Sabina
GOLD & SILVER CORP.

Karén Kharatyan
A/Manager of Licensing
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1J0

April 11, 2018

RE: Response to Back River Project Type A Water Licence Technical Comments (2AM-BRP----)

Dear Mr. Kharatyan,

Sabina Gold & Silver Corp. (Sabina) is pleased to provide the attached responses to Technical Comments on the Type A Water Licence application and supporting documents for development of the Back River Project (Project), received on April 4, 2018 from the following parties:

- the Kitikmeot Inuit Association (KIA);
- Crown-Indigenous Relations and Northern Affairs Canada (CIRNA);
- Environment and Climate Change Canada (ECCC); and
- Fisheries and Oceans Canada (DFO).

I trust the attached information meets the NWB requirements for response to the comments received on the Type A Water Licence for the Back River Project. Sabina looks forward to the further discussions with all Parties at the upcoming Technical Meeting in Cambridge Bay.

Should you have any questions, please do not hesitate to contact me at the below.

Yours truly,

Matthew Pickard
Vice President, Environment and Sustainability
Sabina Gold & Silver Corp.
#1800 – 555 Burrard Street
Box 220
Vancouver, BC V7X 1M9

CC: Dave Baines, NWB

Attachments: Technical Comment Responses

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The BACK RIVER PROJECT

TYPE A WATER LICENCE TECHNICAL COMMENT RESPONSES

April 2018
NWB File No. 2AM-BRP----

Submitted to:
Nunavut Water Board
PO Box 119
Gjoa Haven, NU X0B 0C0

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The BACK RIVER PROJECT

Technical Comment Responses

Kitikmeot Inuit Association

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-01**
Subject/Topic:	Sensitivity of mine inflows to presence of EPZ		

Reference to Type A:

- MAD Appendix F-5_Hydrogeological Characterization and Model Report, Section 6.3

Detailed Review Comment:

The report states that there are similarities between the Ekati mines and the four mines at the Goose property: both sets of mines are developed in taliks within competent bedrock, and the project areas have a similar permafrost depth and TDS profile. While Enhanced Permeability Zones (EPZs) were identified in the Ekati mines, the data collected at the Goose property do not indicate the presence of these zones. Nonetheless, the distribution of hydraulic conductivity (K) in the Goose property mines is subject to uncertainty as it is inevitably based on a discrete data set. Given that the EPZs can lead to a significant increase in mine inflow, a sensitivity scenario where these zones are represented should be conducted, to provide a preliminary estimate of an upper bound for inflows. It is recognized that more information on the presence and extent of EPZs will be acquired during mining. However, conducting a sensitivity run based on the presence of these zones would provide a valuable first-pass upper bound of mine inflow, and it would allow the adequacy of the water management plan to be assessed based on this key uncertainty.

Recommendation/Request:

Conduct a sensitivity run based on the presence of EPZs in the mines.

Sabina Response:

Sabina recognizes that there is a likelihood that flow in the mines will be dominated by enhanced permeability zones (i.e., specific fractures or features; EPZs), and that the mines could intercept such flow conduits. This uncertainty exists for all mining projects conducted in fractured rock and is never completely alleviated until structural geology and hydrogeology data is regularly collected from mining operations. The influx of water into a mine is a normal and well understood phenomenon and is regularly managed by standard operating procedures (SOPs) in operating mines.

Sabina is aware of the uncertainty related to EPZs and will safely and appropriately manage groundwater inflows. Actions to be taken when high permeability formations are encountered may include proactive control measures such as:

- Collection and interpretation of groundwater pressure and inflow data;
- Use of surface and underground exploration information for identifying enhanced permeability that may be intercepted; and
- Advance cover and probe drilling (i.e., exploration drainage holes).

Mitigation measures (adaptive management) that may be adopted to manage increased flows include:

- Modification and/or adjustment of the mine plan to avoid areas of concern, or to use mined-out underground stopes to provide surge capacity;
- Additional sump capacity to handle higher than predicted inflows;

- Pre-grouting of highly conductive structures prior to intersection with the mine workings; and
- Isolation of mining sections with bulkheads to control or minimize mine inflow.

If the average long-term groundwater inflows were higher despite these measures, the meromictic lake in the Llama Reservoir has sufficient extra capacity for saline groundwater storage. Additional details on saline groundwater storage contingencies can be found in the previously submitted Final Environmental Impact Statement Technical Comment responses, F-INAC-TC-5.

Based on the above approach, Sabina believes that the completion of a sensitivity analysis is not warranted.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-02**
Subject/Topic:	Sensitivity of mine inflows to location of permafrost boundaries		

Reference to Type A:

- MAD Appendix F-5_Hydrogeological Characterization and Model Report, Section 6.4.5

Detailed Review Comment:

In section 6.4.5 it is stated that "*the distribution of permafrost is reasonably understood, but the exact 3D distribution of frozen vs. unfrozen ground is not known.*" The effect of different permafrost geometries on mine inflows is described in qualitative terms, but no indication is given that a sensitivity run was conducted to quantify these effects. It is recommended that a sensitivity run be conducted, by assuming plausible changes in the permafrost vertical and lateral boundaries. This would allow the adequacy of the water management plan to be assessed based on the uncertainty in permafrost geometry.

Recommendation/Request:

Conduct a sensitivity run based on a plausible reduced vertical and lateral extent of permafrost in the mine areas, to quantify the resulting increase in mine inflow.

Sabina Response:

As discussed in the Technical Comment response to WT-KIA-NWB-01, Sabina recognizes uncertainty associated with predicting mine water inflows due to the many reasons including the defined extent of the talik. The proactive control measures and associated mitigation measures described in WT-KIA-NWB-01 will therefore also apply towards understanding inflows uncertainty associated with understanding talik zones and any plausible reduction in vertical or lateral extend of the permafrost in mining areas.

Based on the above approach, Sabina believes that the completion of a sensitivity analysis is not warranted.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-03**
Subject/Topic:	Consideration of total concentrations in mine effluents		

Reference to Type A:

- MAD Appendix E-2_Water Load Balance Report, Section 5.4.1, Section 7.
- MAD Appendix F-1_Site-WideWater Management Report, Section 4.2.1.
- Attachment A Type A_IR Responses, KIA-IR12.

Detailed Review Comment:

Section 7 of the Water Load Balance report indicates that the water load balance model generates dissolved concentrations (e.g. Section 7.2, "*Monthly average water quality predictions for dissolved metal concentrations were evaluated…*". The comparison of the modelled dissolved concentrations with the CCME benchmarks for the protection of aquatic life, which are expressed in terms of total concentrations, is not appropriate and leads to underestimating the number of constituents with concentrations above the guidelines, as well as the concentrations in excess of the guidelines. In response to this observation, which is presented in KIA-IR12, the Proponent states that the mine effluents have minimal to no presence of Total Suspended Solids (TSS), so that dissolved concentrations are effectively equal to total concentrations. However, in Section 5.4.1 of the Water Load Balance Report and in section 4.2.1 of the Site-wide Water Management Report it is stated that the water from Llama Lake and Umwelt Lake that will be pre-dewatered and pumped into Goose Lake has a high content of suspended solids. Table 5-1 of the Water Load Balance Report indicates that 50% of the water removed from Umwelt Lake will be discharged directly into Goose Lake, and the water removed from Llama Lake will be treated for TSS and Arsenic only at the final dewatering stage. Therefore, the assumption of negligible TSS in the effluent to Goose Lake does not seem to hold. The discharge of a TSS load can have an adverse effect on the aquatic habitat in Goose Lake, as it may lead to a local reduction in water clarity near the effluent discharge point. The presence of a TSS load in the effluent also implies that constituents with toxicity potential, such as metals, will be discharged not only in dissolved form but also in suspended form. Not including TSS in the water load balance model and considering only dissolved concentrations leads to an underestimate of the substances with potential toxicity that are discharged into Goose Lake.

Recommendation/Request:

The water load balance model should be modified to include consideration of Total Suspended Solids (TSS) and total constituent concentrations, so that water treatment requirements based on the comparison with CCME benchmarks can be adequately defined. The modeling of total metals is also included in the list of the Proponent's commitments of the FEIS and FEIS Addendum Project Certificate (170601-12MN036-FHA EX 45-Recommended PC Terms and Conditions Committments-IA2E), item INAC-C-1.

Sabina Response:

Sabina confirms that the Water and Load Balance Model is currently being updated to meet Sabina's commitments for the FEIS and FEIS Addendum Project Certificate (170601-12MN036-FHA EX 45-Recommended PC Terms and Conditions Committments-IA2E), item INAC-C-1.

As discussed in the response to WT- ECCC-TC-5, the Water and Load Balance Model update will include an evaluation the effect of suspended solids of an assumed composition on the total parameter

concentrations in mine discharges during Operations, Closure, and Post-Closure. Sabina will provide the results of the Water and Load Balance Model update prior to the Technical Meeting.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-04**
Subject/Topic:	Monitoring of seepage from TSF dam		

Reference to Type A:

- MAD Appendix F-4_Tailings Management System Design, Section 5.13 and 5.14.

Detailed Review Comment:

Section 5.13 states that fractured bedrock was identified in the top 2-3 meters in the western portion of the TSF dam, which may allow seepage from the dam. The 6-m dam back fill in this portion of the dam exceeds the minimum thermal thickness required to maintain the underlying materials in frozen state, thus minimizing the likelihood of seepage. A seepage collection berm will also be constructed to intercept the seepage that may be generated from the TSF dam. Nonetheless, it is possible that the liner installed at the base of this berm may not be completely impervious allow some by-pass seepage. The installation of shallow monitoring wells located at a short distance downstream of the berm and drilled through the overburden (if present) to the top 2-3 m of bedrock would allow the early detection of by-pass seepage, and trigger measures for early seepage containment.

Recommendation/Request:

Include the installation of monitoring wells downstream of the seepage collection berm for early detection of by-pass seepage. The review of seepage monitoring options is also included in the list of the Proponent's commitments of the FEIS and FEIS Addendum Project Certificate (170601-12MN036-FHA EX 45-Recommended PC Terms and Conditions Committments-IA2E); item INAC-C-4.

Sabina Response:

Sabina will be conducting more field characterization studies in support of final design of the infrastructure, and further characterization in the form of percolation testing that will be carried out immediately prior to Tailings Storage Facility (TSF) Dam construction (see response to WT-INAC-TRC-17). The information from the field characterization will ensure that the design meets the required intent of managing seepage through both the foundation and the body of the TSF Dam. If, based on this additional characterization, Sabina believes that there remain areas where seepage could occur, Sabina will install the necessary monitoring instrumentation to confirm the performance of the TSF Dam and the TSF WRSA Diversion Berm.

Sabina reiterates commitment INC-C-4 to undertake an infill geotechnical characterization program of the western ridge adjacent to the TSF Containment Dam to determine the extent of the fractured bedrock contact zone and apply proposed mitigation as necessary. This program will include permeability testing, seepage analysis, and planning for thermal monitoring of the western ridge, where appropriate. Sabina is pleased to confirm that an initial infill geotechnical drill program is currently underway at the Goose Property and includes drill holes targeting the western ridge and the TSF Containment Dam. Sabina will complete the remaining infill geotechnical drill program as part of further characterization carried out immediately prior to TSF Dam construction.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-05**
Subject/Topic:	Effect of increase in temperature in climate change predictions		

Reference to Type A:

- Site-wide Water Management Report, Section 2.1.4

Detailed Review Comment:

In Section 2.4.1 of the Site-wide Water Management Report it is stated that "*In accordance with the Standardized Procedure for Climate Change Integration into Engineering Design adopted for the Project (SRK Consulting (Canada) Inc., 2015e), the primary climate variable that is important from a water management infrastructure design perspective is variability in precipitation patterns.*" Accordingly, climate change is accounted for in the design of the water management system only by considering the 10% increase in rainfall expected by 2040. Nevertheless, temperature is also estimated to increase significantly in the project area in the next few decades. The Nunavut Climate Change Centre indicates that temperature in northern Nunavut has increased by an average of 1 to 3°C over the last 100 years, and that this trend is likely to continue into the future. The effect of an increase in temperature based on the historic trend of up to 1.2°C in 2040 will likely be a greater snowmelt rate, greater duration of the open water season, deepening of the active layer and expansion in the volume of taliks. These effects will generate greater volumes of water requiring management at the Goose property. As such, these additional volumes should be accounted for in the design of the water management infrastructure for the project.

Recommendation/Request:

Estimate additional volumes of water requiring management, which would result from the likely increase in temperature over the life of the project based on the current projections for northern Nunavut.

Sabina Response:

Sabina highlights that, in accordance with the Standardized Procedure for Climate Change Integration into engineering design adopted for the Project (SRK Consulting (Canada) Inc., 2015a), the primary climate parameter relevant from a water management infrastructure design perspective is variability in precipitation patterns. Increase in precipitation patterns was accounted for in the design of the water management infrastructure to provide a robust design that can accommodate potential impact to water management structures related to other climate parameters that may be affected by climate change, such as temperature.

Based on the Standardized Procedure for Climate Change Integration into engineering design adopted for the Project (SRK 2015a), and subsequent climate change analysis (SRK 2015b), it is estimated that the rate of change of rainfall depth over baseline conditions is expected to be less than 10% by the year 2040 (i.e., 3 years after Post-Closure). As a result, rainfall design depths were increased by 10% for the purpose of designing the water management structures (i.e., diversion berms, event ponds, culverts).

Based on the above, the design of the water management structures includes a contingency for climate change driven increase in precipitation patterns for conditions that are not expected to manifest during the life of the water management infrastructure. As such, this design contingency will allow mitigation of the impact of other climate parameters that may be impacted by climate change, such

as temperature. Furthermore, ongoing monitoring of climate parameters at the Project site and at regional stations relevant to the Project site would identify the necessity for adaptive management strategies for water management at the Goose site.

References:

SRK Consulting (Canada) Inc. 2015a. Standardized Procedure for Climate Change Integration into Engineering Design. Vancouver.

SRK. 2015b. Climate Change Integration into Engineering Design for the Back River Project. Vancouver.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-06**
Subject/Topic:	Discrepancy in mine inflows reported in the Hydrogeology and Modeling Report, the Water Load Balance Report and the Site-Wide Management Plan		

Reference to Type A:

- MAD Appendix F-5_Hydrogeological Characterization and Modeling Report, Section 6.2, Table 5;
- MAD Appendix E-2_Water Load Balance Report, Section 3.2.7, Table 3-10;
- SD05-Water Management Plan, Section 5.1.3, Table 5.1-1

Detailed Review Comment:

The following mine inflows listed in Table 5 of the Hydrogeology and Modeling Report differ from those listed in Table 3-10 of the Water Load Balance Report and Table 5.1-1 of the Site-Wide Water Management Plan:

Unwelt U/G 2028: 156 m3/d (Table 5) vs. 312 m3/d (Table 3-10 and 5.1.-1)

Llama U/G 2022: 185 m3/d (Table 5) vs. 246 m3/d (Table 3-10 and 5.1.-1)

Llama Open Pit 2020: 109 m3/d (Table 5) vs. 76 m3/d (Table 3-10 and 5.1.-1)

Llama Open Pit 2021: 702 m3/d (Table 5) vs. 19 m3/d (Table 3-10 and 5.1.-1)

Goose Main U/G 2027: 64 m3/d (Table 5) vs. 16 m3/d (Table 3-10 and 5.1.-1)

These discrepancies may be a 'typo', but if they are not, they need to be resolved or a clarification is needed to justify them.

Recommendation/Request:

Resolve or clarify the discrepancies in the mine inflows listed in the Hydrogeology and Modeling Report, Table 5, and those listed in the Water Load Balance Report, Table 3-10, and in the Site-Wide Water Management Plan, Table 5.1-1.

Sabina Response:

Sabina acknowledges this inconsistency. As outlined in the Technical Review of Water, Waste Rock, and Tailings Management/Design (171002 2AM-BRP----MAD App F-7_TechReview-IMLE), Golder completed a review of the water balance, load balance, and water management design. As part of this review, inconsistencies for mine flows were identified and Sabina requested the water and load balance model be updated for groundwater inflows to the open pits and underground mines for consistency with values reported in Hydrogeological Characterization Report (171002 2AM-BRP----MAD App F-5_HydrogCharactModelRpt-IMLE).

The groundwater inflows to open pit and underground facilities (facilities) reported in Table 5 of the Hydrogeological Characterization Report were obtained using yearly average inflow rates, meaning that they are estimated as total inflow volumes to the facilities equally distributed of a period of 12 months. As such, these do not account for the actual schedule of mining completion in the last year of each open pit and underground mines within their last year of operation.

If the facilities are completed in the first few months of their last year, the higher inflow rates for those months would be higher than the yearly average inflow rates, the total inflow volume would be concentrated in a period of time shorter than 12 months.

For the purpose of the water and load balance modelling, the predicted yearly average inflow rates were linearly scaled accounting for the actual duration of the facilities within their last year of operation. As such, the potential discrepancies identified by KIA are all related to the last year of operation of facilities. The one exception is for the Llama Open Pit in Year 2. For this year, Sabina acknowledges a typographical error in Table 5 of the Hydrogeological Characterization Report, where an inflow of 76 m^3/d is incorrectly reported, instead of the model predicted inflow of 109 m^3/d.

Further explanations about the discrepancy in the last year of Llama Open Pit operations will be provided for the Technical Meetings.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-07**
Subject/Topic:	Frequency of Biological Monitoring (AEMP)		

Reference to Type A:

- AEMP: 171005- 2AM-BRP SD21 AEMP Section 4.3

Detailed Review Comment:

Each phase of the Project represents different exposure regimes to Goose Lake and downstream receiving environments. During the construction phase Llama and Umwelt lakes will be dewatered to Goose Lake. While these practices are not expected to increase metal and nutrient concentrations to Goose Lake, they represent unusual hydrological inputs to Goose lake that could have impacts to the benthic and fish communities in Goose Lake and downstream areas. Thus, it is recommended to monitor these areas relative to reference areas early on (within a year) of discharge to Goose Lake for the early detection of possible changes to these communities. If no statistically significant change to benthic and fish communities are observed, subsequent monitoring should be conducted at 3-year intervals (as indicated by the proponent).

This would therefore mean year 1 and year 4 of construction However, if statistically relevant changes are detected that cannot be attributed to natural events, adaptive management should be immediately implemented, and annual monitoring should be instituted until results have normalized. During the operations and closure phases, contact water will be stored in the tailings storage facility or the saline water ponds and effluent will not be release to the receiving environment. Freshwater to support domestic and industrial uses will be sourced from Goose Lake.

During these phases, it is important to continue monitoring these areas to ensure that water withdrawals do not result in unintended effects to biological compartments in Goose Lake and the downstream areas. In addition, the ground surface in the areas upstream of Goose Lake will be developed for infrastructure, and while all contact water will be diverted to the TSF and other water storage ponds, it is important to monitor that these facilities are not unintentionally discharging waters to downstream environments and to ensure that baseline conditions of biologically relevant communities remain stable.

Thus, monitoring at Year 1, 4, 7 and 10 of Operations (in a 10 year Operations phase) and Year 1, 4, and 7 of Closure (8 year closure phase) is recommended. At post-closure water from the TSF will be released to the receiving environment once it meets applicable guidelines. During this phase it is critical to monitor the biological communities downstream of discharge points. Thus, biological monitoring is recommended during Year 1 of Post-closure and if no changes detected on year 3 and 5 of the 5-year post-closure phase to ensure the mine is chemically and physically stable and that no risk of biological harm remains.

Recommendation/Request:

Conduct biological Monitoring within the first year after commencement of dewatering of the Llama and Umwelt Lakes to Goose Lake and in Year 1 of each phase of the Project and during every subsequent 3 years (including during the Construction, Operations, and Closure Phase) and in year 1, 3, and 5 of post-closure, unless statistically significant differences are observed between receiving sites and reference sites. In this case, adaptive management should be immediately implemented and monitoring should be conducted annually until exposed area is recovered.

Sabina Response:

As the KIA notes, water quality effects related to the dewatering of Llama and Umwelt lakes are anticipated to be minimal. Llama Lake has a volume of approximately 1.1 million m^3, Umwelt Lake is approximately 0.24 million m^3. During the dewatering activities, it is anticipated that 50% of the Llama Lake volume will be dewatered into Goose Lake, which has a volume of 10.5 million m^3 (i.e., 20 times that which will be discharged from Llama Lake into Goose Lake). This dewatering will not occur instantaneously, but rather throughout the open water season at a rate tied to the natural outflow rate of Goose Lake.

Sabina believes there are no significant effects related to hydrological changes anticipated as a result of the gradual nature of the dewatering and the limited quantity of water to be discharged relative the receiving waterbody's volume. However, Sabina is willing to initiate the biological sampling described within the Aquatic Effects Management Plan (AEMP; 171002 2AM-BRP----SD21-AEMP-IMLE) earlier in the 3-year monitoring cycle (e.g., within a year of dewatering activities) to verify this is the case.

Once initiated, routine biological sampling will continue in a 3-year cycle to ensure alignment with Metal Mining Effluent Regulations (MMER) Environmental Effects Monitoring (EEM) requirements, noting that the AEMP has specifically been designed to harmonize with the MMER EEM.

Additional biological monitoring may be triggered as a part of the AEMP Response Framework. The AEMP Response Framework is an integral part of the AEMP which allows detection of, and appropriate response to, observed changes of environmental concern. This framework will establish benchmarks reflective of the levels of change beyond which negative environmental effects may occur, based on existing guidelines (e.g., Canadian Council of Ministers of the Environment (CCME) guidelines), natural ranges or site-specific studies. Action levels are set relative to these benchmarks, which, if exceeded, would prompt responses appropriate to the nature and level of the exceedance. Where appropriate, response actions may include increased frequency of biological monitoring.

As outlined in the AEMP, benchmarks as well as initial action levels will be developed in collaboration with KIA and other interested parties. Benchmark and action level development is anticipated to occur in early 2019, post collection of 2018 baseline data (which will feed into the determination of the natural conditions and variability) but before the first interpretive report is prepared.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-08**
Subject/Topic:	Winter ice road melt management		

Reference to Type A:

- Road Management Plan Sections 4.1.7 and 4.2.2

Detailed Review Comment:

In Section 4.2.2, Sabina states that a "discontinuous pad of granular fill may be required over short areas of rough terrain or where there is insufficient snow cover to create a smooth surface" for the WIR (p. 4-11).

Sabina does not discuss how it will manage this fill when the WIR melts in the spring. Insufficient management of the melting WIR may result in runoff and a pulse of suspended solids into adjacent waterbodies.

Recommendation/Request:

Please provide additional information on how fill along the WIR will be managed to avoid entering waterways.

Sabina Response:

Sabina currently does not intend to place any fill within 31 m of the high water mark of waterbodies or drainage channels. Winter Ice Road overland sections within 31 m of waterbodies and drainage channels are intended to be constructed entirely of compacted snow and ice.

If it becomes necessary to place fill within 31 m of the high water mark, Sabina will establish monitoring plans with consideration of vegetation and fisheries impacts.

Sabina acknowledges that most Nunavut Water Board (NWB) water licences, including Sabina's Type B Water Licence (i.e., 2BC-BRP1819 Part E, Item 8), includes the following term and condition:

> *With respect to access roads, laydown area, pad construction or other earthworks, the deposition of debris or sediment into or onto any water body is prohibited. These materials shall be disposed of a distance of at least thirty-one (31) metres from the ordinary High Water Mark in such a fashion that they do not enter the water.*

If Sabina identifies the need to use fill within 31 m of the high water mark of waterbodies or drainage channels, Sabina will provide notice to the land owner and inspector 10 days prior to any placement of fill, and would commit to undertake total suspended solids (TSS) monitoring at spring freshet. Sabina would request that the Type A water Licence allow for this flexibility.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-09**
Subject/Topic:	MLA PAG storage		

Reference to Type A:

- Borrow Pits and Quarry Management Plan Section 6.1

Detailed Review Comment:

Gap/Issue

In Section 6.1, Sabina states that quarry material from MLA has "*negligible potential for ARD*" (p. 6-2), but if PAG material is found at the MLA it will be stored appropriately (e.g., covered with NPAG waste rock).

Where would PAG rock found at the MLA be stored? No WRSA is currently planned for the MLA.

Recommendation/Request:

Please indicate where PAG rock found at the MLA will be stored.

Sabina Response:

As stated in Section 6.1 of Borrow Pits and Quarry Management Plan (171002 2AM-BRP----SD03-BorrowQuarryMgmtPlan-IMLE), if potentially acid generating (PAG) material is encountered during the operation of the MLA Quarry it will be stockpiled within the MLA footprint and ultimately covered with non-potentially acid generating (NPAG) material. Confirmatory testing during quarry operations will be completed, which will flag any potential PAG material such that it can be avoided if possible or managed appropriately.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-10**
Subject/Topic:	Borrow pit and quarry problematic water discharges		

Reference to Type A:

- Borrow Pits and Quarry Management Plan Section 46.2

Detailed Review Comment:

In Section 6.2, Sabina states, "*any flowing water which may leave the working area will be sampled as part of ongoing monitoring and allowed to discharge to the environment if it meets Project discharge criteria as defined in the Water Management Plan (SD-05). Any problematic water will be directed away from waterbodies or held in contact water event ponds with enough capacity to contain high runoff from the spring freshet*" (p. 6-3).

We are concerned that problematic water discharged to the land may result in environmental degradation.

How will the location for discharge be selected? Will discharge locations be monitored? How will it be monitored?

Will contact water event ponds also be designed with enough capacity for increased precipitation forecast under climate change?

Recommendation/Request:

Please provide additional details on how contact water will be managed. In particular, please explain (i) where this water will be discharged, (ii) under what conditions it will be discharged, (iii) whether discharge will be monitored and how and (iv) whether contact water event ponds are designed with sufficient capacity to contain increased precipitation predicted under climate change.

Sabina Response:

Borrow pit and quarry water runoff will be directed to sumps to allow for sampling of water prior to controlled discharge. Discharge suitable for release to the environment will be discharged to the tundra via a portable pump to a location near the quarry/pit. The discharge location will be selected to allow free drainage of the discharged water (to prevent ponding) and discharge will occur in a manner that does not cause erosion, either by locating it in an erosion-resistant area (e.g., on a rocky outcrop), or otherwise mitigating the erosion potential if needed (e.g., through diffusion of flow or reducing discharge rates).

Water which does not meet discharge requirements may be treated in-situ or will be directed to other site water management facilities and managed as appropriate for that facility. Quarry and pit sumps will be low areas in these facilities to which all contact water drainage will be directed and will not be limited in capacity. Refer to Technical Comment response WT-KIA-NWB-05 for information on contact water pond capacity with respect to potential precipitation increases under climate change.

Collected water or runoff that meets the discharge criteria specified in Table 7.5-1 of the Water Management Plan (WMP; 171002 2AM-BRP----SD05-WaterMgmtPlan_IMLE) will be discharged to land at a minimum setback of 31 m from the high water mark of any waterbody.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-11**
Subject/Topic:	Seep and runoff seep surveys		

Reference to Type A:

- Borrow Pits and Quarry Management Plan Section 7
- Mine Waste Rock Management Plan Section 7

Detailed Review Comment:

Table 7-1 outlines the monitoring frequency of different parameters at quarries. "Seepage and runoff water quality" will be assessed through a "Spring seep survey of all quarries and major infrastructure components except roads". The spring seep survey will also be conducted for waste rock storage facility seeps.

This approach appears to focus on freshet but neglects to characterize the impacts of rainfall events. We recommend that both a seep survey and a runoff survey also be carried out following extreme rainfall events.

Sabina lists the parameters to be measured in seep water (and presumably runoff), but these do not include TSS nor nutrients, components of ammonium nitrate fuel oil (ANFO).

Recommendation/Request:

Please monitor seepage and runoff from quarries after extreme rainfall events. Please include TSS and nitrogenous compounds in seep water and runoff.

Sabina Response:

Quarry contact water is collected within the quarries and is sampled prior to discharge to confirm compliance. Seepage surveys capture meltwater runoff from the perimeter of the quarries, and spring seepage samples specifically represent the full extended winter period of cumulative deposition (e.g., blast-related dustfall). As a result, these planned seep surveys provide a conservative estimate of runoff water quality and additional sampling following extreme rainfall events are not necessary. Sabina does, however, agree with the additional characterization of TSS and nutrients (Ammonia as Nitrogen) at quarry seeps; Sabina will include these additional characterization parameters in the next update to Appendix B of the Water Management Plan (171002 2AM-BRP----SD05-WaterMgmtPlan_IMLE) prior to construction.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-12**
Subject/Topic:	Ore stockpile runoff management		

Reference to Type A:

- Ore Storage Management Plan Section 5.2

Detailed Review Comment:

Based on results from humidity cell tests, some ore stockpiles may develop acidic conditions over 10 or fewer years. As a precaution, Sabina states that it will collect ore stockpile runoff and treat "*if required prior to discharge*".

How will Sabina determine if runoff requires treatment? Will regular monitoring be conducted of runoff? What treatment will be undertaken?

Recommendation/Request:

Please indicate what criteria will be used to determine whether ore stockpile runoff requires treatment and what treatment will be used.

Sabina Response:

Sabina clarifies that all surface runoff and seepage from the Ore Stockpile is contained within the Ore Stockpile Pond, which is part of the site contact water management system (see response WT-ECCC-TC-10).

As stated in Section 8.2.5 of the Water Management Plan (171002 2AM-BRP----SD05-WaterMgmtPlan_IMLE), during Operations water from the Ore Stockpile Pond will be pumped to the active tailings management facility and will not be discharged to the environment. As such, no water quality criteria are required.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-13**
Subject/Topic:	Ore storage runoff metal monitoring		

Reference to Type A:

- Ore Storage Management Plan Section 7.2

Detailed Review Comment:

Table 7.2-1 lists site runoff discharge criteria (TSS, oil and grease, and pH). Metals are not measured, despite the potential for metal leaching from stockpiles.

Recommendation/Request:

Please include a runoff discharge criterion for metals and a commitment to monitor metals in ore storage runoff.

Sabina Response:

Please see Technical Comment response, WT-KIA-NWB-12.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-14**
Subject/Topic:	Tailings facility seepage		

Reference to Type A:

- Tailings Management Plan Section 4.2.7

Detailed Review Comment:

Sabina states that seepage from the TSF "*may be released to the receiving environment if water quality permits*" (p. 4-10) but provides no discharge criteria.

Sabina should propose discharge criteria for seepages stemming from the TSFs.

Recommendation/Request:

Please indicate what the discharge criteria are for seepage from the primary TSF and other flooded open pits, which will be used as tailings facilities. We propose using CCME water quality objectives as the criteria to ensure no impacts from direct discharges to the receiving environment.

Sabina Response:

As stated in Section 8.2.6 of the Water Management Plan (171002 2AM-BRP----SD05-WaterMgmtPlan_IMLE), surface runoff and sub-surface seepage through the Tailings Storage Facility (TSF) will be collected downstream in the TSF WRSA Diversion Berm, from which water will be pumped back into the TSF during operations. When the TSF is closed, runoff from the TSF WRSA will be captured in TSF WRSA Diversion Berm and pumped to the active tailings management facility. No uncontrolled discharges of contact water will be released to the environment during TSF operations nor once the TSF becomes a Waste Rock Storage Area. As such, no water discharge criteria are required.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-15**
Subject/Topic:	Construction related dust fall management		

Reference to Type A:

- Tailings Management Plan Section 6.3
- Water Management Plan Section 9.7

Detailed Review Comment:

Sabina states that "*minimal site preparation is required for TSF construction; therefore, dust is not expected to be problematic during the Construction Phase*" (p. 6-1). However, section 4.2.6 describes numerous features that will be constructed during the Construction Phase including trenches, embankments, dykes, and pony walls. Several features will be made with fine crushed gravel or pea-sized gravel, and drilling and blasting will be required. Thus, it appears that conditions may create significant dust during construction.

Sabina should indicate how it will monitor for and manage dust during construction.

Recommendation/Request:

Please explain how dust will be monitored for and managed during construction.

Sabina Response:

Sabina is in the process of revising the Air Quality Monitoring and Management Plan (AQMMP) that was submitted as part of the Final Environmental Impact Statement; the implementation of which will be commensurate with the requirements of the Project Certificate.

In general terms, air quality and dust monitoring at the Back River Project is planned to include a combination of dustfall monitoring using open-topped vessels to retain deposited dust, and active particulate monitoring using industry standard, active particulate monitoring equipment at the Project. The construction of the Tailing Storage Facility (TSF) is considered to be part of the Construction Phase of the Project and any monitoring that would be required to support Construction Phase activities would be initiated coincident to the start of that particular phase of work.

Activities planned for the 2018 season are not "dust-intensive" in nature, and therefore, dust and particulate monitoring is not planned for 2018. A revised AQMMP will be submitted to the NIRB for review 90 days prior to the start of Construction.

Sabina highlights that Section 6.3 of the Tailings Management Plan (171002 2AM-BRP----SD09-TailingsMgmtPlan-IMLE) and Mine Waste Rock Management Plan (171002 2AM-BRP----SD08-MineWasteRockMgmtPlan-IMLE) detail dust management measures related to tailings, waste rock, and overburden during Construction, Operations, and Closure.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-16**
Subject/Topic:	Ash and asbestos management		

Reference to Type A:

- Landfill Waste Management Plan Section 7.4

Detailed Review Comment:

7.4 The landfills will take non-combustible waste, incinerator ash and waste asbestos. Waste will be compacted with a bulldozer and covered daily, with Sabina stating that "*care is to be taken during compaction to ensure that containers of ash are not ruptured and that areas containing waste asbestos are not disturbed*" (p. 7-6). The asbestos waste will be disposed of in labelled bags and buried with "*a minimum of 500 mm of cover material and temporary signage placed to ensure it is not disturbed*" (p. 7-7). Records will be kept on the location of asbestos waste and signage will indicate the area not to be disturbed.

What will waste be covered with? Will ash containers be deposited in designated areas of the landfill, that are marked (as with asbestos)? What type of container will be used for ash?

What is the source of the asbestos? How much will be disposed of at each landfill? Will asbestos be disposed throughout the project, or just during certain times? What material will the bags be made out of (biodegradable or not?)?

Recommendation/Request:

Please indicate (i) how ash and asbestors will be covered; (ii) whether ash containers will be deposited in designated areas; (iii) what type of container will be used for ash; (iv) the source of and volume of asbestos waste; timing of asbestos disposal; (v) what steps will be taken to minimize or eliminate the use of asbestos and (vi) type of bags to be used for asbestos disposal.

Sabina Response:

(i) Sabina clarifies that a minimum of 300 mm of waste rock will be used as cover material over landfills. The one exception is waste asbestos which will receive a 500-mm waste rock cover.

(ii) Sabina confirms that ash containers will not be segregated and will be deposited in the landfill with other non-hazardous wastes.

(iii) As stated in Section 6.4.1 of the Landfill Waste Management Plan (171002 2AM-BRP----SD10-LandfillWasteMgmtPlan-IMLE), ash from incineration will be contained and stored in drums. Sabina may also store ash in lined mega bags or other inert containers approved for landfilling.

(iv) Sabina currently does not anticipate any source of asbestos will be encountered at the Back River Project. The references to asbestos management in the Landfill Waste Management Plan is only a precautionary, proactive contingency in the event these materials are encountered. As noted in Section 7.4 of the Landfill Waste Management Plan, prior to acceptance of asbestos at any landfills at the Project Site, the Government of Nunavut will be notified.

(v) Sabina will not source materials that contain asbestos due to the health and safety risks associated with such products. Sabina supports the proposed Prohibition of Asbestos and Asbestos Products Regulations under the *Canadian Environmental Protection Act* (CEPA) that

were published for comment on January 6, 2018 (Accessed: https://www.canada.ca/en/health-canada/services/chemical-substances/chemicals-management-plan/initiatives/asbestos.html). Any asbestos products that may be found on site from historic building materials will be handled in accordance with the procedures detailed in Section 7.4 of the Landfill Waste Management Plan.

(vi) Sabina commits to only use bags for asbestos disposal that meet the requirements for landfilling in Nunavut.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-17**
Subject/Topic:	Hazardous materials water management at MLA		

Reference to Type A:

- Hazardous Materials Management Plan Section 7.1.1

Detailed Review Comment:

7.1.1 Sabina states that there will be a hazardous material storage pad at the MLA that will lined and graded to collect and contain contact water and snow melt in sumps.

How will the contact water and snowmelt collecting in the sumps at the hazardous material storage pad be managed? Will it be tested? How will it be disposed of? We are also concerned that there is not treatment options at the MLA should water not be suitable for discharges.

Sabina also states that an additional unlined laydown pad will be constructed at the MLA for inert materials, such as ammonium nitrate within sea cans to be transported to the Goose Property.

Will the contact water and snowmelt from the unlined laydown pad at the MLA be collected and contained? How will it be managed? Note that diversion berms will be used at the Goose Property laydown pad for ammonium nitrate to direct runoff to a sump according to 7.1.2l; these do not appear to be present at the MLA.

Recommendation/Request:

Please explain how contact water and snowmelt collecting at the hazardous material storage pad and the unlined laydown pad at the MLA will be monitored and disposed of.

Sabina Response:

The main objective of Sabina's water management strategy is to minimize the amount of water that contacts mine workings, including hazardous material management areas, which ultimately reduces the volume of water requiring management.

Collected water or runoff that meets the discharge criteria specified in Table 7.5-1 of the Water Management Plan (WMP; 171002 2AM-BRP----SD05-WaterMgmtPlan_IMLE) will be discharged to land at a minimum setback of 31 m from the high water mark of any waterbody.

Contact water collecting at hazardous materials management areas will be sampled as described in the Water Management Plan. Sabina's general monitoring program as outlined in Appendix B of WMP indicates that monitoring at the hazardous materials management area (BRP-45) will be completed prior to discharge. In addition, Table B-01 and Table B-02 of the WMP summarizes proposed water quality and flow monitoring of the Project during the Construction, Operations, Closure phases, and includes monitoring station location, monitoring type, description, purpose, mine phase, parameters grouping, and sample frequency for each location. The list of constituents in each parameter group is provided in Table B-03.

For water management related to the unlined laydown pad at the MLA, please see Sabina's response to WT-KIA-NWB-28.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-18**
Subject/Topic:	Hazardous material storage		

Reference to Type A:

- Hazardous Materials Management Plan Section 8

Detailed Review Comment:

Sabina states that "*where appropriate, hazardous materials will be stored in a covered building or sea cans to prevent exposure to the influences of weathe*r" (p. 8-1).

It is not clear how Sabina will decide whether to store hazardous materials under cover or outside.

Recommendation/Request:

Please clarify what criteria will be used to determine whether it is appropriate to store hazardous materials under cover (e.g., hazardous material type? Quantity? Time of year?). What are the risks of storing hazardous materials outside, exposed to the weather, and how will these risks be minimized or avoided for hazardous material stored in this way?

Sabina Response:

All hazardous materials will be contained in designated containers appropriate for their WHMIS hazard classification and in accordance with any other information contained in their respective SDS to prevent chemical reactions or corrosion that could result in spills or emergency situations including minimalization of risks associated with exposure. Hazardous material that cannot get wet will be stored in original containers and, if necessary, will be stored in shipping containers or indoors. Typical hazardous materials inventory including delivery form (i.e., bags, liquid) and storage vessel (i.e., Seacan) provided in Table 7.2-1. As outlined in the Hazardous Materials Management Plan (HMMP; 171002 2AM-BRP----SD13-HazardousMaterialsMgmtPlan-IMLE), Sabina will provide updated information in the Annual Report to regulators on the type and estimated numbers of containers as the Project moves through each development phase.

Sabina will be also registered with Nunavut Department of Environment (DOE) as a 'Hazardous Waste Management Facility' and has provided a summary of general guidelines for the strategy and secure storage of hazardous materials in Section 7.2.4 of the HMMP. In addition, Sabina will submit detailed design of the Hazardous Waste Management Areas 60 days prior to construction.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-19**
Subject/Topic:	Risk assessment and evaluation		

Reference to Type A:

- Risk Management and Emergency Response Plan Section 7.1

Detailed Review Comment:

Sabina follows a four-step risk assessment process:

- Identify hazards
- Evaluate probability of hazards
- Evaluate severity of hazards
- Evaluate risk of hazards based on probability and severity.

Table 7.1-2 lists the different levels of consequence severity of identified hazards. Under the Critical category, the environmental impact is described as "*very serious environmental impacts with impairment on landscape/marine ecology. Long-term, widespread effects on significant environment*" (p. 7-2). There is no mention of potential impacts on freshwater ecology or ecosystems.

Please include potential impacts on freshwater ecology or ecosystems.

The classification of environmental impacts for the five consequence categories is vague and overly general. It is not clear how it will be determined whether an impact is "*very serious with impairment on landscape/marine ecology*" vs "*serious environmental impacts with impairment on ecosystems*" vs "*some impairment on ecosystem function*" vs "*minor effects on biological or physical environment*" vs "*low-level effects on biological or physical environment*". Furthermore, it is not clear how "*displacement of species*" is assigned to the Moderate consequence category. Species could be displaced under all five-consequence scenarios. It would be more appropriate to assign degrees of displacement to different consequence categories (e.g., number of species or proportion of a population displaced is a better measure of impact than the current blanket "displacement of species").

Please develop more stringent and scientifically defensible environmental criteria to classify impacts into the five consequence categories. These criteria should be clearly defined (e.g., what constitutes "minor effect" or "short-term damage" or "widespread effects").

Recommendation/Request:

Please include consideration of potential impacts on freshwater ecology or ecosystems in all consequence categories.

Please develop more stringent, specific and scientifically defensible environmental criteria to classify impacts into the five consequence categories. These criteria should be clearly defined (e.g., what constitutes "*minor effect*" or "*short-term damage*" or "*widespread effects*").

Sabina Response:

Sabina's Risk Management and Emergency Response Plan (RMERP; 171002 2AM-BRP----SD15-RiskMgmtEmergRespPlan-IMLE) and methodology proposed is a comprehensive evaluation of the potential risks from natural hazards, and accidents and malfunctions to meet Sabina's health, safety,

and environmental objectives for the full scope of the Back River Project. Risk or potential impacts to freshwater ecosystems are included as a component of the definition for "Environmental Impact/Compliance" provided in Table 7.1-2 Consequence Severity of the RMERP. Additional details on environmental criteria for the impact classification are provided below (Table 1 below), which are consistent with criteria used to evaluate significance of residual effects from the Project on Valued Ecosystem Components (VECs) in the Final Environmental Impact Statement (FEIS Volume 9). VECs are specific attributes of the biophysical environments (terrestrial, freshwater, and marine) that have scientific, economic, social or cultural significance (see Section 1.2.3.1 in FEIS Volume 9) and those identified for the environmental assessment of the Back River Project are assumed to be applicable for the Risk Management and Emergency Response Plan.

The main attributes used to evaluate the significance (or consequence) of an incident for a VEC include the following:

- Magnitude defined as the amount or degree of change in a measurable parameter or variable relative to existing conditions (e.g., the exposed population); where magnitude can be classified as negligible, low, moderate, or high, and where the higher the magnitude, the higher the potential consequence; magnitude is a primary criterion.
- Extent, the geographic area over which the interaction will occur; where extent may include the Project footprint, local study area, regional study area, or beyond regional, and where the larger the zone of influence, the higher the potential consequence; if magnitude and geographic extent are related, the higher the potential significance; extent is a secondary criterion.
- Duration, the period over which the environmental effect will occur; duration includes short, medium, and long-term definitions, and the longer the duration of an interaction the higher the potential consequence; duration is a secondary criterion.
- Reversibility, the likelihood that a VEC or indicator will recover from an environmental effect, including consideration of active management techniques (which may include fully reversible, reversible with effort, or irreversible effects); reversibility is considered for biological VECs at the population level, and therefore, although an effect like mortality is irreversible, the effect at the population level might be reversible; reversibility is a secondary criterion.

More detailed descriptions of each attribute are provided in Section 1.2.4.5 of FEIS Volume 9. Additional attributes may also be considered as qualifiers in evaluating consequence (e.g., probability of an effect, uncertainty related to overall understanding of ecosystem). It is important to note that the definitions of attributes may be VEC specific and vary accordingly. Where available, quantitative thresholds (e.g., freshwater aquatic life guidelines or ambient air criteria), may be used to assist with evaluating the consequence of an event. The overall significance (or consequence) of an effect is derived from the experience and professional judgment of the environmental practitioners who consider the rankings of the contributing attributes in making such a determination.

As requested Sabina has developed more stringent and scientifically defensible environmental criteria to classify impacts into the five consequence categories consistent with methodology used in the FEIS. Sabina has included the below Table 1 for reference; this table has been adapted from Table 7.1-2 of the RMERP.

Table 1. Updated Environmental Impact/Compliance Definitions for Consequence Severity (Adapted from Table 7.1-2 in Risk Management and Emergency Response Plan.)

Consequence	Definition
Critical	Major uncontrolled event or inefficiency with uncertain and perhaps prohibitively costly remediation. Previous Environmental Impact/Compliance definition: Very serious environmental impacts with impairment on landscape/ marine ecology. Long-term, widespread effects on significant environment. *Revised definition: effects are high in magnitude, regional or beyond regional in geographic extent, long term in duration, and irreversible; the overall effect to a VEC would be significant based on criteria in the FEIS.*
Major	Significant event or inefficiency that can be addressed but with great effort. Previous Environmental Impact/Compliance definition: Serious environmental impacts with impairment on ecosystems. Relatively widespread long-term effects. Regulatory approval withdrawn for a few months. *Revised definition: effects are moderate to high in magnitude, regional in geographic extent, long term in duration, and may be reversible with cost/effort; the overall effect to a VEC would be significant based on criteria in the FEIS.*
Moderate	Moderate event or inefficiency that might need physical attention and certainly engineering review. Previous Environmental Impact/Compliance definition: Some impairment on ecosystem function. Displacement of species. Moderate short-term widespread effects. Regulatory orders with significant cost implications. *Revised definition: effects are low to moderate in magnitude, regional in geographic extent, moderate to long-term in duration, and reversible with cost/effort; the overall effect to a VEC would not be significant based on criteria in the FEIS.*
Minor	Minor incident or inefficiency that might require engineering review and is easily and predictably remediated. Previous Environmental Impact/Compliance definition: Minor effects on biological or physical environment. Minor short-term damage to small areas. *Revised definition: effects are low in magnitude, local in geographic extent, short-term in duration, and fully reversible; the overall effect to a VEC would not be significant based on criteria in the FEIS.*
Insignificant	Minor incident or inefficiency of little or no consequence. Previous Environmental Impact/Compliance definition: No lasting impacts. Low-level effects on biological or physical environment. Limited damage to minimal area of low significance. *Revised definition: effects are negligible in magnitude, confined to the Project footprint, short-term in duration, and fully reversible; the overall effect to a VEC would not be significant based on criteria in the FEIS.*

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-20**
Subject/Topic:	Bulk fuel storage discharge criteria – lead		

Reference to Type A:

- Fuel Management Plan Section 8

Detailed Review Comment:

Sabina states that "water pooling within the secondary containment of the fuel storage facilities will be sampled, treated as necessary, and released to the receiving environment once water quality criteria has been met" as presented in Table 8-1:

Table 8-1. Proposed Bulk Fuel Storage Pooling Water Discharge Criteria

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

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

The discharge criteria correspond to the criteria used in the Meadowbank water license, except for lead. Meadowbank has a lead discharge criterion of 0.001 mg/L for bulk fuel storage pooling water, while Sabina proposes 0.200 mg/L.

6. Effluent from fuel containment facilities that require Discharge to land, shall not exceed the following Effluent quality limits:

Parameter	Maximum Average Concentration
Benzene (ug/L)	370
Toluene (ug/L)	2
Ethylbenzene (ug/L)	90
Lead (ug/L)	1
Oil and Grease (mg/L)	15 and no visible sheen

It is not clear why Sabina is adopting a less stringent discharge criterion than comparable projects in the territory.

Reference: Agnico Eagle. 2014. Appendix B12 – Meadowbank Bulk Fuel Storage Facility: Environmental Performance Monitoring Plan, Version 2. (June 2014).

Recommendation/Request:

Please explain why Sabina is adopting a less stringent discharge criterion for lead than other comparable projects in the territory.

Sabina Response:

Sabina is not proposing a less stringent discharge criteria; the value shown in Table 8-1 of the Fuel Management Plan (171002 2AM-BRP----SD16-FuelMgmtPlan-IMLE) is a typographical error. Sabina notes this same error was also made in Table 5.3-11 of the Main Application Document (MAD; 171002 2AM-BRP----MainApplicationDocument-IMLE).

Sabina confirms that maximum concentration of any grab sample for Lead at 0.001 mg/L.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-21**
Subject/Topic:	Sewage spill response		

Reference to Type A:

- Spill Contingency Plan Section 8.3.2

Detailed Review Comment:

Sabina indicates that if there is a spill of untreated sewage at the Goose Property "*any affected water will be recovered and discharged into the active tailings facility"* but that *"it will not be necessary to remove affected ice or excavate affected soils*" (p. 8-7).

It is not clear why contaminated ice and soils would not be removed. In addition, how often will sewage pipes be inspected to ensure there are no leaks?

Recommendation/Request:

Please explain why contaminated ice and soils will not be removed in the event of a spill of untreated sewage. Please describe how often sewage pipes will be inspected for leaks.

Sabina Response:

Sabina clarifies that only small, untreated sewage spills would not be removed, and agrees that for large spills, contaminated ice and soils would be removed if accessible. In assessing the response to an untreated sewage spill, Sabina will consider the size of spill, the local topography, and the proximity of the spill to water.

Sabina notes that any amount of untreated sewage spilled is reportable under the NWT-NU 24-hour Spill Report Line, and, as stated in Section 4.2 of the Spill Contingency Plan (171002 2AM-BRP----SD17-SpillContingencyPlan-IMLE), Sabina will communicate with KIA and CIRNA and submit the appropriate follow-up reports. Sabina will also confirm compliance with the Water licence and Nunavut Water Regulations with respect to unauthorized discharges of waste.

Regarding leak inspections of sewage pipes, Sabina will have a designated Sewage Treatment Plant Operator and anticipates that the pipeline will be inspected as part of regular operations.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-22**
Subject/Topic:	Bulk fuel volumes		

Reference to Type A:

- Oil Pollution Emergency Plan Base Annex 5

Detailed Review Comment:

Annex 5: Bulk Cargo Transfer Procedures – Sabina states that the total annual volume of the bulk fuel transfers is expected to be approximately 30 – 45 ML. However, in 6.1 of the Oil Pollution Emergency Plan, Sabina states that the total annual volume is expected to be 60 ML (p.6-1). Please clarify.

Annex 5: Sabina indicates that there will be a single or double floating hose approximately 1000 m long linking the vessel to the connecting flange on shore. Does this mean hoses are single or double walled? We recommend that all hoses be double walled to protect against leakage.

In Annex 4: Resident Spill Response Equipment, Sabina lists 1 oil containment boom 300 m long in its spill response equipment inventory. Is this length sufficient to deal with leaks along a 1000 m long hose? – Note that Annex 6: Spill Response Equipment Onboard lists a containment boom that is 1000 ft. long (~300 m). Is it possible that the unit for length of hose is incorrect in Annex 5 (i.e., does Sabina mean 1000 ft. instead of 1000 m? That would fit with ship to shore distance illustrated in Base Figure 4).

Annex 6: It is confusing that this document uses imperial measurement, when metric measurement is used throughout the rest of the Oil Pollution Emergency Plan, and the other Water License application documents.

Recommendation/Request:

Please fix discrepancies noted for bulk fuel volume and length of floating hose.

We recommend use of double walled hoses for all fueling activities.

Please use metric units in Annex to be consistent with the rest of the Water License application.

Sabina Response:

Sabina appreciates the KIA's careful review and will correct the inconsistencies in the next iteration of the Oil Pollution Emergency Plan (OPEP; 171002 2AM-BRP----SD18-OPEP-IMLE). Sabina provides clarification as follows:

Maximum total annual fuel offload volume is anticipated to peak at 60 ML.

The length of floating fuel hose from the fuel vessel (ship) to shore is anticipated to be slightly more 300 m but definitely less than 1,000 m. To minimize stress on the floating hose, the ship will be connected to the shore by a secure line which will keep the maximum distance from vessel to shore as less than 300 m. The floating fuel offload hose will follow this secure line from ship to shore, and the hose will be allowed additional slack to ensure no tension from ship movement is on the hose itself. As a result, the floating hose will transit the same distance (approximately 300 m), but will be slightly longer, and well under 1,000 m. Sufficient spill response equipment will be available during

offload to extend from ship to shore on either side of the fuel line, to fully contain any fuel line leaks. The OPEP will be corrected in the next iteration to consistently reflect the distances in metric units.

Fuel offload may be conducted via either a single line or a double line, depending volume to be offloaded and pump set-up. Fuel transfer hoses will meet all Transport Canada requirements for fuel offload, including being inspected and pressure tested prior to use.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-23**
Subject/Topic:	Quarry PAG bedrock cover at closure		

Reference to Type A:

- Interim Closure and Reclamation Plan Sections 5.2.10.9

Detailed Review Comment:

5.2.10.9 Quarry rock will be tested to determine PAG status. If any PAG bedrock is exposed, Sabina will either handle it as it does other PAG waste rock onsite, or leave in place and cover "with a minimum of a 2 m thick layer of non-acid generating soil or rock" (p. 5-42). The treatment of other PAG waste rock is to cover it with a 5 m NPAG cover.

It is not clear why the greater thickness of NPAG cover will not be applied to PAG bedrock.

Recommendation/Request:

Please explain why the greater thickness of NPAG cover (5 m) will not be applied to PAG bedrock.

Sabina Response:

Quarries will only be developed in areas which have been drilled off and geochemically tested in advance and shown to be sources of non-potentially acid generating (NPAG) material which is suitable for construction. It is therefore unlikely, but not impossible, that potentially acid generating (PAG) materials will be exposed in the backslopes or base of the quarries. Should PAG be exposed, all loose blast-damaged PAG material would be removed and disposed of in the Waste Rock Storage Areas (WRSAs). Thus, the only PAG materials that could be left exposed in the quarries would be comprised of intact bedrock. Care would also be taken to grade the base of the quarry so that it drains freely such that ponding of water will not occur. Any exposed PAG areas identified within the bases or backslopes of the quarries will be encapsulated with a minimum of a 2-m thick layer of NPAG overburden or rock.

The 5-m NPAG material cover over the WRSAs was selected based on thermal models, which showed that the active layer depth of the WRSAs will range from approximately 1.3 to 4.2 m. In the case of the quarry cover, the bedrock will be frozen at the time of the spring freshet. Nonetheless, the active zone could potentially penetrate through the 2-m NPAG cover and cause a brief period of thaw at the end of summer in the upper 1 to 2 m of the underlying intact quarry bedrock. Such thawing would however be of little consequence because the intact bedrock will have a permeability which is 3 or more orders of magnitude lower than that of the waste rock in the WRSAs. Furthermore, the intact bedrock will have very low porosity, so it will not be subject to convective air flow. Also, the specific surface area of the intact bedrock will be many times lower than that of waste rock in the WRSAs. This seasonal thaw at the surface of the intact bedrock is therefore not expected to affect the surface water and groundwater quality which will be confirmed with the proposed water quality monitoring of the quarries. If the proposed water quality monitoring show that additional measures are necessary, Sabina will employ adaptive management which could include increasing the quarry closure cover design thickness.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-24**
Subject/Topic:	Licence Length		

Reference to Type A:

- Main Application Document (MAD) Section 2.2.2

Detailed Review Comment:

Gap/Issue
Sabina has sought a licence term of 14 years to allow for all proposed construction and operational activities of the known resource. The requested license length would conclude immediately prior to closure when discharges of contact water to the aquatic environment are planned. This licence length does not provide an opportunity for substantive review of all management plans and the implementation of improved practices, which would occur through a licence renewal prior to the conclusion of operations.

Disagreement with WL information/ conclusion
The requested licence length of 14 years does not allow for a fulsome evaluation of management and mitigation practices, and the incorporation of that evaluation into ongoing operational activities. This concern is compounded as Sabina is continuing to explore and further delineate the underground resource within the site footprint as described in the project certificate. Any increases to mine life would benefit from the incorporation of the evaluation of the ongoing practices and incorporation into future operational practices.

Reasons for disagreement
The requested licence length does not provide an opportunity to evaluate all management and mitigation activities against their performance and update them accordingly.

A 14 year licence length for the Back River project is longer than that at Hope Bay (2013- 2023; amended 2016 – Licence NO: 2AM-DOH1323 – AMENDMENT NO.1), Meadowbank (2015-2025; Licence NO: 2AM-MEA1525) and Baffinland (2013-2025; Licence NO: 2AM-MRY1325).

We note that the Meliadine Water Licence is longer (2016-2031, Licence NO: 2AM-MEL1631), but stipulate that a) a start date for construction and operations was not firm at the time of licencing, and b) the proponent was currently operating in the territory (Meadowbank) with a proven record of compliance.

Recommendation/Request:

We request the Type A water licence duration be restricted to 10 years ensuring that a renewal process is required and any amendments to operational practices are incorporated into the latter half of extracting the known resource on site.

Sabina Response:

Sabina is of the view that the request for a 14-year licence term is appropriate in the overall context of the Back River Project.

First, the requested 14-year water licence term is well below the maximum terms set by the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*:

> 45. The term of a licence or any renewal shall not exceed
>
> (a) 25 years, in the case of a type A licence respecting a class of appurtenant undertakings that is prescribed by the regulations or in the case of a type B licence; or
>
> (b) the anticipated duration of the appurtenant undertaking, in the case of a type A licence other than one described in paragraph (a).

Consistent with the legislation, water licenses should be issued for the expected life of the mining operation. A 10-year water licence would not be sufficient to permit key project construction and operational activities for the Back River Project.

Second, standard Nunavut Water Board (NWB) licence terms and conditions requiring the annual review of plans provides opportunity for comprehensive, ongoing engagement and review/input over the life of the Project. Sabina anticipates that the NWB would include the following standard term in its water licence:

> "The Licensee shall review the Plans referred to in this Licence, as required by changes in operation and/or technology, and modify the Plan accordingly. Revisions to the Plans shall be submitted in the form of an Addendum to be included with the Annual Report."

As a matter of standard NWB practice, all annual reports and updates to plans are circulated for comment and input from Inuit and regulatory authorities. This practice provides all reviewers with an opportunity to evaluate management and mitigation activities against their performance throughout the life of a project.

Third, in the event of a significant modification or amendment (such as extension of mine life), Sabina would be subject to additional NWB and other regulatory requirements, and Inuit and regulatory authorities would be provided with the opportunity to participate, make information requests, and provide detailed technical information and submissions in respect to the proposed Project changes. Sabina anticipates that any such process would incorporate an evaluation of ongoing site practices into future operational practices, as suggested by KIA.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-25**
Subject/Topic:	Deviations from original design plans		

Reference to Type A:

- Main Application Document (MAD) Section 2.2.3

Detailed Review Comment:

Gap/Issue
Sabina has stated "*The construction summary report will be prepared by an Engineer(s) in accordance with the following requirements… Documentation of field decisions that deviate from the original plans and any data used to support or developed facilities and infrastructure to withhold, divert or retain water and/or waste;*".

It is important that the Engineer(s) document the potential implications of field decisions deviating from the original plans on water management on site.

Disagreement with WL information/ conclusion
The proposed practices do not provide assurance water management will occur as proposed within the Water Licence Application.

Reasons for disagreement
See above.

Recommendation/Request:

It is requested that engineer reported deviations from field decisions be accompanied with an assessment of how those decisions may influence the effectiveness of proposed water management structures.

The Construction Summary report including the discussion of deviations and their implications for water management should be provided to the KIA for review.

Sabina Response:

Sabina acknowledges that the design criteria and design intent of all components that are to be constructed for the Back River Project cannot be changed. Therefore, any deviations from the original 'Issue for Construction' design drawings will only be allowed by the responsible engineer after it has been demonstrated that such change does not alter either the design criteria or the design intent. Furthermore, any deviations must comply with all appropriate licenses, approvals or other land use agreements in place. Any deviations, including the appropriate rationale behind them, will be documented in Sabina's annual Construction Summary Reports, and will be reflected in submitted as-built drawings.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-26**
Subject/Topic:	Phosphorus enrichment		

Reference to Type A:

- Main Application Document (MAD) Section 5.3.2; Table 5.3-1; Water and Load Balance Report Appendix D.

Detailed Review Comment:

Gap/Issue
Sabina indicates "Treated effluent [from the wastewater treatment plant will be] discharged to active tailings facility during Operations. If effluent discharge from the STP meets discharge criteria, effluent will be discharged to land."

We note that effluent in the tailings facility will only reach the receiving environment during closure. We express concern maximum modelled phosphorus concentrations resulting from the discharges indicates a shift in trophic level at PN02, PN03, PN04, PN06, PN10 and in Goose Lake.

Disagreement with WL information/ conclusion
It is unclear if Sabina has accounted for the potential effects of a large influx of nutrients, namely phosphorus, in the receiving environment, and whether the potential for a shift in the receiving environment's trophic status is a potentiality. An alternate steady trophic state may present a potential unmitigated risk to the receiving environment that may be rectified with more stringent sewage effluent criteria for nutrients.

Reasons for disagreement
A significant pulse of phosphorus can result in long-term internal loading within the receiving environment, which may not have been incorporated into modelling results.

Recommendation/Request:

Please indicate the length of time phosphorus concentrations will be elevated above the baseline trophic levels in Goose Lake and at the prediction nodes. Please provide a discussion as to the impact-elevated concentrations will have with respect to a shift in trophic levels.

Note the modeled length of time phosphorus concentrations will be elevated should rely on the updated model as requested in the KIA Technical Comment titled "Water quality modelling results".

Sabina Response:

Prior to the Technical Meeting, Sabina will provide information for discussion regarding the potential for a shift in trophic status in receiving environment waterbodies based on review of monthly predictions from the updated Water and Load Balance model that is currently underway (see WT-KIA-NWB-03). Sabina will consider the potential impact of any shift in trophic status on aquatic life in these waterbodies in the discussion information provided to the KIA.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-27**
Subject/Topic:	Water quality modelling results		

Reference to Type A:

- Main Application Document (MAD) Section 5.4.1, Table 5.4.1; Water and Load Balance Report (WLBR) Section 4.2.2, Appendix D.
- Nunavut Impact Review Board Final-Hearing Report Back River Gold Mine Project. Page 118.
- FEIS KIA-C-8

Detailed Review Comment:

Gap/Issue
Sabina has summarized existing lake and stream water quality in the Project area indicating available data was from 1993 through 2013. As indicated in the KIA's comments as well as ECCC's on Sabina's FEIS (KIA-C-8), additional water quality data was required to substantiate the claim that there was no seasonal variation in water quality data. The KIA and ECCC had indicated that insufficient water quality data had been collected from freshet, a time of year when melting snow mobilizes terrestrial inputs into the aquatic environment and influence water quality.

Sabina has not updated the water quality baseline with additional seasonal data as requested by ECCC and KIA.

Disagreement with WL information/ conclusion
The baseline water quality data was a key input into the water and load balance model, which has not been updated since it, was presented in the FEIS.

Note that the KIA had requested that Sabina commit "*to collect additional baseline water quality data from the lakes in the Project area during freshet and fall as confirmed by measurements of higher flow, prior to construction. The Proponent commits to use this data to update the water and load balance model. The Proponent will ensure sampling is an appropriate and accurate representation of at least one (1) full year of seasonal data.*"

Reasons for disagreement
Failure to incorporate an adequate characterization of seasonal variation into the baseline water quality data inputs to the water and load balance model decreases confidence in its outputs. This may preclude Sabina from providing adequate water treatment for water quality in the pit lakes resulting in an undue negative impact to the aquatic environment.

Recommendation/Request:

We again request the proponent commit to collect additional baseline water quality data from the lakes in the Project area during freshet and fall as confirmed by measurements of higher flow, prior to construction. Sabina should commit to use this data to update the water and load balance model. The Proponent will ensure sampling is an appropriate and accurate representation of at least one (1) full year of seasonal data.

The occurrence of freshet should be confirmed with on-site meteorological and flow measurements. If the results diverge from those presented in the 2015 Water and Load balance report, we request that Sabina provide additional water treatment options as necessary.

We further request that Sabina present monthly outputs for Goose Lake water quality and prediction nodes (PN) 01 through 13 to assist reviewers in determining when site water quality will comply with CCME water quality objectives for the protection of aquatic life and when Goose Lake will return to the baseline trophic level. Monthly outputs should be provided using the updated dataset.

Sabina Response:

At KIA's request, Sabina undertook additional seasonal baseline water quality characterization in 2017 and plans further baseline data collection in 2018. In advance of 2017 sampling, on July 30, 2017, the KIA was provided with an outline of the intended seasonal water quality baseline sampling for review and comment. Supplementary baseline sampling included both lake and stream sampling in August and September (i.e., fall) and included both Goose Lake and Goose Outflow. A summary of the locations and dates sampled, as well as the data to be collected, were included with this submission.

In 2018, Sabina will collect additional baseline data at proposed AEMP sites, including data to further characterize seasonal variability. Goose Lake, as well as the Reference Lake B, will be sampled in April (i.e., winter), as well as monthly during the open water season in July, August, and September (i.e., fall). Goose Outflow and the reference outflow will also be sampled monthly during the stream open water season; namely, June (i.e., freshet), July, August, and September.

To clarify, although streams can be sampled during freshet (June), representative lake water quality samples cannot be collected during freshet due to the difference in melt timing of the streams and lakes. In the Back River region, freshet (defined as peak stream flows) occurs in June, as the streams receive snow meltwater and progressively become ice free. During this month, lakes still remain covered by ice, with initial meltwater being deposited on the ice surface and eventually into the lakes as the shorelines melt; this seasonal melt usually begins near the point of entry of inflow drainages. During this time, lakes are not accessible; the ice surface is variably thinning, weakening, separating from shore, and progressively breaking apart preventing safe access. In contrast to streams, lakes generally only become ice-free in mid-July, at which time lake water sampling is again possible.

Sabina commits to updating the Water and Load Balance Model using all available baseline data, including data that will be that collected in 2018, prior to the initiation of dewatering to ensure the water quality criteria for discharge are appropriate.

Sabina highlights current model results for monthly outputs for Goose Lake water quality and prediction nodes (PN) 01 through 13 were provided in the Type A Water Licence Application. These results are provided in Appendix G of the Water and Load Balance Report (171002 2AM-BRP----MAD App E-2_WaterLoadBalanceRpt-IMLE) and updated results in Attachment 2 of the Technical Review of Water, Waste Rock, and Tailings Management/Design (171002 2AM-BRP----MAD App F-7_TechReview-IMLE).

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-28**
Subject/Topic:	Load Balance for Marine Laydown Area		

Reference to Type A:

- Water and Load Balance Report (WLBR) Section 4, Section 7.1
- Final Environmental Impact Statement Volume 7 Table 2.1-5.

Detailed Review Comment:

Gap/Issue
Load balance source terms and inputs for the MLA have not clearly been defined. This raises particular concern as Sabina has presented water quality predictions for the MLA, which indicate arsenic concentrations (0.045 mg/L) well in excess of the CCME marine WQO (0.0125 mg/L). We note that this is significantly elevated above baseline arsenic concentrations as presented in the FEIS; all arsenic measurements in the local study area between 2001 and 2013 were below the analytical detection limit of 0.002 mg/L and ranged between 0.008 mg/L and 0.011 mg/L in the regional study area.

Disagreement with WL information/ conclusion
Elevated modelled arsenic concentrations represent a risk to the aquatic environment. A clear characterization of the pathway between project activities and the receiving environment with respect to arsenic enrichment has not been presented.

Reasons for disagreement
Failure to characterize the pathway may preclude implementation of appropriate mitigation measures and adaptive management.

Recommendation/Request:

Sabina should provide the source inputs for water quality predictions in the MLA, and a discussion as to why certain parameters such as arsenic are elevated above both baseline concentrations and the CCME marine WQO.

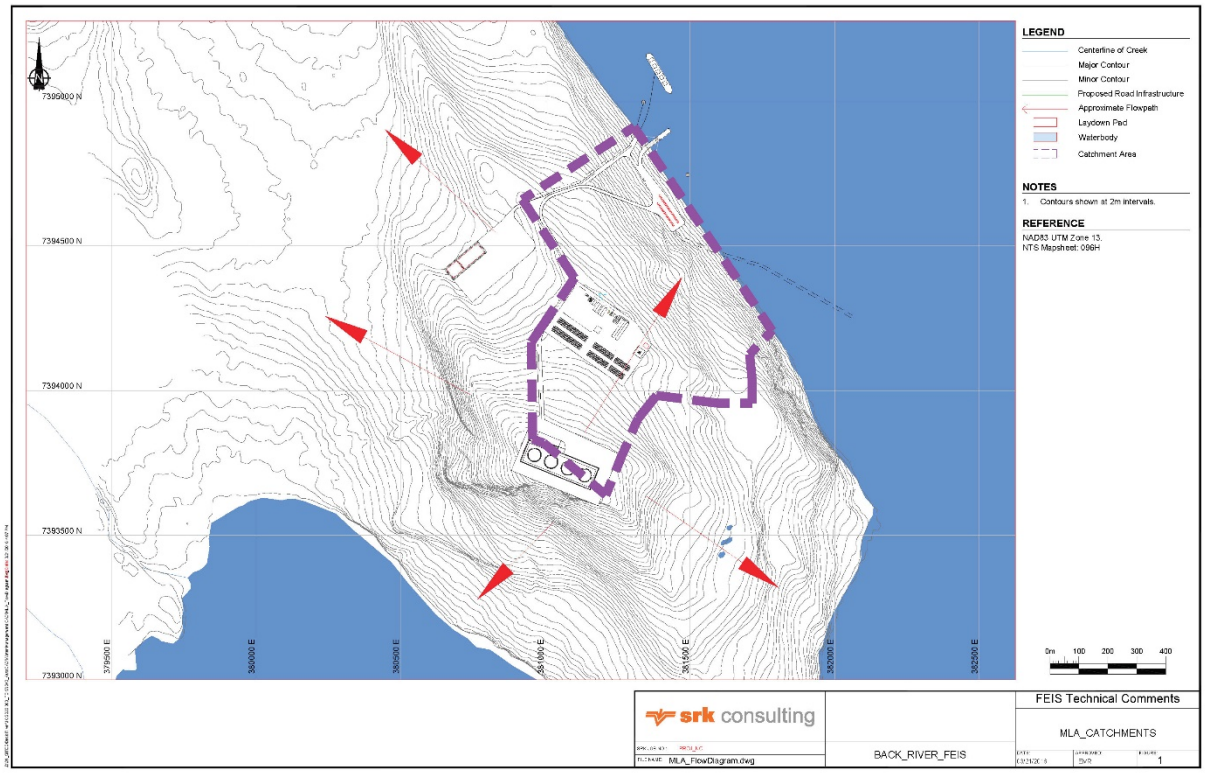
Sabina should also outline appropriate management options that will be implemented to mitigate the impact.

Sabina Response:

Non-contact water will be conveyed around MLA infrastructure to maintain local drainage patterns. Diversion of this clean water and snowmelt will limit contact water volume at the site. Contact water from pads and roads will flow to the Bathurst Inlet along predevelopment ephemeral flow paths (FEIS Volume 10, Chapter 7, Section 3.4.3) where it will mix with non-contact water. Since discharge locations are spread across the area, a detailed load prediction was not included in the SRK Water and Load Balance model (171002 2AM-BRP----MAD App E-2_WaterLoadBalanceRpt-IMLE).

In order to understand the effect of constituent loading from contact water (i.e., from road and rock pads constructed from geochemically suitable sources at the MLA), a water and load balance model was prepared to estimate dilution capacity at MLA. Predictions are based on a ratio of undisturbed and disturbed catchments. The model examines the catchment area with the highest ratio impacted area to unimpacted catchment areas. Water quality predictions would be better for catchment areas with a lower ratio of impacted to unimpacted catchment areas. Figure 1 shows the approximate flow paths from the rock pads, and the delineation of the catchment area with the highest ratio of impacted

to unimpacted catchment areas. This prediction assumes complete mixing of undisturbed runoff and rock pad and road runoff, and is based on the portion of the total MLA catchment which contains the largest area of rock pads to undisturbed area.



Runoff from the site only occurs during the open water season from May to October. During the remainder of the year temperatures are generally below freezing and runoff from rain storms or snowmelt wouldn't be expected from the MLA site to Bathurst Inlet. The highest constituent load from the pads is during June which coincides with the high flow period for the region. Monthly average flow rates were calculated using the runoff coefficients and monthly average runoff from the SRK Water and Load Balance Model (171002 2AM-BRP----MAD App E-2_WaterLoadBalanceRpt-IMLE). June runoff was estimated to be 2.6 mm/day. Table 1 below presents the undisturbed and rock pad/road areas, as well as their corresponding average flow.

Table 1: Catchment Area and Monthly Average Flow

Catchment	Area [m²]	Monthly Average Flow [m³/d]
Total Catchment Area	609,670	1,490
Sum of Rock Pad and Road Area	172,819	368
Net Undisturbed Area	436,851	1,121

The undisturbed source terms and industrial pad source terms were multiplied by the flow rates for each area to obtain the constituent load from each area. Each load was then divided by total flow (impacted and unimpacted) to estimate the concentration in the combined runoff. These concentrations were then compared to the CCME Water Quality Guidelines for the Protection of Marine

Aquatic Life. Though it is not expected that all runoff from the catchment in Figure 1 will fully mix prior to entering the Bathurst Inlet, this example shows how much, if any, additional dilution is required from the Bathurst Inlet to meet the CCME marine life water quality guidelines.

The CCME guidelines which were highlighted in this analysis were arsenic and mercury. Copper was not included because there is no CCME marine guideline and copper would likely precipitate as a carbonate mineral when the runoff mixes with seawater and settle from the water. The predicted concentrations for June under average hydrologic conditions are compared to CCME marine guidelines in Table 2. The prediction would not vary with changes in runoff during wet and dry years because the ratio of impacted to unimpacted runoff would be the same.

Table 2: Water and Load Balance Results for Arsenic and Mercury

Parameter	Rock Pad/Road Total Load (mg/d)	Undisturbed Area Load (mg/d)	Total Load (mg/d)	Resultant Concentration (mg/l)	CCME MAL Guideline (mg/l)
Arsenic	16,533	219	16,751	0.011	0.013
Mercury	3	11	14	0.000009	0.000016

Based on the results in Table 2, the concentrations of arsenic and mercury are below the CCME guidelines for marine aquatic life. The remaining months in the open water season were also modelled to verify that the June condition was the worst case. All resultant concentrations were below the CCME guideline for the protection of marine aquatic life.

This model does not account for the dilution that would occur when the runoff mixes with Bathurst Inlet, reducing the concentrations further. Runoff from the pads and roads in the MLA are predicted to not cause any exceedance in Bathurst Inlet.

Notwithstanding this analysis, which demonstrates why Sabina is satisfied that no additional water management structures are required, Sabina has operational procedures in place to manage and address hydrocarbon spills (FEIS Volume 10, Chapter 4, Fuel management Plan and FEIS Volume 10, Chapter 6, Oil Pollution Emergency Plan).

Sabina highlights the above information was previous submitted during the Final Environmental Impact Statement Technical Comment Phase as response F-INAC-TC-4.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-29**
Subject/Topic:	Water Quality Model Results		

Reference to Type A:

- Water and Load Balance Report (WLBR) Section 4, Section 7.2

Detailed Review Comment:

Gap/Issue
Sabina indicates, "*The predicted water quality concentrations are based on a deterministic modelling approach, assuming average hydrological conditions. This approach is consistent with the derivation of source terms, which are developed based on average hydrology. The predicted water quality under these conditions provides the most likely results to occur.*"

While the sensitivity analysis provides variances from this average "base case", no discussion as to how these "upper cases" reflect realistic potentialities. Many of these scenarios currently appear arbitrary; no rationale has been provided to indicate how realistic these scenarios are, and whether Sabina has a response framework in place should they occur.

Disagreement with WL information/ conclusion
Sabina has not provided a discussion as to how the varying "upper case" scenarios in the water and load balance sensitivity analysis reflect potentialities at the project site.

Reasons for disagreement
Failure to accurately model and evaluate scenarios diverging from the base case may improperly characterize the impacts of project activities under conditions less optimal than average.

Recommendation/Request:

We recommend Sabina provide a discussion as to how the "upper case" scenarios presented in the water and load balance sensitivity analysis reflect realistic potentialities at the Project site, what factors may cause such deviation and whether a more conservative sensitivity analysis is warranted.

We further request Sabina provide a discussion as to how these "upper case" scenarios may be adaptively managed. We are particularly concerned with arsenic concentrations resulting from the "upper case" scenarios as outlined in Figure 9-1, which shows exceedances of the SSWQO (0.01 mg/L) in perpetuity. If this information has already been provided, we request Sabina direct us to that information.

Sabina Response:

Sabina will provide a discussion of the "upper case" scenarios relative to Project conditions and factors that could result in the development of "upper case" arsenic conditions prior to the Technical Meeting. This discussion will include proposed adaptive management scenarios to mitigate the potential for formation of "upper case" conditions.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-30**
Subject/Topic:	Saline Water Management Plan		

Reference to Type A:

- Water Management Plan, Section 8.1.8, Section 9.4.2

Detailed Review Comment:

"*Sabina proposes to include a Saline Water Management Plan as a component of the next revision to the Water Management Plan.*" Saline water management is a significant liability associated with the Back River project. Failure to provide a Saline Water Management Plan at the time of water licencing precludes our capacity to assess whether the project can operate within the confines of the predictions outlined in the Final Environmental Impact Statement.

Recommendation/Request:

We request Sabina provide a full saline water management plan prior to receiving a water licence. We note that the conceptual details of the plan provided in section 9.4.2 of the existing water-managing plan are insufficient.

Sabina Response:

Sabina commits to working with the KIA, NWB, and all other applicable regulatory bodies to develop a Saline Water Management Plan 60 days prior to the commencement of operations.

Sabina notes Term and Condition No. 19 of the Back River Project Certificate (171219-12MN036-NIRB Project Certificate No 007-FT3E) requires Sabina to, reflecting any direction from the Nunavut Water Board, maintain and provide a saline water management plan to the NIRB at least 60 days prior to the commencement of operations.

As stated in Section 9.4.2 of the Water Management Plan (171002 2AM-BRP----SD05-WaterMgmtPlan_IMLE), this saline water management plan will include monitoring of thermal conditions, monitoring of saline water at the Goose Property, and mitigation measures designed to address the potential for higher-than-predicted volumes of saline water inflows into the open pit and the underground mines, treatment, and disposal methods. This plan will also include accurate characterization of saline water inflows into the underground mine workings.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-31**
Subject/Topic:	Flooded Pit Water Management		

Reference to Type A:

- Water Management Plan Section 8.3.3
- Water and Load Balance Figure 7-1 through 7-4.

Detailed Review Comment:

Gap/Issue
Sabina notes "Pit water will meet applicable discharge criteria and then be allowed to overtop into nearby watercourses. Table 6.1-2 provides a summary of the average monthly water quality concentrations at the time of flooding and the average open water long-term steady state conditions in each of the flooded open pits. These predictions are compared to MMER discharge limits. All parameters in each pit lake facility are expected to meet MMER limits at the time of flooding and long-term steady state conditions are expected to meet CCME guidelines or SSWQOs as appropriate".

Sabina has not presented sufficient evidence to validate the claim that the long-term water quality in the pits will meet CCME guidelines or SSWQOs as appropriate.

Disagreement with WL information/ conclusion
Water quality presented in Table 6.1-2 indicates many parameters in the flooded pits, including those converted to tailings facilities during phased mining, will continue to exceed several long-term CCME water quality objectives in perpetuity. This appears to invalidate Sabina's claim leading to concern with water quality in the receiving environment; we acknowledge the flooded pits will be listed tailings impoundment areas under Schedule 2 of MMER.

Our concern therefore is for the receiving environment downstream of the flooded pits. Modelling results presented in the Water and Load Balance Report indicate exceedances in the receiving environment at closure, which do not persist in perpetuity. We are concerned this discrepancy may reflect a calculation error, which affects the duration in which concentrations may continue to exceed CCME WQOs at prediction nodes throughout Goose Lake; additional treatment may therefore be required.

Reasons for disagreement
See above.

Recommendation/Request:

Sabina should provide a discussion as to the discrepancy between the statement "*All parameters in each pit lake facility are expected to meet MMER limits at the time of flooding and long-term steady state conditions are expected to meet CCME guidelines or SSWQOs as appropriate*" and the modelling results presented in Table 6.1-2 of the water management plan. Further discussion should be provided with regard to how this may influence predicted water quality as presented in the water and load balance.

Sabina Response:

Sabina acknowledges the discrepancy between the referenced statement from Section 8.3.3 of the Water Management Plan (171002 2AM-BRP----SD05-WaterMgmtPlan_IMLE) and the long-term results presented in Table 6.1-2 of this plan.

As indicated in Section 8.7 of the Water and Load Balance Report (171002 2AM-BRP----MAD App E-2_WaterLoadBalanceRpt-IMLE), the load balance was completed assuming fully mixed conditions.

The water and load balance did not include an evaluation of the potential for stratification in the flooded pits at Closure. A hydrodynamic model will be completed as part of the detailed engineering phase of the Project. The model will be completed in an iterative approach using results from the updated load balance model. The results of this modelling exercise will produce more robust predictions for the long-term quality of the pit lakes as well as the downstream prediction nodes. It is recommended that this comment be revisited once these new predictions are available.

Sabina clarifies that, as stated in Section 4.5.4 of the Main Application Document (171002 2AM-BRP----MainApplicationDocument-IMLE), ECCC has determined that the following Project waterbodies or portions of waterbodies will require a listing under Schedule 2 of the MMER:

- Pond 6;
- Pond 7;
- Pond 8;
- Pond 9;
- the portion of Goose Inflow South that will be overprinted by the TSF;
- the portion of Goose Inflow East that will be overprinted by the TSF; and
- other ephemeral streams that will be overprinted by the TSF.

As such, Sabina confirm that all flooded pits will not be listed as tailings impoundment areas under Schedule 2 of MMER.

Attachment:

N/A

Interested Party:	KIA	**TC No.:**	**WT-KIA-NWB-32**
Subject/Topic:	Freshet Monitoring		

Reference to Type A:

- Water Management Plan, Appendix B, Table B-01
- Aquatic Effects Monitoring Plan Table 4.3-3

Detailed Review Comment:

Gap/Issue
Water quality monitoring stations BRP 18 (Lama Watershed Outflow), BRP-19 (Echo Outflow), BRP-23 (Gander Pond outflow) and BRP-3- (Goose Southeast Inflow) are all designated to "Test quality of non-contact water runoff from…" their respective sub watersheds. Table B-01 indicates that this monitoring will occur once during freshet.

This monitoring frequency is not sufficiently detailed to provide assurance that potential airborne contaminants deposited on the tundra and sediment mobilized during freshet will be appropriately characterized prior to reaching the aquatic environment.

Similarly, AEMP stations BRP-31 and BRP-34 be should characterize the aquatic environment during freshet but the sampling frequency provided in AEMP Table 4.3-3 does not provide confidence that this will be achieved. The stated sampling "frequency" is "four times per year" and "June, August" respectively.

Disagreement with WL information/ conclusion
Freshet represents a relatively short sampling window in which on land particulate matter may be rapidly mobilized to the aquatic environment. Insufficient detail regarding sampling frequency for sites BRP-18, BRP-19, BRP-23, BRP-31 and BRP 34 has been included in the application to provide assurance that monitoring will occur during this critical period.

Reasons for disagreement
Failure to collect seasonally appropriate samples may result in an unrepresentative characterization of aquatic conditions during freshet and any corresponding impacts from preconstruction activities. This may in turn result in a failure to implement an appropriate adaptive response to changes in the aquatic environment.

Recommendation/Request:

We recommend the monitoring frequency for BRP-18, BRP-19 and BRP-23 be further refined to once during freshet as confirmed by on site air temperature and flow measurements consistent with an increase in flow indicative of melting snow and ice, and monthly during construction while visible flow is present at the station.

We recommend the monitoring frequency for BRP-31 and BRP-34 be reined such that at least one sample annually will be collected during freshet as defined above.

Sabina Response:

Sabina agrees to sampling BRP-18, BRP-19, and BRP-23 once during freshet and monthly during upstream construction while visible flow is present at the stations. As stated in the Aquatic Effects Management Plan (171002 2AM-BRP----SD21-AEMP-IMLE), annual freshet (June) sampling of BRP-34

(Goose Outlet) is already included. Regarding freshet sampling at BRP-31, lake sampling is not possible during freshet due to ice conditions (see response to WT-KIA-NWB-27), but BRP-31 will be sampled as soon as the lake is safely accessible in July.

Attachment:

N/A

Sabina
GOLD & SILVER CORP.

The BACK RIVER PROJECT

Technical Comment Responses

Crown-Indigenous Relations and Northern Affairs Canada

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-1**
Subject/Topic:	Water Management Diversions and Dams		

Reference to Type A:

- Water Management Plan
- INAC Completeness Comment #1
- Sabina's Response to INAC Completeness Comment #1
- Figure A-11, General Arrangement Sheet 1 of 2, updated 2018-02-05
- Figure A-12, General Arrangement Sheet 2 of 2, updated 2018-02-05

Detailed Review Comment:

The discharge location shown on updated Figure A-11 for Umwelt WRSA Diversion Berm appears to flow into the Umwelt WRSA. This is possibly in error since the purpose of the berm is understood to be to prevent the inflow of runoff into the WRSA from the upper basin area.

Updated Figure A-12 does not show flow directions or discharge location for the TSF WRSA Diversion Berm.

Recommendation/Request:

1. INAC requests that Figures A-11 and A-12 be further improved to clearly indicate directions of flow and release points for all diversions.

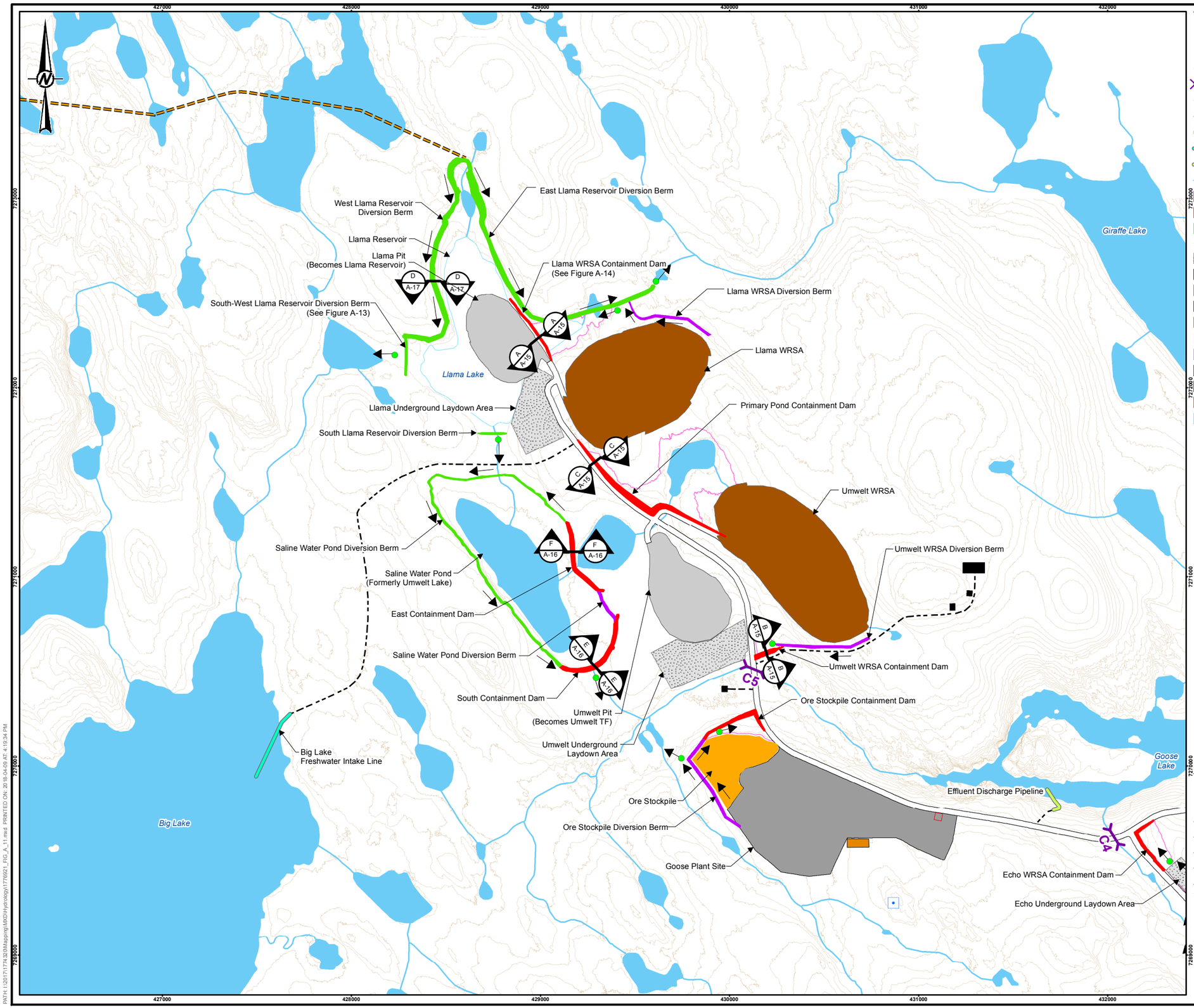
Sabina Response:

Sabina acknowledges CIRNA's request and has provided updated versions of Figure A-11 and Figure A-12 of the Water Management Plan (171002 2AM-BRP----SD05-WaterMgmtPlan_IMLE) with the noted changes.

Attachment:

Figure A-11: General Arrangement Sheet 1 of 2

Figure A-12: General Arrangement Sheet 2 of 2



LEGEND

- DISCHARGE LOCATION
- TREATED EFFLUENT WATER DISCHARGE
- CONTOUR (2 m)
- CULVERT
- FLOW DIRECTION
- SERVICE ROAD
- WINTER ICE ROAD
- WATER INTAKE PIPELINE
- EFFLUENT DISCHARGE PIPELINE
- WATERCOURSE
- CONTACT WATER DIVERSION BERM (UNLINED)
- CONTACT WATER CONTAINMENT DAM (LINED)
- NON-CONTACT WATER DIVERSION BERM (UNLINED)

GOOSE LAYOUT

- U/G LAYDOWN AREA
- OTHER INFRASTRUCTURE
- RESOURCE PIT
- CAMP/PLANT SITE
- WASTE ROCK STORAGE AREA
- ORE STOCKPILE
- CONTACT WATER EVENT POND FULL SUPPLY LEVEL
- HAUL ROAD
- LANDFARM
- TAILINGS EMERGENCY POND
- WATERBODY

ISSUED FOR PERMITTING

0 500 1,000
1:20,000 METRES

REFERENCE(S)

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PROJECTION: UTM ZONE 13N DATUM: NAD 83

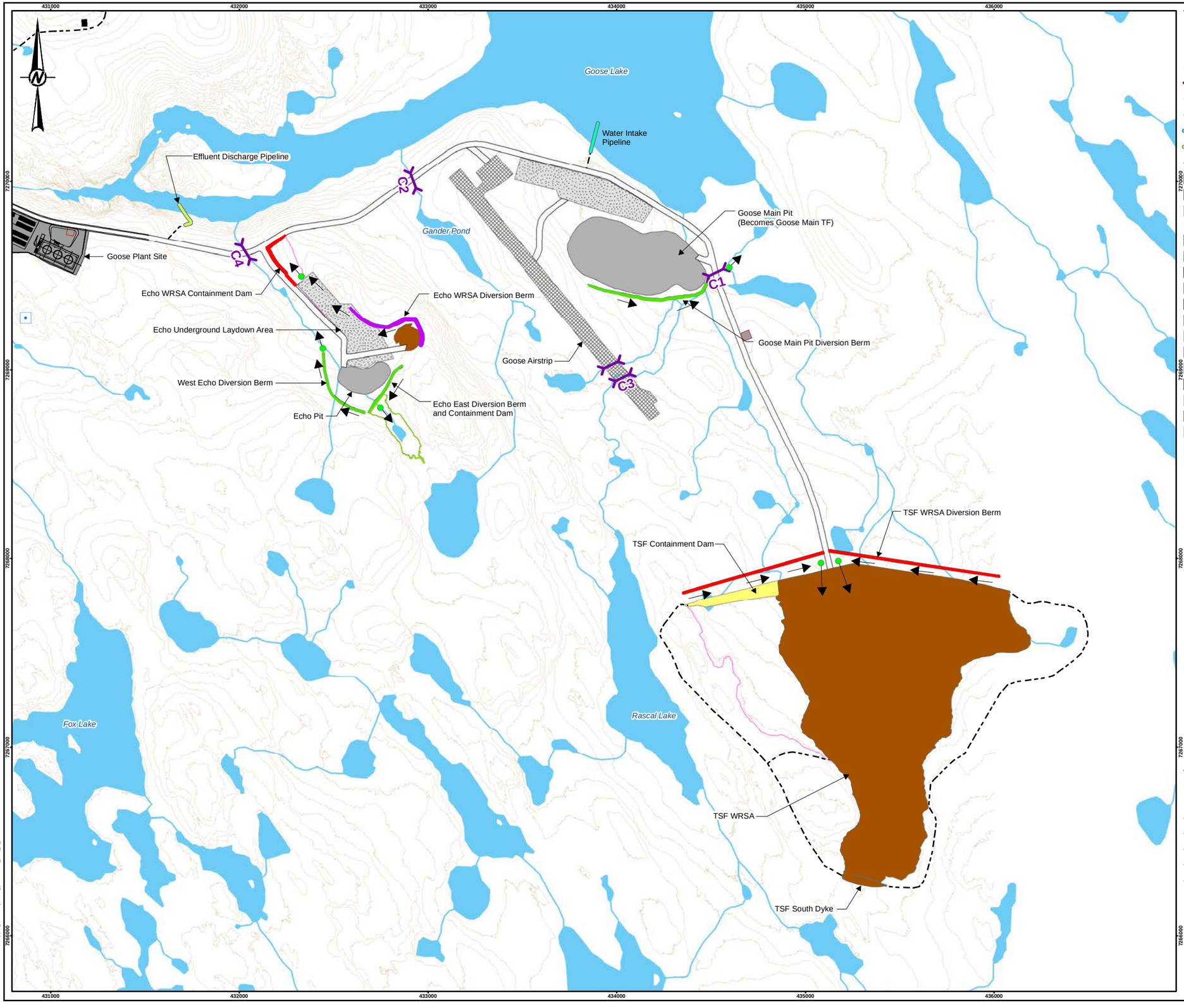
YYYY-MM-DD	2018-04-09
DESIGNED	SRK
PREPARED	SK
REVIEWED	DRW
APPROVED	PC

CLIENT: Sabina Gold & Silver Corp.
CONSULTANT: Golder Associates

PROJECT
BACK RIVER PROJECT, WATER LICENCE PHASE
NUNAVUT, CANADA

TITLE
GENERAL ARRANGEMENT
SHEET 1 OF 2

PROJECT NO.	FIGURE	REV.
1776921	A-11	C



LEGEND

- DISCHARGE LOCATION
- TREATED EFFLUENT WATER DISCHARGE
- CONTOUR (2 m)
- CULVERT
- FLOW DIRECTION
- SERVICE ROAD
- WATER INTAKE PIPELINE
- EFFLUENT DISCHARGE PIPELINE
- WATERCOURSE
- CONTACT WATER DIVERSION BERM (UNLINED)
- CONTACT WATER CONTAINMENT DAM (LINED)
- NON-CONTACT WATER DIVERSION BERM (UNLINED)

GOOSE LAYOUT

- PROPOSED AIRSTRIP
- U/G LAYDOWN AREA
- OTHER INFRASTRUCTURE
- RESOURCE PIT
- CAMP/PLANT SITE
- WASTE ROCK STORAGE
- TAILINGS STORAGE FACILITY EMBANKMENT
- TSF SOUTH DYKE
- CONTACT WATER EVENT POND FULL SUPPLY LEVEL
- HAUL ROAD
- NON-CONTACT WATER EVENT POND
- TAILINGS EMERGENCY POND
- WATERBODY

ISSUED FOR PERMITTING

0 500 1,000

1:20,000 METRES

REFERENCE(S)

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PROJECTION: UTM ZONE 13N DATUM: NAD 83

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CLIENT: Sabina Gold & Silver Corp.

CONSULTANT: Golder Associates

PROJECT
BACK RIVER PROJECT, WATER LICENCE PHASE
NUNAVUT, CANADA

TITLE
GENERAL ARRANGEMENT
SHEET 2 OF 2

PROJECT NO.	FIGURE	REV.
1776921	A-12	C

PATH: I:\2017\1774\32\Mapping\MXD\Hydrology\1776921_FIG_A_12.mxd PRINTED ON: 2018-04-09 AT 2:43:04 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-2**
Subject/Topic:	Water Management at north face of Tailings Storage Facility (TSF) Containment Dam		

Reference to Type A:

- Water Management Plan
- Water Management Plan Figures A-01 to A-08, (eight in total)
- Water Management Plan Figures A-12

Detailed Review Comment:

Figure A-01, titled Goose Property Catchments, presents watershed catchment areas that are the basis for sizing water management ponds and pumps. The present comment is concerned with Catchment TWD2, labelled "TSF WRSA Downstream Seepage Collection" with a small basin area of 0.14 km2. The footprint of catchment TWD2 appears to correspond to the area between the crest of the TSF Containment Dam Embankment and the TSF WRSA Diversion Berm located below the toe of the dam embankment.

Figure A-02, "Goose Property Pumping and Culvert Schematic" shows the dam embankment details and a pump (P14) at the TSF WRSA Diversion Berm.

Figure A-03 (Phase 1 Construction) shows an outline of the TSF Containment Dam Embankment with no tailings present.

Figure A-04 (Phase 2 Stage 1 TSF Operation) shows the same outline of the TSF Containment Dam Embankment, plus a footprint of "Active TSF" on the south (upstream) side of the Dam Embankment. The figure also shows a "Pumped Contact Water Pipeline" from the TSF Diversion Berm to the TSF WD Pond.

The figures that follow, A-05 (Phase 2 Stage 2) through A-08 (Phase 4 Post-Closure) and Figure A-12 all show an altered footprint of waste rock storage that extends over the top of approximately ¾ of the longitudinal extent of the Phase 1 containment dam. This configuration suggests that much of the original dam will be covered with tailings and will not provide its original water management function after the Phase 2 Stage 1 operations have concluded.

If the inference presented above is correct, the tributary basin to the TSF Diversion Berm may increase significantly in the latter stages of the project.

In addition to increased flows, significant sediment loads could also be produced from tailings area runoff which could compromise the proper functioning of pumps that are relied upon to provide water management.

Recommendation/Request:

1. INAC requests clarification of Sabina's plan for the proposed placement of tailings over the footprint of the Phase 1 TSF containment dam.

2. As appropriate, determine the future basin area draining to the TSF Diversion Berm and size pumps accordingly. Provide details on how initial sediment loads from the downstream face of the containment dam, and the higher sediment loads to be expected if the tailings are placed over the top of the dam embankment will be managed.

3. Please provide location of information on the seepage collection system that corresponds to the Figure A-01 label for catchment TWD2: "TSF WRSA Downstream Seepage Collection".

Sabina Response:

Sabina would like to clarify that tailings is not proposed, and will not be, placed over top of the footprint of the TSF Containment Dam.

Sabina clarifies that the figures referenced above (Figure A-05 to Figure A-08, and Figure A-12) shows that only waste rock will be placed over the crest of the TSF Containment Dam. The waste rock is shown in brown in Figures A-05, A-06, A-12, and shown in grey in Figures A-07 and A-08. Sabina apologies for any confusion; please refer to Figure A-02 and Figure A-09 of the Tailings Management Plan (171002 2AM-BRP----SD09-TailingsMgmtPlan-IMLE) for further details on the relative placement of tailings and waste rock associated with the TSF.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-3**
Subject/Topic:	Water Management Facility Summaries are Incomplete		

Reference to Type A:

- Water Management Plan
- Section 6.3: Hydrologic Model
- Tables 6.3-1, 6.3-2
- Section 6.4: Pond Sizing
- Table 6.4-1
- Section 6.6: Diversion Berms and Containment Dams
- Figures A-02, A-03

Detailed Review Comment:

Table 6.3-1, Return Period Selection Criteria, identifies "contact water event ponds with additional water infrastructure downstream" but without a companion summary of how these criteria were applied.

Table 6.3-2, Level of Risk for Each Item of Goose Infrastructure and Contributing Catchment Areas, does not account for pumped water between facilities.

Table 6.4-1, Goose Property Pond Capacity and Pumping Rate Summary, is incomplete. No information is given for pumps P4, P5, or P14.

Water Management Plan Section 6.3.2.1 Return Period Selection, presents return period criteria for each structure, qualitatively assessed using engineering judgement, risk of overtopping or breach, and other factors. For contact water event ponds, the level of risk is assumed to be high (100-year rainfall depth) unless there is "additional water infrastructure downstream" when the risk is reduced to medium (50-year) rainfall.

The section continues with Table 6.3-2 which presents catchment areas and level of risk (low-medium-high) for each water management facility. There are two containment facilities –Primary Pond and East Echo Containment Dam – that are rated medium risk, presumably because of unspecified additional water infrastructure downstream.

The above water management plan section does not provide sufficient information for INAC to review or confirm the assigned risk levels. Additional information is needed to understand which facilities are susceptible to a breach (dam break) failure, what if any downstream facilities would receive that water and whether those facilities have sufficient excess capacity to contain projected flows. INAC notes that facility water type (contact versus non-contact) needed for risk classification per Table 6.3-1 is presented later in Section 6.6, Diversion Berms and Containment Dams.

The return period selection criteria consider "the qualitative level of risk associated with overtopping or breaching of the structure" but there is no further discussion of the risk or use of designated spillway sections to reduce the risk of a breach. Canadian Dam Association guidelines should be used to provide guidance on whether spillway would be recommended for the size of the impoundments proposed and the consequence of failure.

Water Management Plan Section 6.4, Table 6.4-1, presents a summary of Pond Capacities and Pumping Rates, listed by Pump IDs under the column heading of "Pond ID" which is not found elsewhere. Figure A-02, Goose Property Pumping and Culvert Schematic, presents a list of 14 pumps, P1 to P14, and corresponding water management element. Figure A-03, Phase 1 Construction, shows pumped water

pipelines including those from ponds to pits or other ponds, but the pumped water linkages connections are incomplete and unclear.

Section 6.4 does not provide a complete list of pumps and pump capacities, and linkages are missing. Capacities of Pumps P4, P5, and P14 are not included in Table 6.4-1. Linkages between pumped facilities, such as from Umwelt WRSA Pond (Pump P2) to Umwelt Pit Sump (Pump P1) need to be clearly described. Inter-facility pumping will result in increased water flow to the downstream facility, possibly affecting the required storage capacity and pump rate compared to amounts computed solely based on gravity flows from tributary catchment areas.

Recommendation/Request:

1. INAC requests that the facility summary be revised or amended to include the following elements: (1) outlet destination for pumped releases, (2) pumped inflows if any, (3) presence of an embankment which could potentially fail resulting in release of stored water, and (4) downstream water infrastructure in the flow path of an overtopping or breach event.

2. INAC requests that the need for dam embankment spillways be assessed considering Canadian Dam Association guidelines based on facility size and consequence of failure.

3. INAC requests that the Pumping Rate summary be expanded to include Pumps P4, P5, and P14 presently missing, and that storage capacities and pump rates be re-assessed for facilities that receive inter-facility pumped flow in addition to gravity flow from catchment areas.

Sabina Response:

Part 1

Sabina acknowledges CIRNA's request to expand Table 6.3.2 of the Water Management Plan (171002 2AM-BRP----SD05-WaterMgmtPlan_IMLE) to facilitate understanding of the rationale used for defining the risk classifications of the various water management infrastructure. An updated version of Table 6.3.2 providing the following requested information is attached:

- List of pumped inflows to each water management infrastructure;
- List of pumped outflows from each water management infrastructure;
- Type of water;
- Presence of embankment to store water; and
- Downstream water infrastructure.

Sabina will include the updated Table 6.3.2 in the next revision of the Water Management Plan. As stated in the Water Management Plan, Sabina will initiate update to the plan prior to start of construction and will incorporate issue for construction engineering drawings of associated water management infrastructure.

Part 2

The majority of the water ponds at the Goose site will be operated normally empty or minimal water storage; ponds will retain water only for short periods of time mainly during freshet and during the open water season in the hours/days immediately after rainfall events. As water starts accumulating in the ponds, the pumping systems in the ponds will be used to promptly remove accumulated water.

The water ponds are designed to provide storage of a design event (rainfall plus snowmelt) selected based on a qualitative assessment of risk associated to the failure of the ponds, while providing a minimum freeboard. The qualitative assessment was completed taking into consideration human health and safety, environmental, reputational and economic consequences of a failure of the ponds. In broad terms these criteria are consistent with the Canadian Dam Association (CDA) Guidelines.

The minimum freeboard for the water ponds was defined to provide contingency storage for events (rainfall plus snowmelt) larger than the design event, and to manage uprush in water level in the ponds due to wind and waves, that may be generated during the event. With the exception of the Saline Water Pond and the TSF, a freeboard of 0.5 m was considered based on engineering judgment.

A more detailed freeboard assessment was completed for the Saline Water Pond in consideration of the significantly larger (than other water ponds) storage capacity of this pond, the quality of the water in the pond, and the fact that the pond will not have downstream infrastructure. The assessment was focussed on estimating the normal and minimum freeboard according to the Canadian Dam Association (CDA 2013) guidelines. A summary of the findings of this assessment is presented herein; the full assessment is included in Attachment A of Appendix F-1 of the Site Wide Water Management Report (171002 2AM-BRP----MAD App F-1_Site-WideWaterMgmtRpt-IMLE).

The Saline Water Pond containment structures (East Dam and South Dam) were assigned a “High” consequence classification based on CDA (2013).

A wind and wave analysis was performed to ensure that the crests of the dams are protected against the more critical of the following two cases (Canadian Dam Association, 2013):

- Normal freeboard: No overtopping by 95% of the waves caused by the most critical wind with a frequency of 1 in 1,000-year when the pond is at its maximum normal elevation (maximum level during the design event); and
- Minimum freeboard: No overtopping by 95% of the waves caused by the most critical wind associated with the annual exceedance probability event, when the pond is at its maximum extreme level during the passage of the inflow design flood.

Based on this classification, the Inflow Design Flood (IDF) for the Saline Water Pond was defined to be 1/3 between the 1,000-year event and the Probable Maximum Flood (PMF).

As a result of this assessment, a freeboard of 1 m and 1.3 m for the East Dam and South Dam, respectively was defined to meet both normal and minimum freeboard requirements for the Saline Water Pond. These freeboard requirements provide for storage of the IDF within the Saline Water Pond, and therefore a spillway to pass the IDF was not deemed necessary.

Regarding the TSF, as stated in Section 4.6 of the Tailings Management System Design Report (171002 2AM-BRP----MAD App F-4_TailsMgmtSystemDesign-IMLE), a permanent spillway is not required for the facility. Based on the dam hazard classification of High, the guidelines (CDA 2013) recommend the use of an inflow design flood (IDF) of 1/3 between the 1:1,000 return period, 24-hour duration precipitation event and the probable maximum precipitation (PMP) for this region. Notwithstanding this criterion, the TSF has been designed to contain 100% of the probable maximum flood (PMF) of 221 mm, resulting in a freeboard requirement of 0.55 m. This freeboard allowance negates the need of a constructed permanent spillway. Details are provided in Appendix D of the Tailings Management System Design Report.

Part 3

Sabina acknowledges CIRNA's request to expand Table 6.4-1 of the Water Management Plan to include pumping system P4, P5, and P14. The expanded Table 6.4-1 is provided below and will be included in the next revision of the Water Management Plan. As stated in the Water Management Plan, Sabina will initiate update to the plan prior to start of construction and will incorporate issue for construction engineering drawings of associated water management infrastructure.

It is noted that P5 (Water Treatment Plant) is not located within a water management pond; therefore some of the parameters included in Table 6.4-1 are not applicable and are marked as N/A in the table. P14 is located at the TSF WRSA Diversion Berm, which will mainly collect seepage from the TSF plus some runoff from the small area between the berm and the TSF dam. The sizing of P14 will be completed as part of the final design of the TSF.

As shown in the expanded Table 6.3-2, the only ponds that receive pumped inflows are the Primary Pond, the Saline Water Pond, and the TSF WRSA Pond. The Saline Water Pond and the TSF WRSA Pond are not event ponds and are sized based on the site wide water balance which accounts for the pumped inflows. The Primary Pond is an event pond that will receive pumped inflows from other contact water event ponds. Pumping from these ponds to the Primary Pond will be initiated only if the Primary Pond has capacity to receive water; the storage capacity in the event ponds will be used during the period when pumping to the Primary Pond is not possible.

Table 6.4-1: Goose Property Pond Capacity and Pumping Rate Summary

Pond ID	Description	Design Return Period	Required Capacity (m^3)	Available Capacity (m^3)	% Full	Dewatering Duration (days)	Pumping Rate (m^3/s)
P1	Umwelt Pit Sump	10	18,000	n/a	n/a	2	0.10
P2	Umwelt WRSA Pond	100	27,000	30,100	90%	2	0.15
P3	Ore Stockpile Pond	100	10,000	11,000	91%	2	0.06
P4	Saline Water Pond	100	1,100,000	1,550,000	71%	N/A(1)	0.06(1)
P5	Water Treatment Plant	N/A	N/A	N/A	N/A	N/A	0.12
P6	TSF WRSA Pond	100	174,000	1,163,100	15%	16	0.13
P7	Primary Pond	50	109,500	316,650	35%	23	0.06
P8	Llama WRSA Pond	100	20,000	26,000	77%	2	0.11
P9	Llama Pit Sump	10	12,000	n/a	n/a	2	0.07
P10	Goose Pit Sump	10	20,000	n/a	n/a	2	0.11
P11	Echo Pit Sump	50	5,000	n/a	n/a	2	0.03
P12	Echo Diversion Pond	50	11,000	18,000	61%	2	0.06
P13	Echo WRSA Pond	100	48,000	61,000	79%	10	0.06

Note 1: Saline Water Pond is not an event pond (it is not designed to be operated empty); therefore there is no criterion for dewatering duration. The pumping rate shown is based on site wide water balance requirements.

Attachment:

Table 6.3-2: Level of Risk for Each Item of Goose Infrastructure and Contributing Catchment Area

Table 6.3-2: Level of Risk for Each Item of Goose Infrastructure and Contributing Catchment Areas

Infrastructure	Catchment ID	Catchment Area (km²)	Level of Risk	Type of Water	Pumped Inflows	Pumped Outflows	Embankment	Downstream water infrastructure
Umwelt Pit Sump	UP UU	0.23 0.10	Low	Contact Water	None	P1 Construction: to Primary Pond Operations Stage 1: to Primary Pond	No	N/A
Umwelt WRSA Containment Dam (Umwelt WRSA Pond)	UCP2	0.11	High	Contact Water	None	P2 Construction: to Primary Pond Operations Stage 1&2: to Primary Pond	Yes	None
Umwelt WRSA Diversion Berm	UCP2	0.11	Medium	Contact Water	None	N/A	No	None
Primary Pond Haul Road Containment Dam (Primary Pond)	UCP1 UWD2 LWD1	0.38 0.21 0.18	Medium	Contact Water	Construction: P1, P2, P3 Operations stage 1&2: P1, P2, P3, P8, P9	P7 Construction: to Llama Lake Reservoir Operations Stage 1: to TSF Operations Stage 2: to Umwelt TF	Yes	Saline Water Pond and Umwelt Pit
West Llama Reservoir Diversion Berm	LD1	0.57	Low	Non-Contact Water	None	None	No	Llama Lake Reservoir/Llama Pit
East Llama Reservoir Diversion Berm	LD2	0.19	Low	Non-Contact Water	None	None	No	Llama Lake Reservoir/Llama Pit
Southwest and South Llama Reservoir Diversion Berms	LP	0.16	Low	Non-Contact Water	None	None	No	Llama Lake Reservoir/Llama Pit
Llama WRSA Diversion Berm	LWD2	0.19	Medium	Contact Water	None	None	No	None
Llama WRSA Containment Dam (Llama WRSA Pond)	LCP LWD2	0.10 0.19	High	Contact Water	None	P8 Operations Stage 1&2: to Primary Pond	Yes	Llama Lake Reservoir/Llama Pit
Llama Pit Sump	LP LU	0.16 0.07	Low	Saline Water	None	P9 Operations stage 1&2: to Primary Pond	No	N/A
Ore Stockpile Containment Dam and Diversion Berm (Ore Stockpile Pond)	OD MA	0.14 0.45	High	Contact Water	None	P3 Construction: to Llama Lake Reservoir Operations Stage 1&2: to Primary Pond Operations Stage 3 to Goose TF	Yes	None
Saline Water Pond East and South Containment Dams, and Diversion Berms (Saline Water Pond)	SWP	0.52	High	Saline Water	P9, Llama Underground, Umwelt Underground, Echo Underground, Goose Underground	Construction: to Llama Lake Reservoir Operations Stage 2: to Llama UG Operations stage 3: to Llama Reservoir, Umwelt UG and Goose UG	Yes	None
Echo Pit Sump	EP	0.07	Medium	Contact Water	None	P11 Operations Stage 2: Umwelt TF Operations stage 3: Goose TF	No	N/A
East Echo Containment Dam and Diversion Berm (Echo Diversion Pond)	ED2	0.19	Medium	Non-contact Water	None	P12 Echo Diversion Berms	Yes	Echo Pit
West Echo Diversion Berm	ED1	0.38	Medium	Non-contact Water	None	None	No	Echo Pit
Echo WRSA Containment Dam (Echo WRSA Pond)	ECP EU	0.04 0.09	High	Contact Water	None	P13 Operations Stage 2: Umwelt TF Operations stage 3: Goose TF	Yes	None
Echo WRSA Diversion Berm	EWD	0.06	Medium	Contact Water	None	None	No	None
Goose Main Pit Sump	GP GU	0.28 0.10	Low	Contact Water	None	P10 Operations Stage 1: TSF Operations Stage 2: to Echo WRSA Pond	No	N/A
Goose Main Diversion Berm	GD1	31.52	Medium	Non-contact Water	None	None	No	Goose Main Pit
TSF WRSA Pond	TWD1	1.90	High	Contact/Saline Water	Construction: None Operations Stage 1: P7, P10 and P14 Operations Stage 2 & 3: P14	P6 Operations Stage 1: to Mill Operations Stage 2: to Umwelt TF Operations Stage 3: to Goose TF	Yes	None
TSF WRSA Diversion Berm	TWD2	0.14	High	Contact/Saline Water	None	P14 Operations stage 1, 2 & 3: TSF WRSA Pond	Yes	None

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-4**
Subject/Topic:	Design Criteria for Culverts and Diversion Berms		

Reference to Type A:

- Water Management Plan
- Section 6.2: Hydrotechnical Design Criteria
- Tables 6.2-2, 6.2-3, 6.2-4
- Section 6.5: Culvert Sizing
- Table 6.5-1
- Figure A-01

Detailed Review Comment:

Water Management Plan Figure A-01, Goose Property Catchments, shows proposed culverts but corresponding catchment areas are not delineated.

Water Management Plan Section 6.2, Hydrotechnical Design Criteria, presents criteria for designing diversion berms and culverts in Tables 6.2-3 and 6.2-4, respectively. In both tables, the criterion for conveyance capacity is the 24-hour total rainfall volume, plus snowmelt, in units of cubic metres of volume. This proposed criterion does not follow normal practice which is to design conveyance features for a peak flow rate (discharge) expressed in m3/s or equivalent units. The tables identified in Section 6.2 should either be revised to indicate conventional units, or amended to include a detailed explanation if a non-standard approach is proposed.

Water Management Plan Section 6.5, Culvert Sizing, presents additional design criteria not included in Table 6.2-4, specifically (1) The fish bearing crossings will be sized to keep maximum water velocities below 1.5 m/s for the average June flow, and (2) all culverts will be sized to meet a 0.3 m criterion for maximum water depth above the top of culvert. The plan also states that fishbearing culverts will be embedded at depth and a "thin layer of streambed material" will be placed to promote fish passage and habitat suitability.

The origins of the above criteria are not provided. DFO may wish to review the suggested criteria for fish passage design. INAC notes that the suggested maximum headwater depth may exceed standard practice for other northern projects and provides no factor of safety against possible ice or debris blockage of the culvert inlet.

Table 6.5-1, Goose Property Culvert Characteristics, presents culvert characteristics (slope, diameter, embedment, etc.) and design storm hydraulic characteristics, including total discharge (m3/s), depths and velocities. No information is given for catchment area size or fish passage criteria other than is inferred by a non-zero embedment depth. No information is given for hydraulic characteristics corresponding to the average June flow referenced in the criteria for sizing fish passage culverts.

Of five culverts listed in Table 6.5-1, only the Gander Pond Culvert (C2) is designed with a non-zero embedment depth (0.4 m) indicating design for fish passage. Details for this culvert include a relatively steep slope of 3.6% and, for the 100-year storm event, supercritical flow conditions (normal depth less than critical) and an outlet flow velocity of 4.2 m/s. A proposed "thin layer of streambed material" through the culvert is unlikely to withstand such velocities.

Recommendation/Request:

1. INAC requests that Water Management Plan Figure A-01 be amended or supplemented to show watershed areas draining to proposed culverts.

2. INAC requests clarification on whether conveyance capacity criteria for diversions and culverts is intended to be based on a peak flow (discharge) rate and if the tables showing conveyance capacity in volume units are in error.

3. INAC requests further information on the origin of proposed criteria that (1) fish bearing crossings be sized to keep maximum water velocities below 1.5 m/s for the average June flow, and (2) culverts meet a 0.3 m criterion for maximum water depth above the top of culvert.

4. For culverts being sized for fish passage, please provide results of hydraulic calculations for depths and velocities corresponding to the mean June flow identified in the criteria. Also, please review whether a proposed thin layer of substrate through the culvert(s) would withstand ordinary peak flows and/or if alternate measures should be considered to enhance fish passage and habitat.

Sabina Response:

1. Sabina acknowledges and agrees with CIRNA's request to update Figure A-01 of the Water Management Plan (WMP; 171002 2AM-BRP----SD05-WaterMgmtPlan_IMLE) to show watershed areas draining to proposed culverts. Sabina will provide the amended figure prior to the Technical Meeting.

2. Sabina acknowledges an error in the units of measure for the conveyance capacity of the diversion berms and culverts. Diversion berms and culverts are designed to convey peak flows generated during the 24-hour duration design event. The amended tables 6.2-3 and 6.2-4 are provided below, and will be included in the next revision of the Water Management Plan. As stated in the Water Management Plan, Sabina will initiate update to the plan prior to start of construction and will incorporate issue for construction engineering drawings of associated water management infrastructure.

Table 6.2-3: Containment Dams (Event and Saline Water Ponds) and Diversion Berm Design Criteria

	Item	Value	Unit	Source/Comments
Diversion Berm Design	Event Return Period	10-100	Years	BMP
	Conveyance Capacity	24-hour total rainfall volume + Snowmelt	m^3/s	BMP
	Manning's Roughness	0.035	-	For minor natural steam with stones and weeds (Chow 1994)
	Minimum Slope	0.005	m/m	BMP
	Upstream Side Slopes	2:1	(H:V)	Constructability consideration
	Downstream Side Slopes	1.5:1	(H:V)	Engineering judgement
	Berm Top Width	6	m	Constructability consideration
	Minimum Berm Height	2	m	Constructability consideration
	Minimum Berm Freeboard	0.5	m	Engineering judgement
Event Pond Containment Dam Design	Minimum Dam Height	2	m	Constructability consideration
	Bedding Material Thickness around GCL	0.5	m	Engineering judgement
	Liner Tie-Back Length	3	m	Engineering judgement
	Upstream Side Slope (Ponded Water Level > 4m)	3:1	(H:V)	Constructability consideration
	Upstream Side Slope (Ponded Water Level < 4m)	2:1	(H:V)	Constructability consideration
	Downstream Side Slopes	1.5:1	(H:V)	Engineering judgement
Saline Water Pond Containment Dam Design	Bedding Material Thickness around GCL	0.5	m	Engineering judgement
	Dam Top Width	8	m	Constructability consideration
	Minimum Dam Height	2	m	Constructability consideration
	Upstream Side Slope	3:1	(H:V)	Constructability consideration
	Downstream Side Slope	2:1	(H:V)	Engineering Judgement
	Liner Tie-Back Length	3	m	Engineering Judgement
	Key Trench Tie-in Depth	2.2	m	MAD Appendix F-1, Appendix C

Table 6.2-4: Culvert Design Criteria

Item	Value	Unit	Source
Event Return Period	100	Years	BMP; SRK (2014)
Conveyance Capacity	24-hour total rainfall volume	m^3/s	BMP; SRK (2014)
Maximum Velocity during Average June flow for Fish Passage	1.5	m/s	SRK (2014)
Manning's Roughness for culverts with cobble stone base	0.040	-	Chow (1994)
Manning's Roughness for culverts without cobble stone base	0.024	-	Chow (1994)

3. The Gander Pond Outflow culvert is the only culvert crossing that requires a design with considerations for fish passage. The culvert will be designed to maintain fish passage as per requirements under the *Fisheries Act*, specifically that maximum velocities will be below the expected threshold for an adult Arctic Grayling to successfully navigate Rascal Stream West. The culvert guideline of a maximum velocity of 1.5 m/s for mean flows in June is expected to be a protective for fish. This velocity is similar in application to use of the mean annual maximum velocity for June, where the maximum passable velocity is approximately 1.9 m/s for an adult Arctic Grayling based on the fatigue curve derived from Katopodis and Gervais (2016). Additional information on culvert designs for Rascal Stream West will be provided with the Request for Review application or a Fisheries Act authorization application submitted to Fisheries and Oceans Canada (DFO). Please also see Sabina's Technical Comment responses to WT-DFO-TC-3.2 and WT-DFO-TC-3.4 for additional information.

   The 0.3 m criterion for maximum water depth above the top of the culvert during the passage of the peak flow, generated during the design event, was selected based on engineering judgement. As shown in Table 6.5-1 from the Water Management Plan, the maximum headwater for all culverts during design event peak flows is below the crest of the culverts (range from 0.11 m to 0.27 m below the top of the culvert). For these culverts, the space between the maximum headwater and the crest of the culvert plus the minimum 0.3 m allowance between the crest of the culverts and the crest of the roads provides contingency for potential ice blockage. Sabina notes that Echo culvert does not align with this design; this culvert will be updated to match the other culverts as part of final culvert design.

Table 6.5-1: Goose Property Culvert Characteristics – Design Storm

Culvert Description		Goose Culvert	Gander Pond Culvert	Goose Airstrip Culvert	Echo Culvert	Goose Creek Culvert
Culvert ID		C1	C2	C3	C4	C5
Characteristics	Slope (%)	1.0	3.6	1.0	1.5	3.5
	Diameter (m)	2.5	2.5	2.5	1.2	2.5
	Culvert Shape	Circ.	Circ.	Circ.	Circ.	Circ.
	Number of Barrels	2	2	2	1	1
	Culvert Material	CSP	CSP	CSP	CSP	CSP
	Embedment Depth (m)	0	0.4	0	0	0
100 Year Event	Total Discharge (m^3/s)	19.27	9.64	18.82	1.99	10.47
	Culvert Inlet Elevation (m)	100	100	100	100	100
	Headwater Elevation (m)	102.27	101.89	102.23	101.46	102.39
	Water Depth above Culvert (m)	0	0	0	0.26	0
	Invert Control Depth (m)	2.27	1.49	2.23	1.32	2.39
	Outlet Control Depth (m)	1.31	0	0.23	1.46	1.01
	Normal Depth (m)	1.18	0.98	1.17	1.20	1.06
	Critical Depth (m)	1.41	1.21	1.4	0.77	1.10
	Outlet Depth (m)	1.20	0.99	1.18	0.77	1.47
	Tail Water Depth (m)	0.82	0.54	0.83	0.06	0.12
	Outlet Velocity (m/s)	4.14	4.21	4.12	2.58	5.03
	Tail Water Velocity (m/s)	2.34	1.78	2.27	0.64	0.49

4. Sabina provided the estimated flow depth and velocity in the Gander Pond culvert during the mean June flow in Table 3-6 of Appendix F-1 of the WMP. For reference, this table is provided below.

Table 3-6 Gander Pond Outflow Stream Culvert – Average June Flow Characteristics

Parameter	Value
Total Discharge (m3/s)	0.065
Headwater Elevation (m)	100.55
Invert Control Depth (m)	0.15
Outlet Control Depth (m)	0
Normal Depth (m)	0.08
Critical Depth (m)	0.12
Outlet Depth (m)	0.11
Tail Water Depth (m)	0.06
Outlet Velocity (m/s)	0.80
Tail Water Velocity (m/s)	0.43

As stated above, additional information on culvert design, including fish passage considerations, for the Gander Pond culvert crossing will be provided with the Request for Review application or a Fisheries Act authorization application submitted to DFO. Sabina's proposed design includes embedding culverts on fish-bearing streams, which is a standard best management practice to mitigate effects to fish habitat related to a closed-bottom culvert installation (M.C. Ministry of Forests et al. 2012). Assuming that mean peak velocities are in the range of 1.0 to 1.5 m/s, Sabina does not expect that placed substrate (primarily cobble, with some small boulder substrate) will be dislodged or will be susceptible to movement (Gordon et al. 2004). A key design consideration will be a culvert size that spans the channel width to ensure that the flows are not constricted. Sabina intends to perform annual inspections of culverts for bed erosion as outlined in Table 8.4-1 of the Environmental Monitoring and Protection Plan (171002 2AM-BRP----SD20-EMPP-IMLE).

References:

B.C. Ministry of Forests, Lands and Natural Resource Operations, B.C. Ministry of Environment, and Fisheries and Oceans Canada. 2012. Fish-stream crossing guidebook. Rev. ed. For. Prac. Invest. Br. Victoria, B.C.

Gordon ND, McMahon TA, Finlayson BK, Gippel CJ, Nathan RJ. 2004. Stream Hydrology: An Introduction for Ecologists, 2nd Edition. Wiley and Sons NY. 444 pp.

Katopodis C, Gervais R. 2016. Fish swimming performance database and analyses, DFO. Can. Sci. Advis. Sec. Res. Doc. 2016/002. Vi + 550 p

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-5**
Subject/Topic:	Saline Water Migration		

Reference to Type A:

- Water Management Plan
- Section 8.1.8: Saline Water Pond
- Section 9.4.2: Saline Water Management
- Appendix B

Detailed Review Comment:

Umwelt Lake will be dewatered to construct the Saline Water Pond. To minimize surface flows towards the Saline Water Pond, it will be isolated by means of diversion berms.

To manage saline groundwater and minimize potential associated impacts to permafrost, soil, surface water vegetation and wildlife, Sabina is committed to providing additional details reflecting any direction provided by the NIRB and NWB. Sabina proposes to include a Saline Water Management Plan as a component of the next revision to the Water Management Plan. Section 9.4.2 of the Water Management Plan states that the Saline Water Management Plan is:

> *expected to include monitoring of thermal conditions, monitoring of saline water at the Goose Property, and mitigation measures designed to address the potential for higher-than-predicted volumes of saline water inflows into the open pit and the underground mines, treatment, and disposal methods. This plan will include accurate characterization of saline water inflows into the underground mine workings.*

The Water Management Plan identifies that sub-permafrost groundwater will be saline. Chloride concentrations will be upwards of 40,000 mg/L. The chosen management approach is to store the saline water in the former Umwelt lake (the Saline Water Pond). Water quality predictions show that the concentration of Chloride will reach approximately 30,000 mg/L in 2028. At closure the plan is to return the saline water to the underground, or pump it to the base of an open pit forming a meromictic lake.

The Saline Water Pond is to be unlined. Saline water from the Pond has the potential to migrate into the environment through the groundwater. If this occurs the saline groundwater has the potential to migrate beyond the footprint of the Saline Water Pond and potentially impact permafrost, soil, water quality, vegetation and wildlife. Resulting impacts to the environment would be challenging to remediate.

Currently the Water Management Plan contains no scope for monitoring or identifying if the water will be contained within the Saline Water Pond at all locations.

Recommendation/Request:

1. INAC requests that it be demonstrated that hydraulic, geological or permafrost containment is present within the upland terrain around the Saline Water Pond. If it can be demonstrated that containment is present, please provide cross sections (including geology, permafrost, and active layer thickness) for critical sections of the Saline Water Pond.

2. INAC recommends that Sabina submit the Saline Water Management Plan to the NWB a minimum of 60 days prior to the start of preparations associated with development of the Saline Water Pond. This Plan should include shallow groundwater, active layer and permafrost monitoring components.

Sabina Response:

1. Sabina will be conducting more field characterization studies in support of final design of the infrastructure, and further characterization in the form of percolation testing will be carried out immediately prior to construction of the Saline Water Pond. Refer to response WT-INAC-TRC-17 for additional details on percolation testing. This information from the field characterization will verify that the design meets the required intent of managing seepage through both the foundation and the body of any of the Saline Water Pond containment structures. If, based on this additional characterization, Sabina believes that there remain areas where seepage could occur, Sabina will install the necessary monitoring instrumentation to confirm the performance of these structures. Sabina will submit any updated information, including geological cross sections, in support of final designs of the infrastructure, and the results of additional information gleaned from percolation testing or foundation excavation will be documented in as-built drawing of the Saline Water Pond containment structures. All this information will be submitted to the NWB as directed by the Board.

2. Sabina notes Term and Condition No. 19 of the Back River Project Certificate (171219-12MN036-NIRB Project Certificate No 007-FT3E) requires Sabina to, reflecting any direction from the Nunavut Water Board, maintain and provide a saline water management plan to the NIRB at least 60 days prior to the commencement of operations.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-6**
Subject/Topic:	Tailings Storage Facility Water Migration		

Reference to Type A:

- Water Management Plan
- Section 8.2.6: Tailings Management Facilities
- Appendix B

Detailed Review Comment:

Section 8.2.6 of the Water Management Plan states that:

> *The Tailings Storage Facility (TSF) will store both tailings solids and supernatant water for the first two years of Operations. A seepage analysis of the TSF Containment Dam liner predicts that minor seepage through the TSF Containment Dam at an anticipated rate of 1,210 m3/year is expected while it is an active tailings management facility. The TSF WRSA Diversion Berm, constructed downstream of the TSF, will collect surface runoff and subsurface seepage through the active layer, which in turn will be pumped back into the TSF.*
>
> *Once the TSF is closed, the TSF WRSA Diversion Berm will collect runoff from the TSF WRSA, which will ultimately be captured in the active tailings management facility. No seepage or discharge from the TSF WRSA collection pond during active TSF operations or once the TSF becomes a WRSA will be released to environment unless discharge criteria are met.*
>
> *Seepage analysis for the TSF South Dyke was also completed during the FEIS process and flow is anticipated to be 92 m3/year; this minimal seepage will be easily managed by intermittent pumping.*

Water predicted to seep from the TSF that may not be captured has the potential to impact down-gradient groundwater and nearby surface water bodies. Groundwater may also leave the facility through the ridge lines surrounding the Tailings Storage Facility.

The Water Management Plan does not appear to contain a scope for monitoring or identifying if the water will be contained within the Tailings Storage Facility at all locations.

IF the impacted groundwater leaves the facility it has the potential to impact down-gradient water quality and aquatic resources.

Recommendation/Request:

1. INAC requests that it be demonstrated that hydraulic, geological or permafrost containment is present within the ridges around the TSF year-round. If it can be shown that containment is present please provide cross sections (including geology, permafrost, and active layer thickness) at critical sections of the Saline Water Pond.

2. INAC requests that Sabina develop a plan for installing and monitoring instrumentation to confirm groundwater elevations and permafrost conditions around the TSF.

3. INAC also requests that a shallow groundwater monitoring plan be developed. This should include subsurface (active layer) monitoring locations close to the Tailings Storage Facility.

Sabina Response:

1. Sabina will be conducting more field characterization studies in support of final design of the infrastructure, and further characterization in the form of percolation testing will be carried out immediately prior to construction of the TSF Containment Dam. Refer to response WT-INAC-TRC-17 for additional details on percolation testing. This information will verify that the design meets the required intent of managing seepage through both the foundation, which includes the western ridge where nominal surficial fractures rock has been observed, and the body of the TSF Dam. If, based on this additional characterization, Sabina believes that there remain areas where seepage could occur, Sabina will install the necessary monitoring instrumentation to confirm performance of the TSF dam. Sabina will submit any updated information, including geological cross sections in support of final design of the infrastructure, and the results of additional information gleaned from percolation testing or foundation excavation will be documented in as-built drawings of the TSF Dam. All this information will be submitted to the NWB as directed by the Board.

2. As stated in #1 of this response, should conditions be observed that warrant additional monitoring during further field characterization, these measures will be included final designs submitted to the NWB. Sabina does however wish to point out that there is no groundwater in the vicinity of the TSF.

3. The TSF is located on permafrost terrain and therefore there are no deep groundwater pathways. Seasonally, as a result of the presence of the active layer, there is a shallow perched water table. Sabina has assumed that all TSF surface contact water will need to be contained and therefore the facility has been designed to contain this water (171002 2AM-BRP----MAD App E-2_WaterLoadBalanceRpt-IMLE). Seepage containment in the TSF is based on ensuring a seal between the permafrost foundation and the geosynthetic clay liner. The TSF therefore would automatically by design capture any shallow groundwater. Sabina notes the presence of the TSF WRSA diversion berm, which is also keyed into the permafrost, is intended to capture any potential seepage from the TSF. There is therefore no opportunity for the perched shallow groundwater from the active layer to impact the environment beyond the existing containments systems. As a result, there is no requirement for additional shallow groundwater monitoring. As part of regular Project operations, performance of the TSF will be monitored and adaptively managed as appropriate to ensure runoff from the TSF is appropriately captured within the Project site water management system (171002 2AM-BRP----MAD App E-2_WaterLoadBalanceRpt-IMLE).

   Active layer monitoring for seepage flows will be considered once the complete field characterization data described in response #1 above has been obtained and evaluated in the context of the final TSF design.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-7**
Subject/Topic:	Saline Soil Management		

Reference to Type A:

- Water Management Plan
- Section 8.3.8: Saline Water Pond Closure

Detailed Review Comment:

A diffusion model has been used to predict pore water concentrations within the soil underlying the Saline Water Pond. It is unclear if this is the appropriate methodology for predicting pore water quality in sediment overlain by highly saline water (up to 30,000 mg/L Chloride).

Given the transient deposition of water within the Saline Water Pond and the density difference between the pond water and pore water the application of an advective model which considers density dependent transport may be more appropriate.

The outputs of an advective model would likely result in more appropriate but perhaps higher chloride concentrations than are currently being predicted by the diffusion model. This would have implications for current impact predictions and proposed mitigation measures.

Recommendation/Request:

1. INAC requests that the chloride diffusion model used by Sabina be provided as well as the rationale for its use and the underlying assumptions used.

2. INAC recommends that Sabina provide a robust justification for the use of a diffusion model rather than other alternatives to evaluate predicted chloride concentrations in pore water within the soil underlying the Saline Water Pond.

3. INAC requests that a sensitivity analysis be performed on downgradient TSF water quality for various soil quantities and saline concentrations for soil originating from the Saline Water Pond.

Sabina Response:

Sabina acknowledges CIRNA's technical comment and commits to providing additional information prior to the Technical Meeting and looks forward to additional discussion on this issue.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-8**
Subject/Topic:	Response Plan for Encountering Unforeseen Groundwater Flows		

Reference to Type A:

- Water Management Plan
- Section 6.1.4.2: Open Pit and Underground Workings Groundwater

Detailed Review Comment:

As stated in Section 6.1.4.2 of the Water Management Plan:

> *Umwelt Underground, Llama Underground, Llama Open Pit, and Goose Main Underground will all capture groundwater inflows These inflow quantities were included in the water and load balance.*

Making predictions of groundwater flux is challenging as the material properties can be highly variable. A further complication is the transient nature of the mining process and groundwater response. This leads to uncertainty within the model predictions. One way to manage the uncertainty is to have robust water management contingency plans in place as well as excess storage capacity available to handle unforeseen events.

By having a robust response plan in place as well as excess water storage capacity the likelihood of an uncontrolled water discharge is reduced. Uncontrolled discharges have the potential to negatively impact the water quality in surrounding water bodies.

Recommendation/Request:

1. INAC requests that Sabina ensure that robust contingency plans will be put in place prior to commencing mining which will acknowledge uncertainties associated with water balance predictions. Additionally, these plans should contain methods to manage specific events (e.g. flowing exploration borehole underground, flowing fault zone in open pit).

2. INAC requests that Sabina demonstrate that the water balance model shows that sufficient capacity exists in the system to manage unforeseen, short duration, large groundwater flow events at all times of the mine life.

Sabina Response:

1. Sabina recognizes that there is a likelihood that unforeseen groundwater flows could be encountered. This uncertainty exists for all mining projects conducted in fractured rock and is never completely alleviated until structural geology and hydrogeology data is regularly collected from mining operations. The influx of water into a mine is a normal and well understood phenomenon and is regularly managed by standard operating procedures (SOPs) in operating mines.

   Sabina is aware of these uncertainties and will safely and appropriately manage groundwater inflows. Actions to be taken when unforeseen groundwater flows are encountered may include proactive control measures such as:

   - Collection and interpretation of groundwater pressure and inflow data;

- Use of surface and underground exploration information for identifying enhanced permeability that may be intercepted; and
- Advance cover and probe drilling (i.e., exploration drainage holes).

Mitigation measures (adaptive management) that may be adopted to manage increased flows include:

- Modification and/or adjustment of the mine plan to avoid areas of concern, or to use mined-out underground stopes to provide surge capacity;
- Additional sump capacity to handle higher than predicted inflows;
- Pre-grouting of highly conductive structures prior to intersection with the mine workings; and
- Isolation of mining sections with bulkheads to control or minimize mine inflow.

2. Sabina confirms that if the average long-term groundwater inflows were higher despite these measures, the meromictic lake in the Llama Reservoir has sufficient extra capacity for saline groundwater storage. Additional details on saline groundwater storage contingencies can be found in the previously submitted Final Environmental Impact Statement Technical Comment responses, F-INAC-TC-5.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-9**
Subject/Topic:	Water Management		

Reference to Type A:

- Water Management Plan
- Section 8.2.1: Open Pits and other Contact Water
- Section 8.2.3: Underground Facilities

Detailed Review Comment:

The transient nature of mining in the north can result in new or unexpected groundwater flow pathways being encountered or forming due to temperature fluctuations. This is observed in open pit walls when they are exposed to the atmosphere and cycle of warm and cold seasonal temperature fluctuations.

When this occurs near a surface water body the groundwater flux can be greater than predicted. Additionally, a pit wall may need active depressurization to maintain slope stability, again resulting in more water requiring management. More water requiring management can impact the predicted water balance and water quality models.

Recommendation/Request:

1. INAC requests that Sabina provide assurance that the Project has a plan to effectively implement active depressurization measures for the open pits if required.

Sabina Response:

The proposed Goose Main Pit is currently designed to be 195 metres below ground surface (mbgs). The Goose Main Pit is expected to be established entirely within permafrost; this is based on ground temperature data from four thermistors installed in drillholes around and within the footprint of the proposed open pit (KP 2013, 2015), and the ground temperature modelling completed as outlined in the Hydrogeological Characterization Report (171002 2AM-BRP----MAD App F-5_HydrogCharactModelRpt-IMLE). In addition, a thermistor installed between the proposed Goose Main Pit and Goose Lake (drillhole 13-GSE-314) encountered continuous permafrost (KP 2013). Packer tests and data from a vibrating wire piezometer installed in the same drillhole, 13-GSE-314, are also consistent with the drillhole being completely within permafrost.

As a result of mining, an active layer will develop in the slopes of Goose Main Pit. Experience at other mines in the Arctic suggests that this active layer is likely to be on the order of 10 to 15-m thick. The shortest distance between Goose Main Pit and the Goose Lake shoreline is approximately 130 m. As a result, the presence of an active layer within Goose Main Pit is not expected to cause additional groundwater flow between Goose Main Pit and Goose Lake. Sabina acknowledges that the thawing of the active layer in warmer months will result in some groundwater reporting to the open pit, however this volume is conservatively anticipated to be very small. Goose Main Pit is expected to be in operation or in use as Goose Main Tailings Facility (TF) for 9 years before passive flooding for 7 additional years. This short-term mining development of Goose Main Pit are not expected to have a significant impact over such a short period.

With the exception of the active layer, Goose Main Pit is expected to be completely within permafrost. Porewater pressures will not develop within the permafrost, and as a result, slope depressurization is not required. Within the active layer, free water present in the summer months is expected to drain as the result of blast-induced fractures within the rock mass. As a conservative check, stability analyses

considering a fully saturated slope have been completed. The results of the analyses meet the target factors of safety and support the conclusion that slope depressurisation will not be required to achieve the proposed open pit slope geometry.

During Goose Main Pit operations, the thermistor between the open pit and Goose Lake will continue to be monitored to confirm that the rock mass between the Goose Main Pit and Goose Lake remains frozen.

References:

Knight Piésold Ltd., 2013. 2013 Geomechanical and Hydrogeological Site Investigation Summary. Report by Knight Piésold Ltd. Vancouver, Canada. September 23, 2013. Reference VA101-517/3-1

Knight Piésold Ltd., 2015. Open Pit Slope Design. Report by Knight Piésold Ltd. North Bay, Canada. March 25, 2015. Reference NB101-517/11-2

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-10**
Subject/Topic:	Landfill Settlement		

Reference to Type A:

- Landfill and Waste Management Plan
- Section 6.3
- Page 6-2

Detailed Review Comment:

It is understood that the landfills, located within the waste rock storage areas, will be operated as industrial dry waste landfills and that the materials to be placed in these landfills will be largely inert. However, these landfilled materials will be heterogeneous in type and size and are significantly different from the surrounding materials, which are expected to experience considerably less settlement.

During closure, the landfills will be covered with 5 m of NPAG waste rock as will the surrounding PAG waste rock. The concern is that due to the heterogeneous nature of the landfilled materials and the additional weight added at closure, there could be differential settlement at the landfill locations at the surface which could lead to potential ponding, reduction in surface runoff and increase in infiltration.

Recommendation/Request:

1. INAC requests an explanation as to how future minimal settlement will be addressed during operations, closure and during post closure.

2. INAC recommends some overburden overfilling during closure above the landfill areas to allow for future settlement.

3. INAC recommends specific monitoring of these areas during post-closure.

Sabina Response:

1. Landfill operation is described in Section 7.4 of the Landfill and Waste Management Plan (171002 2AM-BRP----SD10-LandfillWasteMgmtPlan-IMLE). Landfilled material will be placed in lifts, compacted, and covered with a minimum 300-mm layer of material before placing subsequent landfill materials. This is an ongoing process throughout Construction, Operations, and Closure and will minimize potential settlement. The landfills will be in use from Construction through to Closure, and as a result, any landfill settlement can be addressed throughout the operational period. Post-closure settlement will be monitored by means of the Post-Closure geotechnical inspections.

   Consistent with standard NWB licence terms and conditions an annual geotechnical inspection (during operations and active closure) of earthworks will be undertaken. Any evidence of landfill settlement will be observed and addressed on annual basis as required.

   In addition, Sabina has provided in the EMPP proposes to implemental a robust Internal Inspection Plan (refer to Table 8.4-1). Sabina will update the EMPP Table 8.4-1 to capture observations of landfill settlement.

2. Sabina will consider overfilling of the final landfill during the Closure phase. A decision on whether this will be necessary, based on life of mine landfill operational experience, will be reserved until the time of submitting the Final Closure and Reclamation Plan.

3. Post-Closure settlement monitoring will be conducted by means of the stipulated geotechnical inspections and general Post-Closure inspections. If, based on these inspections, additional monitoring is required, the rationale and required monitoring methods will be outlined by the engineer conducting the inspections.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-11**
Subject/Topic:	Alkaline and Carbon-Zinc Batteries Management		

Reference to Type A:

- Landfill and Waste Management Plan
- Table B1
- Hazardous Materials Waste Management Plan
- Section 6.1.12

Detailed Review Comment:

While Alkaline and Carbon-Zinc batteries can be landfilled as per the referenced guidelines, all other types of batteries are not permitted to be landfilled. Depending on the rigour to be applied when sorting the batteries into different streams, non-approved batteries could end up in the Umwelt WRSA and the TSF/TSF WRSA landfill sites. There they could pose a potential contamination risk to surface and groundwater.

Recommendation/Request:

1. INAC recommends that waste battery management be simplified and that all batteries be backhauled to an acceptable off-site receiver.

2. INAC requests that more detail be provided on how Sabina intends to ensure that all batteries are directed into the correct waste management stream.

Sabina Response:

Designated waste management personnel, trained in differentiating between these battery types as well as many other waste segregation categories, will ensure only Alkaline and Carbon-Zinc batteries are landfilled. To further assure appropriate segregation, any landfilled batteries will be consolidated within the landfills to facilitate, as appropriate, confirmatory inspection by waste management or environmental personnel, as well as any CIRNA inspectors should they choose to inspect when onsite.

Sabina's waste management procedures will be consistent with appropriate recommendations for pollution prevention, storage, transportation (when appropriate), and disposal consistent with the Government of Nunavut Department of Environment, Environmental Guideline for Waste Batteries (January 2011). Sabina environmental/waste management personnel responsible for proper segregation will maintain accurate records for review by Inspectors upon request.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-12**
Subject/Topic:	Landfill Siting Over Existing Drainage Streams		

Reference to Type A:

- Landfill and Waste Management Plan
- Figures A-01, A-02 and A-04

Detailed Review Comment:

Sabina plans to landfill non-combustible, non-hazardous materials in approved on-site facilities within the Umwelt and TSF WRSAs. Water diversion and collection systems will be incorporated into the design of these landfills, which will be designed for the life of the Project.

The landfills proposed for the Umwelt WRSA and the TSF/TSF WRSA are planned to be placed over the top of existing drainage streams. There is a concern that until permafrost is fully established below the landfills and into the waste mass to be placed in these landfill locations, preferential pathways for contaminant flow into these streams may develop.

Based on Figures A-01 and A-02, it appears that an undefined barrier layer will be placed beneath each of the landfills and adjacent WRSA's. However, the existing flow pathways, especially if not blocked or diverted up-gradient of these drainage streams could lead to the development of preferential contaminant flow pathways.

Recommendation/Request:

1. INAC recommends that Sabina modify the configuration of the landfills within the Umwelt WRSA and TSF/TSF WRSA to avoid placement immediately over the top of existing drainage streams.

Sabina Response:

Sabina agrees and commits that the configuration of the landfills within the Umwelt WRSA and TSF WRSA will be modified to avoid immediate placement over known, natural drainage systems. Sabina commits that the next iteration of the Landfill Waste Management Plan will reflect these updated locations.

Information and confirmation of design details will be provided in the final designs for construction to be submitted to the Nunavut Water Board 60 days in advance of construction.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-13**
Subject/Topic:	Clarification of Landfill & Waste Management Plan Figures		

Reference to Type A:

- Landfill and Waste Management Plan
- Figures A-1 and A-2

Detailed Review Comment:

On Figure A-1 and A-2 a 1.0 m thick layer is shown underneath the waste rock and landfill, but it is not detailed what this layer is.

On Figure A-2, the label for existing ground appears to be incorrect.

Clarification is needed to fully understand the drawing and comment on any concerns related to the proposed design.

Recommendation/Request:

1. INAC requests that both Figures be updated with additional information.

Sabina Response:

The 1.0 m thick layer shown underneath the waste rock and landfill on Figures A-01 and A-02 of the Landfill and Waste Management Plan (171002 2AM-BRP----SD10-LandfillWasteMgmtPlan-IMLE) are an error resulting from the conversion from AUTOCAD to PDF; these double lines should be ignored. The Umwelt WRSA landfill is constructed directly on the existing, original ground surface. The existing ground is incorrectly labelled on Figure A-02; it should be pointed towards the base of the tailings. Sabina will provide updated figures as part of the next revision to the Landfill and Waste Management Plan. Final for construction design drawing will accurately reflect the proposed design and will be submitted to the Nunavut Water Board 60 days in advance of construction.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-14**
Subject/Topic:	Tailings Management - Waste Rock Placement in the TSF		

Reference to Type A:

- Tailings Management Plan
- Section 4.1: Tailings Production and Storage

Detailed Review Comment:

Referring to the following statement in the Tailings Management Plan:

> *After tailings deposition transitions from the TSF to the Umwelt TF in Year 2, the TSF will be converted to a waste rock storage area (namely, the TSF WRSA) and used to dispose of waste rock from the Goose Main Pit.*

Have stability analyses been undertaken to assess the global and/or local stability of the waste rock as it is placed over the deposited tailings. The tailings may well be unfrozen, unconsolidated, saturated, very loose in nature and possibly subjected to undrained rapid loading by the overlying placed waste rock.

As a result, the tailings could form a low strength deposit beneath the waste rock which could influence the local and/or global stability of the advancing waste rock placement.

Recommendation/Request:

1. INAC requests additional information and supporting analyses on how the waste rock will be placed over the deposited tailings to ensure that potential local and/or global failures of the advancing waste rock placement do not occur.

Sabina Response:

Sabina will use an observational method to manage bearing capacity failures when placing waste rock over the tailings surface in the Tailings Storage Facility (TSF). An initial lift of waste rock will be placed and if a bow wave is seen to be formed, Sabina will adjust the lift thickness, or slow down the waste rock advancement and placement rate as necessary. Since much of the TSF surface receives a significantly thicker cover than the minimum thermal cover, there is ample surface area where Sabina can trial their placement methods.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-15**
Subject/Topic:	Tailings Management - Tailings Storage Facility Design Basis		

Reference to Type A:

- Tailings Management Plan
- Section 4.2.1: Tailings Storage Facility Design Basis
- Table 4.2-1: Tailings Storage Facility Design Basis Summary

Detailed Review Comment:

The Project is anticipated to produce about 19.8 million tonnes (Mt) of tailings over the 10-year operational mine life. Tailings to be directed to the TSF (approximately 3. 78 Mt) will dictate how water is managed at this facility.

INAC is concerned that the current TSF design may have Insufficient tailings storage capacity to accommodate the total volume of tailings to be directed to this facility.

The basic design assumption employed by Sabina is that both the subaerial and subaqueous tailings beach slope are 1%. It is generally accepted that subaqueous tailings beach slopes have a greater slope (~5%) than the subaerial tailings beach slope. This has implications for the sizing of the TSF and associated water management considerations

Recommendation/Request:

1. INAC requests that Sabina provide justification for using the same tailings beach slope for both subaerial and subaqueous tailings beaches.

2. INAC requests that Sabina comment on what the impact would be on the tailings deposition plan and the TSF if the subaqueous tailings beaches were steeper – e.g. a more likely 5% slope.

Sabina Response:

1. Tailings deposition modeling was done using a single beach slope as a simplifying assumption as stated in the Tailings Design Report (171002 2AM-BRP----MAD App F-4_TailsMgmtSystemDesign-IMLE). This simplifying assumption was used since the Tailings Storage Facility (TSF) supernatant pond size and level is highly variable over the deposition period. This variability however also justifies the use of a single beach angle mimicking that of a subaerial beach, as the slope angle only changes where constant ponding exists.

2. If there was a constant pond in the TSF, at a constant elevation, then a transition beach angle of 5% at the supernatant pond could be expected. However, as explained in #1 of this response, this is unlikely to occur. Notwithstanding, should this occur, it would require the tailings deposition plan to be adjusted, which can readily be done by moving spigots around. If necessary, such tailings deposition changes could include adding subaqueous discharge points in the TSF supernatant pond to fill in any unused storage space; this is normal practice in tailings deposition.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-16**
Subject/Topic:	Tailings Management – Potential Seepage through Fractured Bedrock Below the TSF		

Reference to Type A:

- Tailings Management Plan
- Section 4.2.3: Seepage Analysis

Detailed Review Comment:

Section 4.2.3 of Sabina's Tailings Management Plan states that:

> *During the 2015 drill program, small zones of fractured bedrock (2 to 3 m thick) were found in some of the drill holes near the west abutment of the dam, which may provide a pathway for seepage through the foundation of the dam. However, the thickness of dam bulk fill present in this specific portion of the TSF Dam, as well as along most of the TSF Dam alignment, will far exceed the minimum thermal cover requirement to maintain the underlying overburden materials in a frozen state; therefore, seepage is unlikely to occur.*

Based on the observations of the 2015 drill program INAC is concerned that if bedrock fractures found in some areas near the west abutment of the dam were ice filled or not. If the bedrock fractures found were not ice filled, INAC would question how the thermal cover would prevent seepage through this fractured bedrock.

Recommendation/Request:

1. INAC requests that Sabina provide confirmation that the fractures in the bedrock were either ice filled or not. If they were not ice filled, please provide justification of how the thermal cover will prevent seepage through the fractured bedrock.

2. INAC requests that Sabina considers adding instrumentation to this west abutment area to monitor for the occurrence of seepage through the zone of fractured bedrock (i.e. additional thermistor cables).

Sabina Response:

1. Geotechnical drilling at the Tailings Storage Facility (TSF) completed to date suggests that all fractures are not ice filled; however, the sporadic nature of the ice content suggests that there are no continuous potential flow pathways. Where fracture zones occur at depth, below overburden, any open void is confined; should water seep into such voids, it will freeze as it has no pathway by which to emerge. If the fractured rock is open (i.e., has no overburden cover), the seepage water entering the void space could well up and emerge as surface seepage. Any such areas will be identified through the proposed further field characterization (see #2 of this response) in support of final design of the infrastructure, and appropriate engineering mitigation would be adopted into the design.

2. Sabina will be conducting field characterization studies in support of final design of the infrastructure, and additional characterization in the form of percolation testing, which will be carried out immediately prior to TSF construction (see response to INAC-TRC-17). This information will verify that the design meets the required intent of managing seepage through both the foundation and the body of the TSF dam. If, based on this additional characterization, Sabina

believes that there remain areas where seepage could occur, Sabina will install the necessary monitoring instrumentation to confirm performance of the TSF dam.

Sabina reiterates commitment INC-C-4 to undertake an infill geotechnical characterization program of the western ridge adjacent to the TSF Containment Dam to determine the extent of the fractured bedrock contact zone and apply proposed mitigation as necessary. This program will include permeability testing, seepage analysis, and planning for thermal monitoring of the western ridge, where appropriate. Sabina is pleased to confirm that an initial infill geotechnical drill program is currently underway at the Goose Property and includes drill holes targeting the western ridge and the TSF Containment Dam. Sabina will complete the remaining infill geotechnical drill program as part of further characterization carried out immediately prior to TSF Dam construction.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-17**
Subject/Topic:	Tailings Management - TSF Site and Foundation Preparation		

Reference to Type A:

- Tailings Management Plan
- Section 4.2.6: Tailings Storage Facility Embankment Construction

Detailed Review Comment:

Section 4.2.6 of Sabina's Tailings Management Plan states that:

> *For the shallow bedrock foundation zone (Figure A-04), the key trench will terminate on clean exposed bedrock. If fractured rock is encountered, it will be examined and tested, and if deemed highly permeable, it will be excavated.*

It is understood that the key trench will be excavated in the frozen overburden underlying the dam to a depth up to 4 m. For the shallow bedrock foundation zone, the intention is for the key trench to terminate on clean exposed bedrock. In the deep overburden foundation zones, the intention is for the key trench to terminate on frozen overburden soil.

To meet the key trench design criteria for termination depth, INAC needs information on the permeability value that Sabina has used to determine when the foundation bedrock is considered to be "highly permeable" and unacceptable, thus requiring further excavation. INAC also needs more detail on the proposed method of in situ permeability testing to be completed by Sabina to determine permeability values in the field.

Recommendation/Request:

1. INAC requests that Sabina provide the permeability value at which the foundation bedrock is considered to be "highly permeable" and unacceptable, thus requiring further excavation.

2. INAC requests that Sabina provide the procedure for determining the field permeability of the in-situ rock to define the final depth of the key trench.

Sabina Response:

1. The target threshold permeability value for the bedrock foundation is 6 x 10^{-6} m/s; above this value, foundation bedrock rock would be considered highly permeable.

2. Prior to excavating the key trench for the Tailings Storage Facility (TSF) Containment Dam, Sabina will conduct percolation testing that will be carried out immediately prior to Tailings Storage Facility (TSF) Dam construction. This is a series of shallow drillholes (approximately 10 m deep) which are completed using a blast hole drill at close spacing (about 25 m) along both the upstream and downstream extent of the key trench. The drill cuttings from each of the drill holes are collected, logged, sampled. In addition, select samples are tested for salinity and water content (which indicates ice content). Next, a falling head hydraulic conductivity test is completed on each drill hole, using heated water if conditions require it. This is a standard construction procedure for any frozen dam and the information collected in this fashion confirms foundation excavation depth.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-18**
Subject/Topic:	Tailings Management – TSF Performance Monitoring		

Reference to Type A:

- Tailings Management Plan
- 4.2.6 Tailings Storage Facility Embankment Construction
- Instrumentation (Text) v's Figure A-07

Detailed Review Comment:

Section 4.2.6 of Sabina's Tailings Management Plan states that:

> *Horizontal ground temperature cables will be placed within the liner cover zone along the upstream side of the key trench.*

However, Figure A-07 indicates that the horizontal ground temperature cables will be placed within the liner cover zone on the downstream side of the key trench. Clarification of this apparent inconsistency is required.

Recommendation/Request:

1. INAC requests Sabina to clarify the location of the horizontal ground temperature cables – are they upstream or downstream of the key trench.

Sabina Response:

Sabina clarifies that the horizontal ground temperature cables within the Tailings Storage Facility (TSF) will be placed along the upstream face of the geosynthetic clay liner in direct contact with the existing ground surface. Sabina believes CIRNA is referring to Figure A-08 instead of Figure A-07 of the Tailings Management Plan (171002 2AM-BRP----SD09-TailingsMgmtPlan-IMLE) and final designs will be provided to the Nunavut Water Board 60 days in advance of construction.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-19**
Subject/Topic:	Overburden Excavation and Handling		

Reference to Type A:

- Mine Waste Rock Management Plan
- Section 5: Planning and Implementation

Detailed Review Comment:

The Mine Waste Rock Management Plan indicates that approximately 5.3 Mt of NPAG overburden will be produced during development of the Project. All of the overburden produced will be stored in engineered WRSAs located close to each of the open pits.

Excavation of overburden from the footprints of much of the mine infrastructure (quarries, open pits, facilities etc.) may be challenging at times, particularly when excavation occurs in the summer months and in ice-rich materials.

Recommendation/Request:

1. INAC recommends that a section be added to the Waste Rock Management Plan that addresses the procedures needed to determine the characteristics (ice content and material type) of the overburden materials.

2. INAC recommends that a section be added to the Waste Rock Management Plan that addresses procedures to be utilized during overburden excavation to eliminate the potential for the release of sediment-laden water to the environment during its excavation and transport to the WRSAs.

Sabina Response:

1. Sabina believes that, based on the geotechnical characterization completed to date at the Back River Project, there are no additional procedures necessary to characterize overburden materials beyond details currently stated in the Mine Waste Rock Management Plan (171002 2AM-BRP----SD08-MineWasteRockMgmtPlan-IMLE). Sabina will manage all overburden materials on the Project as waste rock. In any event the next update to the MWRMP will be initiated prior to construction.

2. All areas impacted by mining activities, including areas where overburden will be excavated are controlled by best management practices for sediment management. In addition, the primary areas where overburden will be excavated are the open pits and quarries. All water from open pits is managed within the site contact water system, and all quarries appropriate water management procedures (171002 2AM-BRP----SD05-WaterMgmtPlan_IMLE). Therefore, Sabina believes an additional section is not required in the Waste Rock Management Plan to address sediment and water management during overburden excavation.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-20**
Subject/Topic:	Mine Waste Management Segregation and Tracking		

Reference to Type A:

- Mine Waste Rock Management Plan
- Section 5: Planning and Implementation
- Section 6: Environmental Protection Measures

Detailed Review Comment:

The Mine Waste Management Plan includes estimates of expected waste rock volumes produced during construction and operation of the mine. There is an intention to identify and segregate the PAG and NAG materials so that they may be stored in the appropriate locations within the WRSAs.

The Plan focuses on the identification of PAG and NAG for placement, and does not include a measure for tracking materials, and comparison to estimates of expected volumes of NAG and PAG. Increased volumes of PAG may require amendments to the design of WRSA's and associated water management infrastructure (ditches and ponds).

Recommendation/Request:

1. INAC recommends that a section be added to the Waste Rock Management Plan that addresses the procedures to track and maintain records of quantities and locations of PAG and NAG waste rock from each mining area.

2. INAC recommends that a section be added to the Waste Rock Management Plan to address procedures to be utilized in the event that actual volumes of PAG encountered during mining are greater than those currently estimated.

Sabina Response:

1. Sabina agrees to add a section that describes the procedures that will be used to track the quantities and locations of potentially acid generating (PAG) and non-potentially acid generating (NPAG) waste rock from each mining area during Operations. This update will be included in the next iteration Mine Waste Rock Management Plan (MWRMP; 171002 2AM-BRP----SD08-MineWasteRockMgmtPlan-IMLE), which will be provided prior to construction. As described in Section 6.1 of the MWRMP, this procedure will be based on the blast hole monitoring program to identify PAG and NPAG materials that is similar to those used to identify and segregate ore in the mining operations. Geochemical test results from the blast hole monitoring program will be tracked in an acid rock drainage (ARD) block model to identify the location and volume of PAG and NPAG material.

   Reporting of quantities and locations would be provided in Annual Report to regulators consistent with Section 7 of the current plan.

2. Contingency strategies are outlined in Table 8-1 of the MWRMP in the event that the ratio of PAG to NPAG waste rock might be different than expected, specifically should a higher volume of PAG material be encountered during mining compared to the currently estimated volume. These include the potential use of a geosynthetic liner, disposal of a portion of PAG material in exhausted open pits upon closure or sourcing additional NPAG material locally.

As stated in Section 8 of the Mine Waste Management Plan, Sabina is committed to reviewing the Plan on a regular basis during Operations to incorporate any lessons learned, major changes to facility operation or maintenance, and environmental monitoring results.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-21**
Subject/Topic:	Winter Ice Roads – Expected Traffic on Ice Roads		

Reference to Type A:

- Road Management Plan
- Section 4.2.2: Expected Traffic on Winter Ice Roads

Detailed Review Comment:

Section 4.2.2 of the Road Management plan states that:

> *Snow/ice thickness on land will be sufficient to prevent damage to soil and vegetation, and Surface layers usually consist of compacted snow and/or ice where available. Ice-capped snow roads will be constructed for highway legal loads (e.g., B-trains). A discontinuous pad of granular fill may be required over short areas of rough terrain or where there is insufficient snow cover to create a smooth surface. If this is insufficient to provide an acceptable surface and gradient, additional grading effort may be required to create a road that meets the design criteria. Although Sabina currently does not anticipate any such locations, it is possible that operational requirements may require some fill.*

The surface conditions along the route consist of numerous areas where microtopography, including boulder fields may be difficult to level out with compacted snow. Additionally, some areas will likely blow clear of snow. This may require transporting snow from areas where it accumulates.

Alternately, consideration may need to be given to artificially enhancing snow accumulation (e.g. using snow fencing). This must be accomplished in a manner that does not cause disturbance to the ground surface that could lead to erosion.

In addition, the noted microtopography and lack of snow in some locations on the proposed route points to the likely need to construct pads of granular fill in some locations. Quarrying and pad construction brings with it the potential for additional sediment release into the environment.

Recommendation/Request:

1. INAC recommends that the proposed winter road alignment be observed in early winter in a winter prior to the first winter road construction season to examine snow conditions and microtopography along the route. This will allow a better prediction of the requirements for and availability of snow along the route that can be used for winter road construction and/or the need to construct discontinuous granular fill pads in some locations.

2. INAC recommends that Sabina consider providing additional information in the Road Management Plan in regards to the procedures to be employed to obtain and transport snow from areas where it accumulates to the road alignment.

Sabina Response:

1. Sabina agrees with CIRNA's recommendation that observation of the winter ice road (WIR) route in the winter prior to the first WIR construction season allows for better prediction of snow availability and potential granular fill pad requirements along the proposed route. Sabina is pleased to report a WIR Reconnaissance Program was recently completed in March 2018 where

microtopography and snow conditions were part of the route evaluation. Sabina is currently compiling and reviewing the results of this program.

2. The transport of snow along the WIR alignment will mainly occur from the lakes crossings to the overland portages sections. Snow from the lakes, collected from the snow banks created from clearing the ice-covered road sections, will be transported in loader buckets and dump trucks to areas of thin snow cover on the portages. Snow that is accumulated by snow fencing will be transported during WIR construction and distributed using specialised snow drags; these drags spread and level snow to create a smooth-running compacted snow surface. Sabina will include the above information in the next iteration of the Road Management Plan prior to the start of construction (171002 2AM-BRP----SD02-RoadMgmtPlan-IMLE).

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-22**
Subject/Topic:	Winter Ice Roads - Ice Road Design and Operation		

Reference to Type A:

- Road Management Plan
- Section 4.2.3: Design Criteria for Winter Ice Roads
- Second bullet

Detailed Review Comment:

Section 4.2.2 of the Road Management Plan lists the Design Criteria for Winter Ice Roads. Among the criteria presented, the maximum speed for loaded trucks (>50% of maximum load limit) is specified as 35 km/hr on ice and the maximum speed for loaded trucks on land is 40 km/hr.

The suggested maximum speed on ice of 35 km/hr is higher than the maximum speed (25 km/hr) set on what is undoubtedly the most highly engineered, controlled and highest traffic ice road in the world, the Tibbitt to Contwoyto Winter Road (TCWR).

Operating at higher speeds, particularly on the numerous small lakes of the proposed route will mean travelling at speeds closer to the critical speed. Failure of the floating ice sheet due to vehicles operating at speeds close to or at the "critical speed" could lead to vehicles breaking through the ice and spill incidents into water bodies.

Similarly, the maximum speed on land portages for the TCWR is 30 km/hr. Vehicles travelling at higher speeds on land (portages) increases the risk of vehicle accidents on portages resulting in the potential release of contaminants on land with the potential for subsequent contaminated runoff into nearby streams or other waterbodies

Recommendation/Request:

1. INAC requests additional information and supporting analyses showing why the maximum operating speed on the Sabina Winter Road is higher than the busiest ice road (TCWR) operating in northern Canada.

2. INAC recommends that Sabina consider adopting the maximum loaded vehicle speeds specified for the TCWR.

Sabina Response:

Sabina has contracted NOR-EX Engineering Ltd. (NOR-EX) to provide ice engineering design and quality assurance for the Back River Project Winter Ice Road (WIR). NOR-EX has been the Engineer of Record for the Tibbitt to Contwoyto Winter Road (TCWR) since 2012 and is very familiar with the TCWR design and control measures. Sabina will be applying the same level of engineering, quality assurance, and due diligence for the Back River Project WIR.

The speed limit recommended in the Road Management Plan (171002 2AM-BRP----SD02-RoadMgmtPlan-IMLE) is a maximum speed. Ice conditions, ice thickness, and loading details will be considered during WIR operations; speed limits, loading charts, and other control measures will vary depending on site conditions.

Sabina highlights that the TCWR operates at various speed limits along different sections of the winter road. For example, on TCWR sections south of the treeline, the normal speed limit is 25 km/h with some lakes operating at 30 km/h. North of the treeline, TCWR speed limits on lakes range from 30 km/h to 35 km/h, depending on ice conditions and ice thicknesses present. As Sabina's WIR is situated above the treeline, the engineering recommendation from NOR-EX is that a maximum speed limit of 35 km/h is safe and feasible once minimum ice thickness reaches 107 cm (42 inches). Prior to this ice thickness milestone, speed limits for loaded trucks will be 30 km/h. Sabina also notes that the volume of haul trucks travelling on the Sabina WIR is approximately 16 to 27 trucks per day, compared to approximately 160 to 200 trucks per day travelling on the TCWR.

Sabina will prioritize the safety of personnel and environmental stewardship in determining the maximum speed limits along each section of the WIR. Sabina's Road Management Plan (171002 2AM-BRP----SD02-RoadMgmtPlan-IMLE) incorporates the best practices, ice engineering, and quality assurance program from the TCWR and other ice operations throughout Canada's north.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-23**
Subject/Topic:	Updates to Emergency Contact Information for Emergency Response Program Plans		

Reference to Type A:

- Risk Management & Emergency Response Plan
- Fuel Management Plan
- Spill Contingency Plan
- Oil Pollution Emergency Plan
- Emergency Contact Sections in each plan

Detailed Review Comment:

To effectively respond to an emergency or spill incident, the emergency contact sections for each of the afore-mentioned plans will need to be completed and updated as necessary prior to Project start-up. This will help to ensure that all emergency response team members, contractors, key government contacts and external spill response contacts can be efficiently and effectively contacted as necessary to assist as may be required. These contacts and contact details should be updated on an annual basis or as necessary to reflect personnel, contractor and organizational changes.

Recommendation/Request:

1. INAC recommends that all of Sabina's emergency and spill response plans be completed and updated as necessary prior to Project start-up, to ensure that the contact details for all emergency response team members, contractors, key government contacts and external spill response contacts are available in the event of an emergency and/or spill incident.

2. INAC recommends that these contacts and contact details be updated on an annual basis or as necessary to reflect personnel, contactor and organizational changes.

Sabina Response:

Sabina agrees with the recommendations. Sabina will update the emergency and spill response plans prior to Project start-up to ensure that the contact details for all emergency response team members, contractors, key government contacts, and external spill response contacts are available in the event of an emergency and/or spill incident.

Sabina will also update the above details in the emergency and spill response plans on an annual basis, or as necessary, to reflect personnel, contactor, and organizational changes consistent with standard terms and conditions of NWB water licences.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-24**
Subject/Topic:	Risk Management & Emergency Response Planning		

Reference to Type A:

- Risk Management & Emergency Response Plan
- Section 7: Risk Assessment and Management

Detailed Review Comment:

Section 7 of the Risk Management & Emergency Response Plan contains useful background information. However, INAC is of the view that most of this information would be better located in an Appendix to the Plan. This would result in the Plan being more focused on the Emergency Response components of the Plan. This would be of benefit to Sabina's Emergency Response Team in implementing more timely, efficient and effective responses to emergency incidents.

Recommendation/Request:

1. INAC recommends that Section 7 of the Risk Management & Emergency Response Plan be relocated to an Appendix of the Plan.

Sabina Response:

Sabina agrees and commits that the next iteration of the Risk Management & Emergency Response Plan prior to the start of construction (171002 2AM-BRP----SD15-RiskMgmtEmergRespPlan-IMLE) will include the relocation of Section 7 of this plan to an appendix.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-25**
Subject/Topic:	Deployment of Spill Containment Booms During Ship Bulk Fuel Transfer Operations		

Reference to Type A:

- Oil Pollution Emergency Plan (OPEP)
- Section 11.3 Spill Prevention Measures – Bulk Fuel Transfer
- Annex 5: Bulk Cargo Transfer Procedures

Detailed Review Comment:

The total annual volume of the bulk fuel to be transferred from ships to the bulk fuel storage facility will be in the order of approximately 30 - 45 million litres, and will take place during the open shipping season between the months of late August through early October.

The fuel transfer operations will involve the use of either a single or double four (4) inch floating hose with an approximate length of approximately 1,000 metres deployed between the vessel and the connecting flange on the shore. A six (6) inch steel pipeline will convey the fuel from the connecting flange to the bulk storage facility.

Section 11.3 of the OPEP lists a number of preventive measures to be implemented to minimize risks of spills during bulk fuel transfer operations from ship to shore. Sabina notes that they have reviewed a copy of the Shipboard Oil Pollution Emergency Plan (SOPEP) that each ship is required to have to prevent and respond to spill incidents that may occur in relation their vessel's activities.

Given the significant volume of bulk fuel to be transferred on an annual basis from ships to the bulk fuel storage facility and the risk of leakage or spills posed by such operations, INAC wants to ensure that all reasonable preventive measures are implemented for all facets of the bulk fuel transfer operation.

In particular, to minimize potential impacts on the marine environment due to possible fuel leaks or spills associated with ship bulk fuel transfer operations, INAC is of the view that Sabina should commit to ensure that each ship involved in such operations deploy a spill containment boom below the point where the fuel transfer hose extends from the vessel to the sea surface, immediately adjacent to the vessel. The containment boom should be deployed prior to and for the duration of each fuel transfer operation.

The effective implementation of this proactive protective measure would serve to contain any possible fuel leaks or spills at source, would facilitate subsequent fuel cleanup efforts and would assist in protecting the valued marine components of the nearshore area.

Recommendation/Request:

1. INAC recommends that Sabina commit to ensure that each ship involved in such operations deploy a spill containment boom below the point where the fuel transfer hose extends from the vessel to the sea surface immediately adjacent to the vessel as an additional proactive, protective measure.

Sabina Response:

Sabina will discuss deployment of preventative spill containment and associated safe implementing measures with shippers, and Transport Canada, in the final review of the OPEP prior to shipping.

Sabina remains committed to revising and providing an updated OPEP to the NIRB and Transport Canada prior to the commencement of Project related shipping.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-26**
Subject/Topic:	Near Shore Marine Sediment Quality Sampling to Support Adaptive Management		

Reference to Type A:

- Marine Monitoring Plan
- Section 4.2: Sediment Quality
- Aquatic Effects Management Plan
- Section 1.1: Background

Detailed Review Comment:

Section 4.2 of the Marine Monitoring Plan states that:

> *Sediment quality samples will be collected in 2017 to supplement baseline data collected for the Final Environmental Impact Statement and to support future adaptive management responses. Sediment samples will not be collected on an annual basis but will be collected as required if triggered by through adaptive management.*

INAC is of the view that nearshore marine sediment quality sampling should be undertaken in the vicinity of the MLA/port area as a component of the Marine Monitoring Plan to permit adaptive management actions to be implemented, as may be necessary, based on the future results of such sampling.

Consistent with Sabina's Aquatic Effects Management Plan (AEMP), the sampling frequency for the sediment sampling component of the Marine Monitoring Plan should be harmonized with the Metal Mining Effluent Regulations (MMER) and Environmental Effects Monitoring (EEM) requirements. These requirements call for sediment sampling every three (3) years.

The incorporation of sediment sampling as a component of the Marine Monitoring Plan will facilitate the characterization of special and temporal variations and trends in marine sediment quality of the Marine Laydown/port area and provide the basis for adaptive management actions to be undertaken as and if determined to be necessary.

Recommendation/Request:

1. INAC recommends that Sabina incorporate nearshore marine sediment quality sampling as a component of the Marine Monitoring Plan to permit adaptive management actions to be implemented, as may be necessary, based on the future results of such monitoring.

Sabina Response:

Sabina agrees with CIRNA's request and will include near shore sediment sampling on a routine basis at the MLA and associated reference location at an interval in alignment with Metal Mining Effluent Regulations (MMER) sampling (i.e.; every 3 years) as a component of the Marine Monitoring Plan (171002 2AM-BRP----SD23-MarineMonitoringPlan-IMLE). Sabina remains committed to the Back River Project Certificate Term and Condition No. 62, to provide the NIRB with an updated Marine Monitoring Plan, 60 days prior to the commencement of shipping.

Sabina also notes that we have initiated our 2018 marine monitoring field programs.

Attachment:

N/A

Interested Party:	CIRNA	**TC No.:**	**WT-INAC-TRC-27**
Subject/Topic:	Incorporation of Active Revegetation into Closure Plan		

Reference to Type A:

- Interim Closure and Reclamation Plan

Detailed Review Comment:

Active revegetation as a reclamation option is common practice, even in northern locations. INAC is unclear which precedent is being referred to with respect to mine closure in Nunavut.

The closure and reclamation guidance document prepared by the Mackenzie Valley Land and Water Board and Aboriginal Affairs and Northern Development Canada (2013) for mine sites in the Northwest Territories (which is applicable for sites in Nunavut as well) identifies how enhanced or active revegetation considerations can be incorporated into mine planning and design.

While there are certainly drawbacks and limitations to active revegetation at northern sites compared to more southern locations, this should not preclude attempts to consider active revegetation as another option to site restoration.

Including such a practice provides a more comprehensive approach to reclamation and offers another option that is compatible with the landscape and desired end land uses/objectives, such as the achievement of physical stability. The inclusion of active revegetation does not translate to it becoming the only reclamation option; it simply provides another alternative that can assist with land restoration following disturbance.

Recommendation/Request:

1. INAC recommends that the Proponent include active revegetation (such as seeding and/or staking) as another potential reclamation option in the closure plan.

Sabina Response:

As stated in Appendix F of the Interim Closure and Reclamation Plan (171002 2AM-BRP----SD26-ICRP-IIMLE), a revegetation research program will be considered during Operations to allow potential modifications to be incorporated during progressive and final reclamation to encourage natural revegetation. Techniques that could be trialed may include: harrowing the ground along contours to slow runoff and encourage natural capture of seeds, and native sod transplanting to create sod islands. Sabina will also benefit from lessons learned at other sites in the north.

Active revegetation of the Back River Property is not part of the current Interim Closure and Reclamation Plan given the harsh climate setting of the Project. The avoidance of foreign plant species, the lack of suitable growth medium, and the unavailability of soil amendments for Post-Closure reclamation may also make active revegetation impracticable. This could be revised in the future based on the results of any revegetation research on site and elsewhere in the north.

Attachment:

N/A

Sabina
GOLD & SILVER CORP.

The BACK RIVER PROJECT

Technical Comment Responses

Environment and Climate Change Canada

Interested Party:	ECCC	TC No.:	WT-ECCC-TC-1
Subject/Topic:	Closure Objectives and Criteria: Receiving Water Quality		

Reference to Type A:

- SD26 Interim Closure and Reclamation Plan Section 5.2.1.3 Closure Objectives and Criteria, Section 5.2.1.5 Engineering Work Associated with Selected Closure Activity and 5.2.9.1 Project Component Description

Detailed Review Comment:

The Proponent states that water quality at closure will meet MMER and other objectives in numerous places in the WL Application and Appendices. It is not clear how the objectives will be applied and what the quality of water in the mined-out pits (Goose, Umwelt, Echo and Llama) will have to be in order to be acceptable for reconnection to the receiving environment. It is also unclear what the selected water quality objectives will be based upon. In various water bodies the discharge water quality may exceed receiving water quality objectives at the point of release, while at others the expectation is that objectives will be met in the pit water before being allowed to discharge to the receiving environment. Excerpts are provided below which make reference to the closure water quality standards and illustrate the ambiguity and/or inconsistency.

5.2.1.5 Engineering Work Associated with Selected Closure Activity

Page 5-5 of the ICRP (Interim Closure and Reclamation Plan) states that:

> *"Predictions of open pit and TF overflow water quality were developed by SRK (2015c). It is expected that the overflow water discharged from the flooded pits and TFs will meet MMER Schedule 4 limits at the time of flooding. The overflow water from each of the pits and TFs is expected to exceed receiving water quality objectives (CWQG-PAL or SSWQOs) at the point of release. However, these objectives are expected to be met at the point of entry into receiving waters under steady state conditions."*

It is not clear where and how receiving water quality objectives will be met if overflow water exceeds these.

For Llama, Umwelt, and Echo:

> *"Based on lag time calculations completed for the waste rock, it is likely that acidic conditions will develop in some of the PAG rock that is exposed in the pit walls. This was taken into account in developing water quality predictions for the flooded pits (SRK 2015b). Nonetheless, results from the water and load balance indicate that water from these pits will meet applicable discharge criteria which will enable passive discharge into nearby watercourses.*

For these three pits, "applicable discharge criteria" should be defined or referenced.

For Goose:

> *"Portions of the Goose Main Pit may be exposed long enough that some ML/ARD may develop. Runoff from the TSF WRSA Pond will also be directed into Goose Main TF. Water from Goose Main TF will be treated throughout the Closure Phase until closure objectives have been met, which is expected to be in Year 17."*

5.2.9.1 Project Component Description

> *"At the Goose Property, mine contact water will be treated to levels specified in the MMER or site-specific water quality objectives prior to release at the final discharge point. Sabina will meet water quality objectives for entry into receiving waters (Goose Lake). The water quality objectives will be consist [sic] with the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME 2013) and SSWQOs developed in line with the CCME (2007) framework. Sabina committed to derive a SSWQO for arsenic and a memo has outlining [sic] proposed value for Arsenic has been provided in the Main Application Document, Appendix E-1. Sabina will be providing a SSWQO for copper in advance of the NWB technical meeting."*

The closure objectives for water quality in Goose Main TF (Tailings Facility) should be defined or referenced.

Recommendation/Request:

ECCC recommends that the Proponent provide clarification of the water quality objectives for each of the water management structures for closed pits including Goose, Umwelt, Echo and Llama and any ponds which will be discharging to the receiving environment at closure. Clarification of water quality objectives should include an explanation of how and where they are proposed to be applied.

Sabina Response:

As noted in Section 6.3.10 of the Main Application Document (171002 2AM-BRP----MainApplicationDocument-IMLE), mine contact water will be treated to levels specified in the Metal Mining Effluent Regulations (MMER) or site-specific water quality objectives (SSWQOs) prior to release at the final discharge point. The water quality objectives will be consistent with the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME 2013) and SSWQOs developed in line with the CCME (2007) framework. Objectives consistent with the CCME (2007) framework have already been derived for arsenic and copper.

Sabina acknowledges that CCME or SSWQO must be met at the receiving environment. Potential methods to ensure water quality meets CCME or SSWQO will depend on the water quality within the pit lakes; this will determine the best course action. It is only reasonable to advance these discussions once a better understanding of water quality within the closed-out pits is gained.

Sabina notes that the Water and Load Balance Model is currently being updated to meet Sabina's commitments for the FEIS and FEIS Addendum Project Certificate (170601-12MN036-FHA EX 45-Recommended PC Terms and Conditions Committments-IA2E), item INAC-C-1 (see WT-KIA-NWB-3).

References:

CCME. 2007. A protocol for the derivation of water quality guidelines for the protection of aquatic life 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, 1999, Winnipeg.

Attachment:

N/A

Interested Party:	ECCC	**TC No.:**	**WT-ECCC-TC-2**
Subject/Topic:	Saline Water Pond Closure Site Specific Water Quality Objective		

Reference to Type A:

- SD26 ICRP Section 5.2.9.1 Project Component Description
- MAD Appendix E-2 Water and Load Balance Report (WLBR) Section 6.8 Saline Water Pond and Underground Storage

Detailed Review Comment:

Saline water stored in the Saline Water Pond (SWP) during Operations will result in lakebed sediments that will require management during Closure due to high chloride levels. These will be excavated and deposited in the Goose Main Tailings Facility once the SWP has been dewatered to the underground mines.

Following excavation of the lakebed sediment, the Saline Water Pond diversion berms and dams will be breached allowing Umwelt Lake to re-establish. The metals in the sediments will primarily be solid particles and it is expected that sediment solids excavated from the SWP and placed in Goose Main Tailings Facility will settle once deposited, given the 7 year filling time.

There is no discussion of the expectations for the sediment behaviour and subsequent impacts on water quality during refilling of the former Umwelt Lake. Umwelt Lake will have had extensive sediment removal done, and former shore areas and substrate will have been disturbed. The Water and Load Balance Report states that it is expected that natural filling of Umwelt would take less than one year and thereafter water would flow towards Goose Lake. It is not clear that there is allowance for sufficient time for settling of suspended solids from the disturbed (post-excavation) substrate. The proposed water quality objectives for the water which will be targeted for discharge water quality indischarged from the refilled Umwelt Lake at closure when re-connection to surface water occurs is not provided.

The water quality modeling results shown in Table 7-7 and Appendix D of the Water Load and Balance report are for the nearest node at PN10, which is downstream from Umwelt Lake at the confluence with two other streams. There do not appear to be any predictions for the refilled Umwelt Lake water quality. It is unclear to ECCC if the Proponent will maintain the capacity to hold water in the refilled Umwelt Lake in the event there are concerns with water quality. In one reference (page 5-37 ICRP) the statement is made that "*sediments will be tested and **if the chloride content is too high**, it will be removed and placed in the Goose Main TF.*"

This was the first reference found to implementing a threshold for removal of sediments. ECCC is concerned with the potential chloride content in sediments and how this chloride may affect fish-bearing waters once the former Umwelt Lake reconnects with the receiving environment. ECCC believes that the Proponent should identify what chloride level in sediments would be considered acceptable and at what concentration removal would be triggered in order to ensure that no deleterious substances enter fish-bearing waters.

Recommendation/Request:

ECCC recommends that the Proponent provide:

- Clarification of the expected water quality in the former Saline Water Pond upon removal of sediments and refilling with runoff/natural drainage;

- Identification of objectives that will be met prior to reconnection of the refilled Umwelt Lake to surface waters;
- A description of contingencies available to manage water if quality is unacceptable for release; and
- Identification of the chloride threshold that would trigger removal of sediments.

Sabina Response:

1. The mass of precipitated chloride sediments on the base of the Saline Water Pond (SWP) is expected to be very low because of extremely high solubility of sodium chloride in water (i.e., 359,000 mg/L). As a result, the pumping out of the SWP will remove practically all of the masses of the salt ions. However, if chloride sediments are encountered at the bottom of the lake once the saline water has been removed (which will be confirmed by testing of the sediments), the base of the dewatered SWP will be washed down with freshwater and the rinse water will be pumped out. If necessary, this rinsing method will be repeated until the salinity of the rinse water is acceptably low. Sabina defines an acceptable salinity as one which, after refilling the SWP with freshwater, would produce a lake chloride concentration of 120 mg/L or less (i.e., the CCME long-term limit for protection of aquatic life).

   The rinsing method will be used in preference to the excavation and removal of lake bottom sediments. Minimal disturbance of the lakebed sediments is expected by using the "rinsing" method.

2. The SWP will continue to be "rinsed", as stated above, until, after refilling with freshwater, the water quality in the re-established Umwelt Lake will meet CCME long-term limits for the protection of aquatic life. Only when Umwelt Lake has been refilled and the water quality has been verified will the SWP containment infrastructure will be breached.

3. As explained above, the rinsing method will be repeated until the measured salinity of the rinse water is acceptably low, based on a mixing calculation.

4. The SWP will continue to be "rinsed" in an effort to remove chloride from the sediments until the concentration of chloride in the lake water after re-filling will meet the Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life; this criteria for chloride concentration is less or equal to 120 mg/L (freshwater long term concentration criteria, CCME 2018).

References:

CCME. 2018. Canadian Environmental Quality Guidelines. Available at: http://www.ccme.ca/publications/ceqg_rcqe.html. Accessed April 2018.

Attachment:

N/A

Interested Party:	ECCC	**TC No.:**	**WT-ECCC-TC-3**
Subject/Topic:	Nitrite		

Reference to Type A:

- MAD Appendix F7 Technical Review of Water, Waste Rock, and Tailings Management/Design
- MAD Appendix E-2 Water and Load Balance
- Julio A. Camargo and Álvaro Alonso. 2006. Ecological and toxicological effects of inorganic nitrogen pollution in aquatic ecosystems: A global assessment. Environment International 32: 831–849

Detailed Review Comment:

ECCC has concerns with the predicted exceedances of nitrite Canadian Council of the Ministers of the Environment (CCME) guidelines in surface waters, including in Goose Lake. Figure A2-2 in the Main Application Document (MAD) Appendix F7 illustrates CCME guideline exceedances for nitrite, most notably at PN-06 (up to 0.4 mg/L, previously predicted to be 0.36 mgN/L) and to a lesser degree at PN-03 (previously 0.18 mgN/L) and PN-09 (previously 0.11 mgN/L). The text on Page 7 states that there is an additional nitrite CCME guideline exceedance at PN04, but this is not reflected on the graph. Also, the CCME Short-term guideline for Nitrite is shown as 0.08 mg/L, rather than 0.06 mg/L NO3-N. Furthermore, Table 7-8 MAD Appendix E-2 shows maximum NO2-N of 0.31 mg/L in Goose Lake, while the updated predictions in Appendix A of the MAD App F-7 shows it at 0.32 mg/L maximum. In either case, the whole lake average nitrite concentration in Goose Lake is predicted to reach maximums, which are in the range of acute toxicity to salmonid fry documented in the literature (Carmago & Alonso, 2006).

Sources of nitrite entering surface waters are explained as follows in Section 7.4 of Appendix E-2: "*…the rise in nitrite concentrations is associated with ANFO residual from roads and pads. The first spike in 2017 (Year -2) are from the initial construction of the roads. The spike in 2028 (Year 10) is from the Echo WRSA pond draining to PN09 and the final spike in 2036 (Year 18) is from the Goose Main TF overflow to PN06.*"

The primary source of the nitrite loadings is the use of explosives. Section 9.8 of the Water Management Plan has an ammonia management plan, which describes handling and storage of blasting products. While the elevated chloride levels will be a toxicity-modifying factor and reduce nitrite toxicity to some degree, it is important that source loadings be reduced to levels, which will not be deleterious to fish-bearing aquatic ecosystems.

In addition, Appendix C of MAD Appendix E-2 shows 0.000 as the nitrite input value for the stockpile and unfrozen waste rock pile (as well as pit walls, tailings and industrial pads), which contradicts Section 4.2.7 of the Water and Load Balance which states loadings were included. If those sources have not been accounted for, the model would substantially underestimate nitrite. ECCC also notes that the model inputs for nitrite for treated camp sewage were erroneously based on effluent concentrations of 30 mgN/L (Table 4-6 MAD Appendix E-2) rather than the actual treatment target of 0.5 mgN/L, which may overstate predicted nitrite concentrations. Review and revision of the model inputs and an update of the nitrite model is recommended.

Recommendation/Request:

ECCC recommends that the Proponent

- Update the Water and Load Balance model with the revised nitrite numbers for camp wastewater contributions and
- Confirm model inputs for nitrite sources.

Sabina Response:

Sabina is currently in the process of updating the Water and Load Balance Model as described in WT-KIA-NWB-03. This update includes revisions to the nitrite input value as outlined in the Type A Water Licence Information Request response, ECCC-IR-6. Sabina will provide the results of the Water and Load Balance Model update prior to the Technical Meeting.

Sabina can confirm, as stated in the response to ECCC-IR-6, the following concentrations for nitrogen species in the sewage treatment plant effluent will be used in the updated Water and Load Balance Model:

- Nitrate – 22 mg-N/L
- Nitrite – 0.5 mg-N/L
- Ammonia – 8 mg-N/L
- Total Kjeldahl Nitrogen – 12 mg-N/L

Attachment:

N/A

Interested Party:	ECCC	**TC No.:**	**WT-ECCC-TC-4**
Subject/Topic:	Arsenic		

Reference to Type A:

- MAD Appendix F7 Technical Review of Water, Waste Rock, and Tailings Management/Design
- MAD Appendix E-1 SSWQO Arsenic

Detailed Review Comment:

MAD Appendix E-1 Site-Specific Water Quality Objective (SSWQO) Arsenic, page 1, states:

> *"During the final NIRB hearing in June 2017, Sabina confirmed the intent to use an arsenic SSWQO value of 0.01 mg/L for the Project (NIRB 2017), which is well below the calculated 0.025 mg/L SSWQO."*

Revised modelling work has resulted in higher arsenic levels being predicted for several waterbodies. For example, in Figure A2-3 of MAD Appendix F7, arsenic at PN06 (0.023 mg/L in Year 17) is substantially higher than the 0.010 mg/L committed to by the Proponent, although it remains below the SSWQO of 0.025 mg/L. Other exceedances are predicted for PN04 (0.11 mg/L), PN10 (0.022 mg/L maximum, 0.016 mg/L long-term, and 0.018 mg/L maximum at closure) and Goose Lake (0.015 mg/L maximum).

Recommendation/Request:

ECCC recommends that the Proponent clarify the likelihood that the stated arsenic objective of 0.010 mg/L will be maintained and whether additional contingency mitigation measures are being considered.

Sabina Response:

An arsenic site-specific water quality objective (SSWQO) of 0.01 mg/L was proposed for Goose Lake as part of the Final Environmental Impact Statement (FEIS) for the Project as confirmed at the final NIRB hearing in June 2017 by Sabina. In response to information requests and technical comments on the SSWQO proposed as part of the FEIS, a revised SSWQO was subsequently derived using standard methods as required for submission with the Type A Water Licence Application for the Project (171002 2AM-BRP----MAD App E-1_SSWQOArsenic-IMLE). The revised SSWQO also considered relevant toxicity information and data available up to 2017.

The revised SSWQO for arsenic was developed in general accordance with standard methods provided for the development of a long-term guideline for freshwater environments by the Canadian Council of Ministers of the Environment (CCME) in the guidance document "*A Protocol for the Derivation of Water Quality Guidelines for the Protection of Aquatic Life 2007"* (CCME 2007). Consistent with this guidance and in consideration of the available toxicity data, the revised SSWQO was statistically derived using a species sensitivity distribution (SSD) of the available and acceptable toxicity data. A review of the data confirmed that the minimum data requirements of this approach had been met. In total, chronic toxicity data for 27 aquatic species were included in the long-term SSD that supported the derivation of a SSWQO of 25 µg/L.

As stated in Technical Comment response WT-KIA-NWB-3, Sabina is currently updating the water and load balance and will provide additional clarification on the likelihood that the stated arsenic SSWQO

of 0.01 mg/L will be maintained and whether contingency mitigation measures should be considered prior to or at the Technical Meeting.

References:

CCME. 2007. A protocol for the derivation of water quality guidelines for the protection of aquatic life 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, 1999, Winnipeg.

Attachment:

N/A

Interested Party:	ECCC	**TC No.:**	**WT-ECCC-TC-5**
Subject/Topic:	Dissolved versus Total Fractions of Metals		

Reference to Type A:

- MAD Appendix F7 Technical Review of Water, Waste Rock, and Tailings Management/Design
- MAD Appendix E-2 Water and Load Balance
- SDO5 Water Management Plan

Detailed Review Comment:

As noted in KIA-IR-12, comparisons are made of modeled dissolved metals to guidelines for total metals and this is not necessarily a valid comparison. The justification for doing this is based on model source terms being derived using data for dissolved metals and the assumption that there will be a negligible particulate component.

In Section 6.3 Page 8 of the MAD Appendix F7, the statement is made that "*Golder does not consider it necessary to provide total metal concentrations as there is limited potential for concentrations to exceed available guidelines as the constituent concentrations in process water are not expected to exceed guidelines.*" This circular argument does not address concerns with comparing dissolved fractions of parameters to guidelines for the total metals. Dissolved metals do not account for any metals associated with particulate matter and may underestimate metal concentrations (to the detriment of the environment).

The Proponent has indicated in their response to KIA-IR-12 that this approach will be re-evaluated in the context of information collected since the submission of the Type A Water Licence Application, specifically for new tailings geochemical test results. The commitment is made in this response that water quality predictions will be updated to include dissolved and particulate fractions. Further commitments were made in Section 6.1.5 of the Water Management Plan to modelling of total metal concentrations as may be required, to establish appropriate discharge criteria and to predict downstream compliance.

ECCC concurs with updating predictions to include the total metals concentrations and requests details on the approach that will be used to estimate total metals for the source terms/model inputs.

Recommendation/Request:

ECCC recommends that the Proponent provide details on the approach that will be used to derive total concentrations.

Sabina Response:

Sabina confirms that the Water and Load Balance Model is currently being updated to meet Sabina's commitments for the FEIS and FEIS Addendum Project Certificate (170601-12MN036-FHA EX 45-Recommended PC Terms and Conditions Committments-IA2E), item INAC-C-1. The objective of this update is to evaluate the effect of total suspended solids (TSS) of an assumed composition on the total parameter concentrations in mine discharges during Operations, Closure, and Post-Closure. Total loads will be calculated for all mine facilities (pads, roads, waste rock storage area, tailings management facilities).

Total metal concentrations for Project discharges will be estimated by adding a calculated particulate fraction to the existing model predictions of dissolved concentrations. Particulate fractions for the relevant parameters were developed as follows:

- The relative proportions of each waste rock lithology produced at each pit are calculated based on the total tonnage of waste volume presented in Table 2-2 of the Geochemical Characterization Report (171002 2AM-BRP----MAD App E-3_GeochemCharactRpt-IMLE). Lower greywacke (LGW) and deep iron formation (DIF) proportions are combined to reflect the distribution of samples as summarized in Table 5-1 of the Geochemical Characterization Report.
- The available results of solid phase geochemical analysis of each rock type at each deposit was reviewed. The input for modeled constituents was defined using the average of samples collected for each rock type at each deposit, as presented in Appendix E2 of the Geochemical Characterization Report. In the absence of data for a specific lithology at a given deposit, the overall average, calculated based on all samples of that rock type collected at the Goose Property, was used to define its elemental composition.
- Using the solid phase geochemistry data and the relative proportions of each rock-type, the weighted average was calculated to define the chemical composition of the TSS associated with waste rock produced by each pit. For pads and roads, the weighted average was calculated using the relative proportion of each rock type for the entire Goose Property and the overall average composition for each rock type based on all samples of that rock type collected at the Goose Property. Tailings were defined by using the average of the solid phase geochemistry results for the composite samples used to develop the tailings source terms, specifically samples KM4030-147 TAILS, BR-TAIL-02, and BR-TAIL-03 as described in the Geochemical Characterization Report.
- The product of the weighted average (expressed as µg/g) and the TSS concentration discharge limit, set to 15 mg/L (per the Metal Mining Effluent Regulations, 2013), defined the concentration of each modeled constituent associated to the TSS load. The TSS load was then added to the dissolved fraction load to estimate metal concentrations for the fraction.

Sabina will provide the results of the Water and Load Balance Model update prior to the Technical Meeting.

Attachment:

N/A

Interested Party:	ECCC	**TC No.:**	**WT-ECCC-TC-6**
Subject/Topic:	Seep Surveys		

Reference to Type A:

- SD20 Environmental Management & Protection Plan, Table 8.4-1 Internal Inspection Plan

Detailed Review Comment:

Table 8.4-1 shows the internal inspection frequency for seep surveys as annually each spring. This timing will pick up flows associated with freshet, but in spring the interstitial spaces in the rock piles will not be thawed yet and the sample will not necessarily be representative of what is exiting the waste rock or ore storage piles. By adding a fall or rain event sampling period, better data on seepage quality can be obtained.

Recommendation/Request:

ECCC recommends that the Proponent conduct seepage surveys in both spring and fall at the waste rock and ore piles and at any other water-retaining structures subject to seeping that may be frozen during the spring survey.

Sabina Response:

Sabina commits to conduct seepage surveys in both spring and fall at the Waste Rock Storage Areas (WRSAs) and the ore stockpiles. Sabina notes, as stated in Table 8.4-1 of the Environmental Management and Protection Plan (171002 2AM-BRP----SD20-EMPP-IMLE), that Collection Ponds, Containment Dams, Diversion Berms, and Sumps all have inspection frequencies of: (1) Prior to and at freshet; (2) Immediately after a major rain event; and (3) Weekly for the remainder of the ice-free season while actively pumping.

Attachment:

N/A

Interested Party:	ECCC	**TC No.:**	**WT-ECCC-TC-7**
Subject/Topic:	Closure Monitoring		

Reference to Type A:

- SD05 Water Management Plan Section 8.3.3
- Type A Water Licence Response to Information Requests – Feb. 5, 2018, KIA-IR5

Detailed Review Comment:

According to the Water Management Plan (WMP), post-closure monitoring of pit lakes water quality will be conducted to ensure it meets discharge criteria prior to pit overtopping and passive discharge. The duration is proposed to be five years of post-closure water quality monitoring for each open pit to ensure that water quality objectives are met. This duration may not be sufficiently long to demonstrate that water quality is stable and will be of acceptable quality in the long term.

KIA-IR5 raises similar concerns, and Sabina has committed to potential monitoring at Years 7, 10, 15, and 25 as a stated adaptive management measure.

Recommendation/Request:

ECCC recommends updating the Water Management Plan to reflect an additional duration of monitoring and supports planning for longer-term closure monitoring of pit water quality.

Sabina Response:

Sabina agrees and commits to update the next revision of the Water Management Plan (171002 2AM-BRP----SD05-WaterMgmtPlan_IMLE) prior to the start of construction to state if closure objectives have not been met, to include Post-Closure monitoring beyond the stated 5-year Post-Closure monitoring period.

Sabina notes that the above proposed monitoring is already included in the Interim Closure and Reclamation Plan (171002 2AM-BRP----SD26-ICRP-IMLE_Version2.0) and the Closure Cost Estimate (171002 2AM-BRP----SD26-ICRPCostEstimate-IMLE). In response to the 2017 Closure visit with KIA and CIRNA, Sabina included this allowance for "Long Term Monitoring to Years 1 to 5, 7, 10, 15, 25" in the cost estimate.

Attachment:

N/A

Interested Party:	ECCC	**TC No.:**	**WT-ECCC-TC-8**
Subject/Topic:	Mitigation for In-Water Works		

Reference to Type A:

- SD05 Water Management Plan (WMP) Section 7 Water Supply; Section 9.4.1 Sediment and Erosion Control Measures; Appendix B Water Quality Monitoring
- Type A Water Licence Response to Information Requests – Feb. 5, 2018, KIA-IR20

Detailed Review Comment:

Water intakes will be constructed in Goose and Big lakes and this work will involve installing pipelines and rock structures. The Proponent proposes mitigation measures to limit disruption to aquatic ecosystems including the use of silt curtains and ongoing monitoring of turbidity. In KIA-IR20, the Proponent has provided further details on mitigation and development of a regression to correlate the site-specific turbidity-Total Suspended Solids (TSS) relationship. Details are not provided in the WMP on how turbidity will be used as a surrogate for TSS, and what turbidity/TSS levels will trigger further action.

Runoff management and monitoring will also be needed to prevent sediment migration into surface waters. The WMP states in Section 7.5.1 that: "*Sediment and erosion control are an important component of the environmental protection plan for the Project. Mitigation and management measures for sediment and erosion control measures are presented in the Aquatic Effects Management Plan (SD-21)…*" However, ECCC could find no mention of these in the Aquatics Effects Management Plan (AEMP) SD-21. Section 9.4.1 Sediment and Erosion Control Measures in the WMP provides a limited description of mitigation plans and focuses mainly on runoff.

Dewatering activities will also need site-specific correlation of turbidity and TSS for use prior to directing the water to treatment for TSS. A brief description is provided in WMP Appendix B Water Quality Monitoring and includes a threshold of 90% of the discharge criteria that will be used to trigger mitigation.

Recommendation/Request:

ECCC recommends that the Proponent develop a Sedimentation Management Plan (either as a separate document or as a section of the Water Management Plan) which would outline details of mitigation measures for sediment and erosion control and in-water works, including development of a turbidity-Total Suspended Solids (TSS) relationship and action levels for monitoring of TSS during construction and in-lake activities.

Sabina Response:

Sabina will include the following details related to mitigation and management measures for erosion and sediment control, as well as bank stabilization in the next revision of the Water Management Plan (WMP):

Mitigation by Erosion and Sediment Control

- The area of landscape disturbance will be minimized, and restoration will occur as soon as possible 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.

A total suspended solids (TSS)-turbidity relationship will be developed, where needed, either from historical site data (if sufficient TSS-turbidity data are available to create a statistically supported relationship), experimentally, or during activities (in which case, the use of Turbidity in place of TSS would only be possible once a relationship had been established; until that time compliance would only be verifiable through TSS concentrations). Which methodology to be used will depend on the site, the amount of historical data available, and the planned work. In all situations, regression analysis will be used to identify site-specific statically significant relationships (equations) relating turbidity to TSS in a manner to allow the derivation of TSS from in-field measurements of turbidity.

TSS will be monitored during in-water construction against criteria presented in the WMP (section 7.5). Should monitoring indicate that TSS has surpassed 80% of these criteria additional mitigation measures will be implemented (such as a temporary reduction in, or cessation of, activity or use of additional mitigation).

Attachment:

N/A

Interested Party:	ECCC	**TC No.:**	**WT-ECCC-TC-9**
Subject/Topic:	Aquatics Effects Management Plan		

Reference to Type A:

- SD21 Aquatic Effects Management Plan (AEMP)
- Type A Water Licence Response to Information Requests – Feb. 5, 2018, ECCC-IR8 to ECCC-IR24 (inclusive)

Detailed Review Comment:

ECCC provided technical review comments on the AEMP in the conformity review submitted to the Nunavut Water Board January 22, 2018. The Proponent provided their responses in the Type A Water Licence Response to Information Requests document submitted to the Nunavut Water Board on February 5, 2018, but many of the comments raised are still outstanding. The Proponent has initiated meetings with ECCC to discuss and resolve concerns related to the AEMP and develop a path forward for the AEMP. Meeting minutes from these meetings have been uploaded to the NWB registry. Work is underway by the Proponent to assess data collected in 2017, to identify data gaps and any limitations for the study design and to address questions raised by reviewers. ECCC anticipates that technical meetings with the Proponent in advance of the NWB Technical Meetings (scheduled May 1-3, 2018) will be constructive in resolving or tabling concerns prior to public hearings.

Recommendation/Request:

ECCC recommends continued development of the Aquatics Effects Management Plan by the Proponent so that questions and concerns can be addressed in preparation for the Nunavut Water Board Technical Meetings.

Sabina Response:

Sabina acknowledges ECCC's recommendation and anticipates further conversation related to the Aquatic Effects Management Plan (171002 2AM-BRP----SD21-AEMP-IMLE) with ECCC prior to the Technical Meeting. Sabina confirms that the meeting minutes from the meeting referred to by ECCC were submitted to the NWB on April 7, 2018 for upload to the Nunavut Water Board Public Registry.

Attachment:

N/A

Interested Party:	ECCC	**TC No.:**	**WT-ECCC-TC-10**
Subject/Topic:	Ore Stockpile Metal Leaching and Acid Rock Drainage		

Reference to Type A:

- SD07 Ore Storage Management Plan, Section 5.4 Goose Property Ore Stockpile Methods and Procedures

Detailed Review Comment:

The Proponent states:

> *"The acid generation potential of the ore is not expected to adversely impact surface water and soil quality as the temporary ore stockpiles will be consumed during processing. In the unlikely event that ore stockpiles are present at closure, the ore will be relocated to Waste Rock Storage Areas (WRSAs) or left in place; in either instance the remaining ore would be capped with NPAG waste rock."*

ECCC noted that the temporary stockpile will be consumed during processing, but it is unclear how long the temporary stockpile will stay on the surface before processing. The longer the temporary stockpile stays exposed, the higher the possibility for Metal Leaching/Acid Rock Drainage (ML/ARD). If there is a possibility that the stockpile will stay on the surface longer than expected, there is no indication of how the Proponent will address any incidence of ML/ARD or contact seepage that might occur before the ore is processed. Adaptive management triggers should be developed in regards to the possibility of prolonged exposure time.

Recommendation/Request:

ECCC recommends that the Proponent clarify how they intend to manage the temporary ore pile for Metal Leaching/Acid Rock Drainage, including adaptive management triggers if the ore pile stays exposed for enough time that such conditions could develop.

Sabina Response:

Sabina clarifies that all surface runoff and seepage from the Ore Stockpile is contained within the Ore Stockpile Pond, which is part of the site contact water management system. Therefore, additional mitigation measures to manage surface water is not required. Adaptive management measures to manage the ore stockpile itself has been documented in the Ore Storage Management Plan (171002 2AM-BRP----SD07-OreStorageMgmtPlan-IMLE) and includes relocation of the ore to another waste rock storage area and capping with NPAG waste, or capping the ore stockpile in-situ with NPAG waste. In either case, the presence of the Ore Stockpile Pond ensures full containment with regard to seepage and runoff.

Attachment:

N/A

Interested Party:	ECCC	**TC No.:**	**WT-ECCC-TC-11**
Subject/Topic:	Waste Rock Storage Freeze Back		

Reference to Type A:

- SD08 Mine Waste Rock Management Plan, Section 5.6 Waste Rock Storage Area Thermal Modelling and Section 5.7.1 Waste Rock Storage Alternatives Analysis Design Basis

Detailed Review Comment:

The Proponent states

> *"Freeze back of the WRSAs is considered to be validated if the temperature throughout the PAG waste rock remains below 0°C. Under these conditions, freeze back at the Property is estimated to be less than five years with no allowance for convective cooling in the winter, and less than 2.5 years with allowance for convective cooling."*

Then in 5.7.1 Waste Rock Storage Alternatives Analysis Design Basis, the Proponent states that *"Although acidic conditions could occur more rapidly in some of the waste rock, average pH conditions in seepage and runoff would be expected to remain non-acidic until complete freeze back of the WRSAs."*

ECCC noted that there is no time lag given before ML/ARD occurs. Therefore, if freeze back takes 2.5 to 5 years, any incidence of ML/ARD before the freeze back occurs will not be mitigated.

Recommendation/Request:

ECCC recommends that the Proponent update the Mine Waste Rock Management Plan to manage metal leaching/acid rock drainage that may occur prior to freeze back.

Sabina Response:

Sabina clarifies that all surface runoff and seepage from the Waste Rock Storage Areas (WRSAs) will be contained within the WRSA ponds, which is part of the site contact water management system. Therefore, additional mitigation measures to manage surface water prior to waste rock freeze back is not required.

As stated in Section 5.6 of the Mine Waste Rock Management Plan (MWRMP; 171002 2AM-BRP----SD08-MineWasteRockMgmtPlan-IMLE), freeze back of the WRSAs is anticipated to take between 2.5 to 5 years (i.e., during mine operations). It is unlikely that acidic conditions will develop in the WRSAs during this freeze back period (Section 5.7.1 of the MWRMP). During Operations, runoff from the WRSAs will be collected in perimeter berms and directed towards collection ponds (Section 8.1.6 of the Water Management Plan [171002 2AM-BRP----S05-WaterMgmtPlan_IMLE]). Therefore, if metal leaching/acid rock drainage occurs prior to freeze back, this contact water will be managed according to the mine water management plan.

Attachment:

N/A

Interested Party:	ECCC	**TC No.:**	**WT-ECCC-TC-12**
Subject/Topic:	Errata		

Reference to Type A:

- SD20 Environmental Management & Protection Plan, 8.3.3. Environmental Monitoring

Detailed Review Comment:

Site-specific water quality objectives and CCME are neither regulations nor discharge limits, as stated in the following excerpt (emphasis added to highlight the errata):

> *Environmental monitoring consists of three forms, these being:*
>
> *Regulated discharge monitoring occurs at monitoring points specified in licenses or regulations. It includes discharge limits that must be achieved to maintain compliance with an authorization (i.e., Type A Water Licence **or Site-specific Water Quality Objectives**) or regulation (i.e., Metal Mining Effluent Regulations **or Canadian Council of Ministers of the Environment**). Enforcement action may be taken if discharge limits are exceeded for a parameter. Refer to the Water Management Plan (SD-05) for details on specific discharge criteria.*

Recommendation/Request:

ECCC recommends that the Proponent correct these errata.

Sabina Response:

Sabina appreciates the identification of these errors and will correct them in the next revision of the Environmental Management and Protection Plan (171002 2AM-BRP----SD20-EMPP-IMLE).

Attachment:

N/A

Sabina
GOLD & SILVER CORP.

The BACK RIVER PROJECT

Technical Comment Responses

Fisheries and Oceans Canada

Interested Party:	DFO	**TC No.:**	**WT-DFO-TC-3.1**
Subject/Topic:	Avoidance and Mitigation of Effects of Blasting on Fish		

Reference to Type A:

- FEIS addendum, volume 1, appendix v1-9; table regarding Party-Recommended Terms and Conditions and Commitments, p. 1
- FEIS addendum, volume 6, Table – Recommended Terms & Conditions and Commitments, p. 6-17
- FEIS addendum, volume 10, chapter 19, section 5.4.6, p. 5-12
- Back River Project, Conceptual Fish Offsetting Plan, February 2017, Part 2, table 5.1-1, p. 24
- Back River Project, Conceptual Fish Offsetting Plan, February 2017, Part 2, section 5.4, p. 27
- Borrow Pits and Quarry Management Plan, section 4.3.3: Winter Ice Road, pg. 4-8
- Nunavut Impact Review Board, Project Certificate [No.: 007], December 2017, pg. 25 and 26

Detailed Review Comment:

DFO-FPP's Final Written Submission (March 2016) noted several recommendations related to updating the blasting thresholds:

- Recommendation 3.1.1 - Fisheries and Oceans Canada recommends that Sabina revise their instantaneous pressure threshold limit of 100 kPa to 50 kPa, and recalculate the appropriate setback distances. Development of adequate mitigation measures to address the effects of blasting on fish and reduce the risk of serious harm to fish as a result of the Back River Project should also be based on Fisheries and Ocean Canada's Measures to Avoid Causing serious harm to fish and fish habitat.
- Recommendation 3.1.2 - Fisheries and Oceans Canada recommends that Sabina develop an appropriate blast monitoring and mitigation plan to ensure that peak particle velocities do not exceed 13 mm/s at important spawning habitats in Goose lake, especially during the time of Lake Trout egg incubation and should include procedures to be followed in the event that blasts may approach or exceed this threshold.

In response to DFO-FPP recommendations, Sabina committed to "*engage with Fisheries and Oceans Canada in exploring possible Project specific thresholds, mitigation and monitoring for blasting that would exceed the requirements of Fisheries and Oceans Canada's Guidelines for the Use of Explosives In or Near Canadian Waters (Wright and Hopky, 1998).*"

DFO-FPP notes that Sabina's commitment was captured in Term and Condition #25 of Sabina's Back River Project Certificate No. 007.

DFO-FPP is still awaiting the project specific details respecting updated blasting thresholds, setback distances and blast monitoring. However, DFO-FPP notes that Sabina will be required to adhere to Term and Condition 25 of the Project Certificate issued by the Nunavut Impact Review Board (pg. 25&26), and will need to submit the requested information to DFO-FPP as part of any 'DFO Request for Review' submission.

Recommendation/Request:

Recommendation 3.1.1: DFO-FPP recommends that Sabina continue to work with DFO-FPP to finalize project specific blasting thresholds, mitigation and monitoring for blasting that would exceed the requirements of Fisheries and Oceans Canada's Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (D.G. Wright and G.E. Hopky, 1998) as per Term and Condition 25 of the NIRB Project Certificate 007.

Recommendation 3.1.2: DFO-FPP also recommends Sabina continue to work with DFO-FPP to develop and finalize a blast monitoring and mitigation plan.

Sabina Response:

Sabina agrees to revise the instantaneous pressure limits and recalculate the setback distances as part of a blasting and monitoring plan submitted with a Request for Review application to Fisheries and Oceans Canada (DFO). The setback distances will be developed to protect fish and their incubating eggs from maximum allowable limits for blasting-induced overpressure (50 kilopascals [kPa] in the swimbladder of a fish) and peak particle velocity (PPV; 13 millimetres/second [mm/s] in a spawning bed). It is expected that all blasting will occur in isolated and dewatered areas outside of fish bearing waters and blasting in the Goose Main Pit will be outside of the recommended DFO setback distances.

If the recommended setback distances are approached, then site-specific operating mitigation could be implemented to protect fish if required. For example, if necessary, it may be possible to adjust blasting practices during the time of highest biological sensitivity (i.e., the window of early development for eggs of Lake Trout and Lake Whitefish) or to use controlled blasting techniques. As shown in Figure 3.4-8 in Appendix V6-6D of the Final Environmental Impact Statement (attached), there are no nearby spawning beds in Goose Lake. Furthermore, several studies have demonstrated that exposure to a blast that generates up to 28.5 mm/s (expected at Goose Main Pit), egg mortality would be minimal as eggs are resilient to effects from vibrations within this range (Faulkner et al. 2006, 2008). In addition, potential effects on overpressure and vibrations are reduced as the pit depth increases.

Sabina reiterates the commitment to develop a blasting and monitoring plan for the Back River Project for avoiding and mitigating Serious Harm to Fish and to engage with DFO on this plan prior to construction, as part of the Request for Review application. This approach will ensure that survival and reproduction rates of fish in nearby surface waters during Project Operations will remain unchanged from blasting in the Goose Main Pit.

References:

Faulkner SG, Tonn WM, Welz M, Schmitt DR. 2006. Effects of explosives on incubating lake trout eggs in the Canadian Arctic. N Am J Fish Manage. 26: 833-842.

Faulkner SG, Welz M, Tonn WM, Schmitt DR. 2008. Effects of simulated blasting on mortality of rainbow trout eggs. T Am Fish Soc. 137:1-12.

Attachment:

Figure 3.4-8 from Appendix V6-6D of the Final Environmental Impact Statement

Lake Morphometry	Goose
Surface Area (m^2)	3,292,828
Max Depth (m)	29
Volume (m^3)	36,411,738
Shoreline Length (m)	18,603

Goose Property Area

N

430500 431500 432500 433500 434500

7272000 7271000 7270000

Approximate Location of Lake Trout

Potential Spawning Location Habitat Quality

- Excellent
- Good
- Fair

Shoreline Substrate

- Fines
- Gravel
- Cobble
- Boulder
- Bedrock

- Existing Exploration Camp
- Haul and Access Road
- Diversion Channel
- Water Intake
- Infrastructure
- Landfill
- Resource Pit
- Proposed Airstrip
- Tailings Impoundment Area Embankment
- Waste Rock Storage Area
- Camp\Plant Site
- Stockpile Location
- Quarry
- Potential Development Area (PDA)
- 1 m Isobath Interval
- 5 m Isobath Interval

1:12,500

0 250 500

Metres

Projection: NAD 1983 UTM Zone 13N

Sabina GOLD & SILVER CORP.

Rescan an ERM company

Figure 3.4-8

Lake Trout Spawning Survey Observations, Goose Lake, 2013

Interested Party:	DFO	**TC No.:**	**WT-DFO-TC-3.2**
Subject/Topic:	Avoidance and Mitigation of Effects to Fish and Fish Habitat		

Reference to Type A:

- FEIS addendum, volume 6, Table – Recommended Terms & Conditions and Commitments, p. 6-18
- Back River Project, Conceptual Fish Offsetting Plan, February 2017, Part 2, section 5.2, p. 25
- Back River Project, Conceptual Fish Offsetting Plan, February 2017, Part 2, section 6.3.3, p. 36
- Nunavut Impact Review Board, Project Certificate [No.: 007], December 2017, pg. 27 and 28
- Back River Project, Water Management Plan, October 2017, Part 1, section 9.3, p.9-2
- Back River Project, Water Management Plan, October 2017, Part 5, Figure A-17
- Back River Project, Main Application Document, October 2017, section 5.3.4.5, pg. 5-24

Detailed Review Comment:

DFO-FPP acknowledges Sabina's commitment to adhere to Terms and Conditions 29 and 30 of the Project Certificate issued by the Nunavut Impact Review Board (pg. 27&28).

DFO-FPP notes that Sabina has updated their Back River Project Water Management Plan (October 2017) to incorporate the terms and conditions:

- *"For fish bearing crossings, Sabina will implement all applicable DFO BMPs to avoid and mitigate serious harm to fish as the result of water crossing construction, operation, and decommissioning for all fish-bearing water crossings. These measures will include, but are not limited to, appropriate design of water crossings to facilitate fish passage at both high and low flows; timing windows that incorporate spawning, incubation and hatch times for all species using watercourses; sediment and erosion control; protection of riparian vegetation; and other forms of bank stabilization."* (Water Management Plan, s. 9.3, p.9-2)
- *"unless otherwise directed by DFO, Sabina's monitoring program for culverts on fish bearing watercourses during Construction, Operations, and Closure phases will include measures to ensure that barriers to fish passage do not form over time as a result of crossing damage due to ice blockage, flooding, or movement of debris; all of which may occur at freshet. Detailed design drawings and an updated monitoring program for culverts on fish bearing watercourses will be produced prior to construction."* (Water Management Plan, s. 9.3, p.9-2)

DFO-FPP acknowledges that in the Back River Project Main Application Document dated October 2017, in section 5.3.4.5 Water Crossings, it states: "Sabina will conduct a fish passage flow assessment as part of the culvert design process (wherever fish passage is required) … Sabina has committed (FA-DFO-C-3) to providing DFO with detailed site-specific plans of all fish bearing water crossings, supported by measured or modeled stream flow data, for review during the regulatory phase." (Main Application Document, pg. 5-24)

Although DFO-FPP acknowledges the above noted commitments, DFO-FPP notes that the design schematics provided as part of the Water Management Plan, Part 5, in Figure A-17 are "Typical cross-section of double culvert crossing" and as such, not site or watercourse specific.

DFO-FPP will require the detailed site-specific plans, that includes engineered drawings for each watercourse crossing supported by measured or modeled stream flow data as part of Sabina's 'DFO Request for Review' submission.

Recommendation/Request:

Recommendation 3.2.1: DFO-FPP recommends that Sabina provide detailed site-specific plans of all water crossings, supported by measured or modeled stream flow data, for review prior to construction. This may be provided as part of Sabina's 'DFO Request for Review' submission and Application for *Fisheries Act* Authorization.

Sabina Response:

Up to four culvert crossings are proposed for watercourses at the Back River Project (see Base Figure 2 in Appendix A of the Main Application Supporting Document [171002 2AM-BRP----App A_baseFigures-IMLE]). All proposed culverts would be located on watercourses that flow into Goose Lake. One from the Llama Watershed (Umwelt Outflow), three from the Wolf Watershed: Echo Outflow, Rascal Stream West (Gander Pond Outflow), and where Rascal Stream East and Goose Main Pit Stream converge.

Baseline information provided in the Appendix V6-6D of the Final Environmental Impact Statement identifies only two fish-bearing crossings as Racal Stream West and Rascal Stream East/Goose Main Pit Stream. Sabina will provide detailed site-specific plans for these two culvert crossings, supported by modelled stream flow data, to Fisheries and Oceans Canada (DFO) as part of Sabina's 'DFO Request for Review' process. Note that the Request for Review application for the Rascal Stream West crossing is currently under review by DFO.

Attachment:

N/A

Interested Party:	DFO	**TC No.:**	**WT-DFO-TC-3.3**
Subject/Topic:	Avoidance and Mitigation of Effects to Fish and Fish Habitat		

Reference to Type A:

- FEIS addendum, volume 6, Table – Recommended Terms & Conditions and Commitments (p. 6-17)
- FEIS addendum, volume 6, appendix V6-6G
- Nunavut Impact Review Board, Project Certificate [No.: 007], December 2017, pg. 26 and 27
- Technical Memorandum, Draft: Winter Ice Road Withdrawal Evaluation – Back River Project, Prepared by Golder Associates for Sabina Gold & Silver Corp., February 5, 2018

Detailed Review Comment:

DFO-FPP acknowledges that Sabina commits to adhere to Terms and Conditions 27 and 28 of the Project Certificate issued by the Nunavut Impact Review Board (pg. 26&27).

DFO-FPP also notes a Technical Memorandum was submitted on February 5, 2018 that provided bathymetry, depth and potential locations of possible water withdrawal sites, proposed volumes to be extracted and anticipated water level decreases. The Technical Memorandum provided a preliminary desktop analysis and discussion on the potential risk to shoal habitat from a 10% water level withdrawal as shown in Table 1 below (WIR Tech Memo, 2018, pg. 2):

Table 1: Water Withdrawal Risk Level Framework for Spawning Shoal Habitat for Fall-Spawning Fish[a]

Risk of Spawning Habitat Loss	Change in Water Elevation Under Ice (m)	Rationale
Nil or negligible	Less than 0.22	The reduction in water level lies within the average change in ice thickness (i.e., within normal variation)
Low	0.22 to less than 0.42	The reduction in water level remains within 1 SD of the average
Medium	0.42 to 0.8	The reduction in water level remains between 1 and 2 SD of the average
High	Greater than 0.8	The reduction in water level is beyond 2 SD of average and there is less than a 5% chance for this occurring naturally

a) includes coregonid species, such as Lake Whitefish (*Coregonus clupeaformis*), and Lake Trout (*Salvelinus namaycush*); SD = standard deviation

DFO-FPP acknowledges the preliminary analysis and discussion of risk to shoal habitats, however, DFO-FPP will require detailed water withdrawal plan that includes an in- depth risk analysis informed by site specific fish and fish habitat features for the waterbodies chosen for water withdrawal as part of Sabina's 'DFO Request for Review' submission.

Recommendation/Request:

Recommendation 3.3.1: DFO-FPP recommends that Sabina provide a detailed water withdrawal plan for the winter ice road, including specific fish habitat features within each waterbody proposed to be used for winter water withdrawal and before use of the waterbodies. This information can be provided as part of Sabina's 'DFO Request for Review' submission and / or Application for Fisheries Act Authorization.

Sabina Response:

Sabina is confident that the submitted technical memorandum (Winter Ice Road Water Withdrawal Evaluation - Back River Project, as Appendix E-4 to the Type A Water Licence Application) provided an in-depth risk analysis to identify water withdrawal volumes that are protective of fish habitat. The recommended under-ice water withdrawal volumes are expected to be more protective of habitat than the 10% under-ice volume guideline provided by Fisheries and Oceans Canada (DFO) for 18 of the 55 source lakes that were identified; specifically, recommended under-ice volumes for these 18 lakes are less than the 10% under-ice volume. Any changes in water levels from water withdrawals will be less than 22 cm, and within the normal variation of ice thickness in the Back River Project region.

Importantly, anticipated actual volumes of water required from any of the 55 identified source lakes during winter ice road (WIR) construction are expected to be much less than the recommended maximum volumes for the respective lakes presented in the technical memorandum. For example, the current plan for the WIR construction is based on 675 m^3/km of water (108,000 m^3 total), which is lower than the recommended under-ice volume for many of the individual source lakes (19 lakes) along the WIR alignment; see Table 2 of the technical memorandum. Furthermore, the anticipated volume of 108,000 m^3 of water for WIR construction represents less than 1% of the total recommended under-ice water volume for all 55 lakes combined.

Sabina is confident that the proposed construction plan for the WIR represents minimal risks to fish habitat, including shoal habitat. DFO's request to identify site-specific habitat features in each of the source lakes is not expected to change the outcome of the water withdrawal evaluation. However, Sabina is committed to continue discussion with DFO on potential risks to shoal habitats and a proposed approach for winter ice road construction that minimizes any such risks.

Attachment:

N/A

Interested Party:	DFO	**TC No.:**	**WT-DFO-TC-3.4**
Subject/Topic:	Arctic Grayling Goose Lake Population - Spawning Habitat		

Reference to Type A:

- FEIS Addendum, volume 6, appendix V6-6F
- Main Application Document Appendix F-6: Rascal Stream Fishway Memo, ERM, February 2017
- Nunavut Impact Review Board, Project Certificate [No.: 007], December 2017, pg. 26.

Detailed Review Comment:

By providing a Rascal Stream Fish Passage Mitigation memorandum, DFO-FPP understands that Sabina is potentially addressing DFO-FPP's concern regarding the Arctic Grayling population of Goose Lake.

DFO-FPP also acknowledges that Sabina commits to adhere to Term and Condition #26 of Project Certificate No. 007 issued by the Nunavut Impact Review Board: "*The Proponent shall engage Fisheries and Oceans Canada, the Kitikmeot Inuit Association, and other interested parties during the regulatory phase on the design, construction, and operation of adequate fish passage to permit migration of Arctic Grayling from Goose Lake to natural spawning and rearing habitat located in upper Rascal Stream East, south of the planned airstrip. Any additional information required to ensure the design of the fish passage will be completed prior to significant construction activities at the Goose Property.*" (NIRB Project Certificate 007, p.26&27)

However, DFO-FPP will require further information as part of the Rascal Stream Fish Passage plan to be able to determine the effectiveness of the proposed mitigation strategy. This updated plan should include design, construction, operation, monitoring, closure/remediation, and design of habitat creation.

Recommendation/Request:

Recommendation 3.4.1: DFO-FPP recommends Sabina provide a Rascal Stream Fish Passage plan prior to its construction. The plan should include, but not be limited to, design, construction, operation, monitoring, closure/remediation, design of habitat creation, etc. This information can be provided as part of Sabina's 'DFO Request for Review' submission and Application for *Fisheries Act* Authorization.

Sabina Response:

Sabina is currently preparing an additional technical memorandum for Fisheries and Oceans Canada (DFO) that models stream flow conditions (depths and velocities) under mitigation alternatives for Rascal Stream in response to concerns expressed by DFO (DFO 2017) during the environmental review of the Project. Results from the modelling work are intended to inform and support the final mitigation design for Rascal Stream.

Included in the DFO technical memorandum evaluation is a mitigation design (Berm Scenario 1) where berms would be installed on Goose Stream Reach 3 and Rascal Stream East (RSE) Reach 4 (Sabina 2017), southwest of the proposed airstrip extension, to divert all flows from RSE and Gosling Pond 1 through Rascal Stream West (RSW) to Goose Lake (Sabina 2017). The installation of berms would also result in the modification or re-alignment of RSE (upper section of Reach 4), creating what was previously termed the 'Rascal Stream Fishway'. The basic premise of this mitigation concept is the use of berms to redirect flows from potentially low-quality habitats to higher-quality habitats where they can be utilized by spawning Arctic Grayling. This modification is also expected to mitigate effects of altered

habitat east of the runway due to mining infrastructure, in part, by increasing depths for fish passage and by increasing available habitat for spawning and rearing in RSW through increased flows.

A modification of the above scenario is also currently being evaluated (as Berm Scenario 2). A consideration to further improve the productivity of the system for Arctic Grayling is the installation of a berm to divert flows from RSW Reach 7, just downstream of Rascal Lake outlet, to RSE Reach 5. This would create a single channel from Rascal Lake to Gosling Pond 1. The RSW Reach 7 berm was proposed as mitigation given the relatively low-quality habitat in RSW Reach 7, where flows are dispersed and boulder gardens are the predominant habitat type, and given the potential of upper RSE (Reach 4 and 5) to support additional spawning and rearing habitat (Sabina 2017).

Based on results from the hydraulic modelling, the number of suitable flow days for Arctic Grayling passage will be quantified (adult and juvenile upstream migrations, and young of year downstream migration) to better evaluate and inform the mitigation designs for Rascal Stream; where suitable flow days are to be based on the hydraulic predictions combined with criteria for minimum depth and maximum water velocity criteria (e.g., Katopodis and Gervais 2016). The technical memorandum in preparation, along with requested design plans, and any new baseline information collected for Rascal Stream in 2018 will be submitted to DFO as part of the application for a Request for Review or as part of the application for a *Fisheries Act* Authorization. Sabina will provide information to the NWB related to the Rascal Stream diversion design concurrent with the Request for Review or no later than 60 days prior to construction.

References:

DFO (Fisheries and Oceans Canada). 2017. Final Written Submission – Final Environmental Impact Statement Addendum. Submitted to the Nunavut Impact Review Board (NIRB). April 24, 2017.

Katopodis C, Gervais R. 2016. Fish swimming performance database and analyses, DFO. Can. Sci. Advis. Sec. Res. Doc. 2016/002. Vi + 550 p.

Sabina (Sabina Gold & Silver Corp.). 2017. *Addendum Appendix V6-6F: Final Environmental Impact Statement Addendum for the Back River Project*. Submitted to the Nunavut Impact Review Board (NIRB). February 2017.

Attachment:

N/A

Interested Party:	DFO	**TC No.:**	**WT-DFO-TC-3.5**
Subject/Topic:	General Fish-out and Dewatering Plan		

Reference to Type A:

- FEIS addendum, Volume 6, Table – Recommended Terms & Conditions and Commitments, p. 6-18
- FEIS addendum, volume 10, chapter 31, section 1.1, p. 1
- FEIS addendum, volume 10, chapter 31
- DFO Final Written Submission to NIRB, April 24, 2017, section 3.5, pg. 23: Response to Appendix B of a letter from the NIRB dated February 23, 2017
- Back River Project, Water Management Plan, October 2017, Part 1, section 9.3, p.9-2

Detailed Review Comment:

During the Nunavut Impact Review Board's environmental assessment process, Sabina proposed to work with DFO-FPP and the impacted communities during the regulatory phase to finalize the fish-out plan. Sabina also proposes to engage with communities on "*how to best utilize the fish resource and conduct dewatering activities.*" The final fish-out plan was planned to be finalized during the regulatory review process. DFO-FPP will continue to work with the proponent in finalizing the fish-out plan.

DFO-FPP notes that in the Water Management Plan submitted by Sabina in October 2017, it states: "*Inline with dewatering, a fish-out program will be completed. The fish-out program will follow the DFO's General Fish-Out Protocol for Lakes and Impoundments in the Northwest Territories and Nunavut (Tyson et al. 2011). Lake dewatering will commence once the catch-per-unit-effort (CPUE)/recapture phase of the fish-out program has been completed (typically between August and September).*" (Water Management Plan, s. 9.3, p.9-2)

DFO-FPP notes Sabina will be required to submit a finalized fish-out and dewatering plan as part of their Application for a *Fisheries Act* authorization should the water license be granted.

Recommendation/Request:

Recommendation 3.5.1: DFO-FPP recommends that Sabina continue to work with DFO-FPP and the impacted communities to develop a detailed fish-out and dewatering plan.

Sabina Response:

Sabina agrees and is committed to continue to work with Fisheries and Oceans Canada (DFO) and the impacted communities to develop a detailed fish-out and dewatering plan. The dewatering plan will be submitted to the NWB as directed by the Board or in any event no later than 60 days prior to initiation of dewatering.

Attachment:

N/A