet</p>	<p>Should on-site storage volumes be insufficient, saline water, or high salt brine from reverse osmosis treatment, could be transported to Bathurst Inlet and discharged via a diffuser. Should this option be required it is noted that significant additional regulatory requirements (including MDMER) may be required.</p>
<p>Physical barriers to cut off groundwater inflow</p>	<p>Current data suggest that permafrost and tight ground conditions will limit the volume of inflows. Use of physical barriers to cut off groundwater inflows prior to it reporting to the mine workings is a high cost measure, especially if used on a large scale, and is therefore not the preferred option for the Project. However, this option will be considered as an adaptive management measure to mitigate local, higher than expected inflows, if encountered.</p>

The availability and applicability of the above options depend upon a number of factors, including timing (when the saline water will be generated relative to when the appropriate storage location is available), actual Project development schedule, the need for prioritizing the disposal of tailings over saline water, and the fact that, unlike solid mine wastes such as tailings or waste rock, saline groundwater can be temporarily stored more easily as it can be moved (i.e., pumped) to its final disposal location with relative ease.

Should contingency measures for saline water storage in open pits or other above-listed storage locations be identified (other than what is currently captured in the mine plan), B2Gold Nunavut intends to provide the NWB at least 60 days' notice prior to implementation with the following: water disposal volumes, disposal timing, maximum pit/storage capacity, effects to pit closure, and appropriate mitigation and monitoring plans.

4.3 SALINE WATER POND DESIGN CRITERIA

The Saline Water Pond (SWP), in the former Umwelt Lake, was selected as the preferred alternative for the temporary storage of Project saline water before permanent storage capacity becomes available in Goose Main Pit, transitioned to Goose Main Reservoir.

The SWP is proposed to be constructed stages, as described in the WMP. The Stage 1 will have one containment dam located on the south end of the Umwelt Lake basin (WMP Figure A-01). The Stage 2 will have a second containment dam extending towards the Primary Pond. Additional details are provided in the WMP.

The design event for the containment structures was defined based on a qualitative assessment of the risk level associated with overtopping or breaching of the structure. The SWP Containment Dam was assigned a "high risk" classification based on the consideration that discharge from these structures in the unlikely event of an overtop/breach would be directly into the environment; this consideration is consistent with overall Project design criteria.

In 2018, Sabina (now B2Gold Nunavut) completed a geotechnical drill program at the Goose Mine that included field characterization at the SWP location at that time (which has now been updated). The findings from this drilling program and additional field characterization studies that will be completed in 2025 have been used to support the final design of the SWP. Further characterization, in the form of drilling and field percolation testing, will be carried out immediately prior to construction of the various stages of the SWP. The information from the field characterization will verify that the design meets the required intent of full containment of the saline water and will inform B2Gold Nunavut on the need for implementation of additional measures to provide containment of saline water. Information, including geological cross sections, collected in support of final designs of the infrastructure, will be provided to the NWB, and any additional information relevant to the design gathered during construction will be documented in the as-built drawings for the facility.

4.4 EXISTING GROUNDWATER MANAGEMENT CONTROL STRUCTURES

There are currently no existing groundwater management control structures in place at the Project.

4.5 SALINE WATER MANAGEMENT SCHEDULE

Table 4.5-1 outlines the timeline for key saline water management activities, including tasks and facilities. A detailed Mine schedule for overall mine water management activities is presented in the WMP.

During Year 1 dewatering of Umwelt Lake to construct the SWP was initiated, with approximately 50% of the lake volumed dewatered. Completion of Umwelt Lake dewatering will occur in Year 2. The Stage 1 SWP Containment Dam will be constructed in Year 2, and the SWP will be available to receive saline water in Q1 of Year 3. Saline water that will be encountered in the mine workings before Q1 of Year 3 will be managed locally or pumped to dewatered Umwelt Lake. It is expected that the dewatered Umwelt Lake will have capacity for saline water storage even before the completion of the stage 1 SWP Containment Dam. The stage 2 of the SWP is expected to be constructed in Year 3. B2Gold Nunavut is advancing preliminary designs for a Stage 3 SWP, to provide additional storage for saline water shall this be found to be required.

For Phase 2 (Operations), saline water from the Umwelt and Llama underground mine and the Llama Open Pit will be pumped to the SWP. Starting in Year 4, saline water from the SWP will be treated at an RO plant at a rate of around 5,000 m³/day and pumped to the Umwelt Pit (now Umwelt TF) and then to Llama Pit (Llama TF), if required. The brine sludge from the RO plant will be cycled back to the SWP. RO treatment of saline water and discharge to Umwelt TF or Llama TF may continue up to Year 9 when Goose Main Pit becomes available to receive water (Goose Main Reservoir). At that point all saline water collected at the site will be pumped to Goose Main Reservoir. It is expected that seasonal (summer only) RO treatment will be sufficient, except potentially in the first year of treatment when greater volume of water is in SWP. However, need for year-round RO treatment will be confirmed as part of the design of the RO treatment plant.

From approximately Year 4 the RO treatment and the pumping to Goose Main Reservoir will allow maintaining low water levels in the SWP, providing contingency storage capacity, as required. Following the final dewatering of the SWP during either during operations (when Goose Main Reservoir becomes available) or during closure, sediment in the basin will be tested, and removed, if required, to meet defined discharge water quality criteria; see Section 5.2 for additional details. The containment dam will be breached once water from the SWP area is deemed suitable for discharge.

Table 4.5-1. Overview of Saline Water Management Activities

Activity	Mine Year	Notes
Umwelt Lake is fished out in preparation for lake dewatering	-1	Completed
Umwelt Lake is partially (Approximately 50%) dewatered to Goose Lake to allow for construction of the Saline Water Pond.	1	completed
Umwelt Lake dewatering is completed	2	Portion of water is treated for TSS
The Stage 1 SWP is constructed.	2	
The Stage 2 SWP is constructed.	3	
Saline water from underground mines and Llama Open Pit is pumped to the Saline Water Pond.	2-9	Approximately until Q2 of Year 9
Saline water collected in SWP is treated at a RO Plant and pumped to Umwelt TF or Llama TF	4-9	Approximately until Q2 of Year 9
Saline water is pumped to Goose Main Reservoir	9-13	SWP may be used as transfer facility before pumping to Goose Main Reservoir
Surficial soils in the footprint of former Umwelt Lake lakebed are excavated and placed in the Llama TF	As early as Year 9	Top 1-2m will be removed
Decommissioning of Saline Water Pond Containment Dam	During Closure Phase	During Closure.

Source: Water Management Plan

5. MONITORING AND REPORTING PROGRAM

This section presents a summary of the saline water monitoring and reporting programs that will be carried out during Operations related to mine development water quantity and quality.

As part of effective mine water management, monitoring is important to verify the predicted water quality and quantity trends and conduct adaptive management should differing trends be observed. Monitoring will occur at three levels:

- ◆ Regulated discharge monitoring occurring at monitoring points specified in the approved Licence or regulations.
- ◆ Verification monitoring carried out for operational and water management purposes by B2Gold Nunavut. This monitoring data will not be reported to the Regulators in the Annual Water Licence Report but can be provided upon request by the Regulators.
- ◆ General monitoring included in the Licence requirements and subject to compliance assessment to confirm sampling was carried out using established protocols, including quality assurance/quality control provisions, and addressing identified issues. General monitoring is subject to change as directed by an Inspector, or by the Licensee, subject to approval by the NWB.

All three types of monitoring will be used at the Mine. The WMP presents the monitoring plan relating to water management during Construction, Operations, and Closure. More detailed information on the planned monitoring programs for the Project is provided in the Environment Management and Protection Plan (2AM-BRP1831 Amendment No. 1 Part I, Item 1).

5.1 WATER QUANTITY

The volume of saline water being collected and transferred to and from the SWP will be measured using flow meters. This data will be supplemented by periodic seepage surveys which will record visually observed groundwater inflows in the open pits and underground mines. Measured groundwater inflow rates will be compared to model predictions on an annual basis. If significant variations from model predictions are observed, the assumptions behind the analysis will be reviewed and the analysis updated, if required. In addition, updates to the groundwater model may be required based on operational changes as the Project advances.

The prediction node PN04 will illustrate flows downstream of Umwelt Open Pit and the SWP.

5.2 WATER QUALITY

Saline water quality will be monitored in the SWP to assess the quality of groundwater flowing into Llama Open Pit and the underground workings. The Water Quality Monitoring for the Project provides information on proposed water quality sampling stations to be monitored. Saline water inflows from Llama Open Pit and underground mines will be monitored. The proposed BRP-11 monitoring station at the SWP will be used monitor the quality of water in this pond.

To understand and plan for treatment requirements at surface, if deemed necessary, water accumulating in sumps underground will also be sampled on a monthly basis prior to recirculation for underground use or pumping to the SWP.

Water quality results will be compared to regulated water licence requirements, Metal and Diamond Mining Effluent Regulations (MDMER; Canada Gazette 2017), Canadian Council of Ministers of the Environment (CCME), and Site-Specific Water Quality Objectives guidelines.

B2Gold Nunavut notes the potential for chloride concentrations within sediments encountered at the bottom of the SWP, once the saline water has been removed. B2Gold Nunavut has identified a number of mitigation measures to reduce chloride concentrations within the sediment, including removal of sediments for disposal within Goose Main Reservoir (if removal happens during operations when Goose Main Reservoir becomes available) or Llama TF (if removal occurs later in the operations phase or in closure). B2Gold Nunavut will track sediment and pore water chloride concentrations for the SWP to ensure appropriate water quality for the reconnection of Umwelt Lake to surface waters. A target chloride concentration of 120 mg/L (following the CCME guideline for the Protection of Aquatic Life) would be achieved at the receiving environment (defined as per the *Fisheries Act*).

B2Gold Nunavut also notes the potential exists for migration of saline water from the SWP to the surrounding environment. B2Gold Nunavut will therefore monitor the permafrost in the locations where seepage may occur as well as monitor the condition of vegetation in the vicinity of the SWP for effects due to the presence of saline groundwater.

5.3 THERMAL CONDITIONS MONITORING

The potential effect of the underground operations to the permafrost thermodynamics and hydrogeological system will consist of minor local modification of the thermal regime at the vicinity of the underground workings and a mobilization of frozen groundwater into the regional system.

During Operations, the underground workings will be backfilled progressively with waste rock, as practicable, and the groundwater encountered at depth will be pumped to the SWP (or Goose Main Reservoir) at surface. Once mining and backfilling are complete, remaining saline water stored in the SWP will be pumped mostly to Goose Main Reservoir or into the remaining underground void space. As water (pumped or from natural saline groundwater inflows) saturates the mined-out areas, the heat will transfer to the surrounding permafrost and generate local thawing of the frozen ground surrounding the workings. The underground areas will be expected to freeze back where the minimum ground temperature is less than -2°C (above ~350 mbgs depth). However, it is possible that parts of the underground areas will not completely freeze back due to the large latent heat requirements combined with relatively warm permafrost temperatures at depth.

The underground mines are in competent rock and the structural stability of this bedrock does not rely on permafrost. The Project mine design parameters for the permafrost and talik zones are identical demonstrating that the structural integrity of the mines does not rely on presence of permafrost. There are therefore no concerns that permafrost thawing would lead to subsidence at surface. Pending final engineering designs and additional field characterization, B2Gold Nunavut will review and assess the requirements associated with thermal conditions monitoring. B2Gold Nunavut will undertake verification monitoring if needed.

6. QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Quality Assurance refers to plans or programs that encompass a wide range of internal and external management and technical practices designed to ensure the collection of data of known quality that matches the intended use of the data. Quality Control is a specific aspect of Quality Assurance that refers to the internal techniques used to measure and assess data quality.

Quality Assurance and Quality Control specific guidelines for the Project are provided in the Quality Assurance/Quality Control Plan (2AM-BRP1831 Amendment No. 1 Part I, Item 1). These guidelines will equally apply to the saline water management structures and the saline water monitoring program.

7. ADAPTIVE MANAGEMENT

The mine design, including the management of saline water, has been carefully prepared taking into consideration the vast database of site characterization data gathered for the Project, coupled with rigorous engineering analysis. Where data were limited, conservative assumptions were consistently applied. While there is a high level of confidence that the plans are viable and realistic, it is understood that mining activities are by nature inherently uncertain. Therefore, additional mitigation or adaptive management may be required as an outcome of monitoring activities described in Section 5. This may include changes to saline water management as a result of operational, engineering, and/or environmental monitoring. Any additional mitigation or adaptive management that is found to be required will be implemented in a timely manner.

Possible upset scenarios, and contingency strategies to address, are outlined Table 7-1.

Table 7-1: Saline Water Contingency Strategies

Possible Scenario	Contingency Strategy
Saline inflow volumes into the mine workings are greater than expected.	<p>Modification and/or adjustment of the mine plan to avoid areas of concern, or to use mined-out underground stopes to provide surge capacity.</p> <p>Additional sump capacity to handle higher than predicted inflows.</p> <p>Pre-grouting of highly conductive structures prior to intersection with the mine workings.</p> <p>Isolation of mining sections with bulkheads to control or minimize mine inflows.</p> <p>If the average long-term groundwater inflows are higher despite these measures, the meromictic lake in the Goose Main Reservoir has extra capacity for saline water storage.</p> <p>Additional storage locations (including stage 3 of SWP) could be identified, blending of saline water with other contact water may be investigated, or treatment to desalinate the water may be required.</p>
Water quality in the SWP does not meet wildlife guidelines and wildlife (such as migratory waterfowl or caribou) are found to be using the pond or drinking from the pond.	Wildlife will be excluded from the ponds following an adaptive management approach.
Underground mining operations cease prior to the underground deposition of the required volume of saline water from the SWP.	Additional storage locations will need to be identified, or treatment to desalinate the water may be required. If necessary, the meromictic lake in the Goose Main Reservoir has extra capacity for saline water storage.

Possible Scenario	Contingency Strategy
Chloride sediments are encountered at the bottom of the Saline Water Pond once the saline water has been removed.	Sediments will be excavated and deposited in Goose Main Reservoir or Llama TF. Alternatively, the base of the dewatered SWP could be washed down with freshwater and the rinse water will be pumped out. If necessary, this rinsing method would be repeated until the salinity of the rinse water is acceptably low (i.e., chloride concentration of 120 mg/L or less).
Water quality within the re-watered Umwelt Lake does not meet the requirements (Section 5.2) at the time of release.	Additional water treatment may be necessary.

The SWMP is part of a continually evolving process that relies not only on the efficacy of data collection and analytical results, but is also dependent on feedback from the communities, government, Indigenous groups, and the public. Having an adaptive and flexible program allows for appropriate and necessary changes to the design of monitoring studies, and the mitigation and monitoring plans. Some changes may come about through the observation of unanticipated effects or inadequacies in the sampling methods to detect measurable effects. Other changes may result from ecological knowledge acquired through working with Indigenous community members and discussions with Elders, both in the field and through workshops.

The SWMP will be reviewed on a regular basis to incorporate lessons learned, major changes to facility operation or maintenance, and environmental monitoring results relating to the management of saline water at the Project. Any updates will be filed with the Annual Report submitted under the Type A Water Licence (2AM-BRP1831 Amendment No. 1 Part B, Item 2), unless otherwise directed by the NWB.

8. RECLAMATION

The majority of the SWP closure activities will occur as progressive reclamation with the remainder occurring in the Closure Phase. The SWP will be dewatered to the Goose Main Reservoir using separate pumping and pipeline infrastructure during Operations.

Once the SWP has been dewatered, sediments will be tested and if the chloride content would be considered to be too high to achieve Site-specific Water Quality Objectives and/or CCME guidelines for the Protection of Freshwater Aquatic Life when the facility was re-watered, this sediment would be removed and placed in the Goose Main Reservoir or Llama TF. In either Goose Main Reservoir or in Llama TF, the SWP sediments will have several years to settle prior to overflows from the facility are anticipated. The water will be tested prior to overflow, and treatment for suspended sediment will be implemented if necessary.

Once the water in the re-watered SWP meets Site-specific Water Quality Objective and/or CCME guidelines for the Protection of Freshwater Aquatic Life, the SWP Containment Dam will then be breached allowing Umwelt Lake to re-establish.

Additional details pertaining to reclamation and closure are provided in the Interim Closure and Reclamation Plan (2AM-BRP1831 Amendment No. 1 Part J, Item 1).

9. REFERENCES

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