Crown-Indigenous Relations and Northern Affairs Canada
Relations Couronne-Autochtones et Affaires du Nord Canada

Water Resources Division
Resource Management Directorate
Nunavut Regional Office
P.O. Box 100
Iqaluit, NU, X0A 0H0

Your file - Votre référence
2AM-MEL1631

November 13, 2020

Our file - Notre référence
CIDM# 1291195

Richard Dwyer
Manager of Licensing
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU, X0B 1J0

sent via email: licensing@nwb-oen.ca

Re: Crown-Indigenous Relations and Northern Affairs Canada Completeness Review for Type A Water Licence 2AM-BRP1831 Amendment for Back River Modification Project by Sabina Gold and Silver Corporation in Nunavut.

Dear Mr. Dwyer,

Thank you for the October 15, 2020 invitation for completeness review of the application for amendment of Water Licence 2AM-BRP1831. The Water Resources Division of Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) examined the application pursuant to CIRNAC's mandated responsibilities under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Department of Crown-Indigenous Relations and Northern Affairs Act*. The information requests from the review of the application are provided in the enclosed memorandum for consideration by the Nunavut Water Board.

CIRNAC is willing to participate in any form of Technical Meeting and Pre-Hearing Conference set by the Nunavut Water Board.

If there are any questions or concerns, please contact me at (867) 975-4550 or godwin.okonkwo@canada.ca

Sincerely,

Godwin Okonkwo
Manager Water Resources

Canada

Technical Review Memorandum

To: Richard Dwyer, Manager of Licensing, Nunavut Water Board

From: Godwin Okonkwo, Manager Water Resources, Crown-Indigenous Relations and Northern Affairs Canada

Date: November 13, 2020

Re: Crown-Indigenous Relations and Northern Affairs Canada's Completeness Check for Type A Water Licence 2AM-BRP1831 Amendment for Back River Modification Project by Sabina Gold and Silver Corporation in Nunavut

Region: ☒ Kitikmeot ☐ Kivalliq ☐ Qikiqtani

A. BACKGROUND

Back River Project is operated by Sabina Gold and Silver Corporation (Applicant) in the West Kitikmeot region of Nunavut. The project includes the development of open pit and underground mines at the Goose Property, and underground mines at the George Property. The proposed development of mineral deposits in the Goose and George properties are associated with infrastructure including all-weather and winter access roads connecting the properties, as well as a Marine Laydown Area in southern Bathurst Inlet. The Project is anticipated to produce 300,000-400,000 ounces of gold per year over at least 10-15 years of production. The Applicant has applied for an amendment of their Type A Water Licence 2AM-BRP1831 based on a Back River Project 2020 Modification proposal.

The Back River Project 2020 Modification Package scope includes the following:

1. Goose Property
   - Goose Property Airstrip Extension
   - Umwelt Underground Extension
   - Goose Property Total Water Use Increase.

2. Goose Property Waste and Water Management
   - Waste and Water Management Infrastructure.

3. Marine Laydown Area (MLA)
   - MLA Fuel Transfer Area
   - MLA Airstrip Extension.

4. Marine Laydown Area – Shoreline Pad Extension

- MLA Shoreline Pad Extension.

5. Winter Ice Road (WIR)
   - WIR Subbase Upgrade
   - WIR Service/Emergency Camps
   - WIR Total Water Use Increase.

The Applicant has confirmed that the scope of activities in Part A, Item 1 of licence 2AM-BRP1831 remains unchanged, and that the new scope of activities associated with the 2020 Modification Package will be added to the licence as part of this amendment application. The Applicant has also indicated that mining areas and associated infrastructure already included in the Project Certificate (PC No. 007; NIRB File No. 12MN036) and the Type A Water Licence 2AM-BRP1831 will remain in the amended licence.

B. DOCUMENTS REVIEWED

Water Licence 2AM-BRP1831 amendment application documents Reviewed include the following:

1. Amendment Application Cover Letter, dated October 13, 2020;
2. NWB Application for Water Licence Amendment Form, dated October 9, 2020;
3. Compliance Assessment Table, dated October 1, 2020;
4. Back River Project 2020 Modification Package, Version 2, dated October 2020, including:
   - Plain Language Summary (English);
   - Appendix A – 2020 Modification Package Figures;
   - Appendix B – Water Management Plan, dated October 2020;
   - Appendix C – Goose Property Water Availability Memo, dated March 13, 2020;
   - Appendix D – MLA Shoreline Pad Extension Memo, dated June 5, 2020;
   - Appendix E – WIR Water Increase Memo, dated March 11, 2020.

C. RESULTS OF THE REVIEW

1.0 GROUNDWATER INFLOWS PARAMETERS INFORMATION

Comment 1

Section 5.1.3 of the Back River Water Management Plan states that:

Table 5.1-1 provides a summary of estimated annual groundwater inflows at the Goose Property. Linear interpolation was assumed for groundwater flow into Llama open pit during pit flooding, ranging from a maximum of 900 m^3/day to 0 m^3/day (Appendix E).

It is unclear how the refilling calculation has extrapolated groundwater inflow rate with other input values (tailings, climate, direct precipitation etc.) to determine the pit flooding time.

Information Request 1

CIRNAC recommends that the Applicant provide a summary of the input and output parameters as well as the methodology used in the determination of the Llama Pit flooding. Commentary on how the more sensitive variables in the analysis could impact predicted water quantity and quality should also be provided to facilitate more effective technical review of this project component.

2.0 METHODOLOGY FOR EXTRAPOLATED WATER QUANTITY AND QUALITY PREDICTIONS

Comment 2

In Section 5.1.3 of the Back River Water Management Plan, it is stated that:

Multiple hypothetical scenarios were modelled to assess the sensitivity of groundwater model predictions to hydraulic conductivity (K) values, the potential presence of fault conduits, lake sediment K values, and permafrost distribution. The hypothetical scenarios were used to contextualize the overall groundwater model in terms of both quantity and quality of water estimated to report to the mines; as part of the 2020 Modification Package, Sabina reviewed this historic data and applied reasonable engineering judgement to appropriately scale the groundwater quantity and quality inflows to the updated mine plan. Refer to the Hydrogeological Characterization and Modelling Report for the Project (Sabina 2017, Appendix F-5) for additional details on the original modelling.

Predictions of water quantity and quality are highly sensitive to the hydraulic properties and the degree of interconnectivity of the rock mass. Subsequently, the specific properties of the rock mass in the immediate vicinity of the proposed Umwelt Underground Extension should be considered in extrapolating quantity and quality predictions.

Information Request 2

The management of saline water is a key issue for technical review, and the predictions of surface water quality and quantity depend on this groundwater model. CIRNAC recommends that the Applicant provide the methodologies applied, including assumptions and calculations, for the extrapolated water quantity and quality predictions for the Umwelt Underground Extension.

3.0 UNANTICIPATED GROUNDWATER QUANTITIES

Comment 3

In Section 5.1.3 of the Back River Water Management Plan, it is stated that:

Sabina recognizes that there is a chance that flow in the mines may be dominated by specific fractures or features that are intercepted. This uncertainty exists for all mining projects 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.

It is agreed that encountering groundwater in unanticipated quantities is typical in mining projects and that SOPs are used to manage these situations. However, in Canada's north, much of the exploration work done during winter is from drill pads located on frozen lakes. An open exploration hole, when encountered underground, will form a direct connection between the lake and the underground with a corresponding potential for a high flow rate at a high pressure in excess of what would normally be encountered in a natural geological structure.

Information Request 3

CIRNAC recommends that the Applicant provide details of Sabina's SOP used as a contingency in managing groundwater when unanticipated quantities are encountered.

4.0 TREATED SEWAGE ATTENUATION

Comment 4

Section 7.4.3.1 states that treated sewage:

"*will be land discharged to maximise attenuation distance prior to entering an outflow watercourse...*"

Attenuation of treated sewage can be complex since multiple different mechanisms occur for different constituents of the treated sewage. A further complicating factor is that the ground is frozen for much of the year, limiting infiltration and attenuation through groundwater flow mechanisms.

It is unclear precisely how the discharge will physically occur, and how the magnitude of attenuation has been determined to meet surface water quality standards requirements at the outflow watercourse or alternative compliance point.

Information Request 4

CIRNAC recommends that the Applicant provide supporting documentation, including applied methodologies, assumptions, and calculations to show that the treated sewage quality will have achieved the required attenuation when meeting a surface watercourse.

5.0 ACTIVE LAYER GROUNDWATER MONITORING

Comment 5

Section 9.1 of the Water Management Plan states that:

"Pending further direction from the NWB, Sabina is committed to maintain a Water Management Plan designed to the above main objectives. The plan includes monitoring that demonstrates that contact water (runoff and shallow groundwater) from the ore storage and WRSAs is adequately captured and managed consistent with the MWRMP (2AM-BRP1831 Part F, Item 1)".

Monitoring of active layer (shallow groundwater) quality is challenging given the cyclical seasonal freeze-thaw of the layer.

Information Request 5

CIRNAC recommends that the Applicant provide the methodology which will be used to monitor shallow groundwater near mine infrastructure.

6.0 DESIGN CRITERIA FOR EVENT PONDS

Comment 6

Tables 6.2-2 of Section 6.2 (Hydrotechnical Design Criteria) of the October 2020 Back River Water Management Plan (WMP) provide design criteria for event ponds. The criteria specify return periods from 10 to 100-years (depending on consequence), minimum dewatering time of 2 days (by pumping), and storage volume based on a 24-hour total rainfall volume plus snowmelt. In the same table, the storage volume for the Saline Water Pond is given as 1.1 Mm^3 based on the 95th percentile volume from the SRK 2015 Water Balance Report rather than the SRK 2020 Water Balance Report.

The 24-hour design criteria may be insufficient to achieve the performance targets that are expressed as a return period, such as once in 10 years. For example, the runoff volume from a 10-year 48-hour event will be larger than from a 10-year 24-hour event. Design events are rarely limited to an isolated 24-hour window, especially when snowmelt is involved. A pond sized for a 10-year 24-hour event will overflow during 10-year events with longer durations unless sufficient outflow (by pumping) is initiated during the initial 24-hour period. A minimum 2-day, or preferably 3-day, event duration should be considered. SRK's 2020 Water and Load Balance Report states that the Saline Water Pond 95th percentile volume is 1,473,000 m^3, about 34% larger than the prior estimate.

Information Request 6

6.1 CIRNAC recommends that the Applicant provide justification for designing the event ponds for a 24-hour duration or, alternatively, increase the duration to a more conservative period for achieving the return period criteria.

6.2 CIRNAC also recommends that the Applicant update the 2020 Water Management Plan to incorporate updated information from the 2020 Water and Load Balance Report for the Saline Water Pond and other facilities as applicable.

7.0 DESIGN CRITERIA FOR DIVERSION BERMS AND CULVERTS

Comment 7

Tables 6.2-3 and 6.2-4 of Section 6.2 (Hydrotechnical Design Criteria) of the 2020 WMP include conveyance design criteria for diversion berms and culverts. The criteria for diversion berm designs specify return periods from 10 to 100 years and conveyance capacity of "24-hr total rainfall volume + m^3/s snowmelt" derived from "BMP". The criteria for culvert designs specify return periods from 50 to 100 years and conveyance capacity of "24-hour total rainfall volume" derived from "BMP, SRK (2014). Report references identify SRK (2014) as "Rascal Realignment Hydraulic Model." Table 6.5-1 presents culvert characteristics and 100-year design discharges for five culverts but does not include information on watershed characteristics.

Conveyance capacity should be given as a flow rate, not volume units. This comment was made during a prior review in 2018. The criteria are inconsistent in whether snowmelt is included in the conveyance design and are generally unclear as to how the design discharge is to be computed. Our comments below assume that the reference to SRK (2014), which we have not reviewed, is in error and that SRK (2015a) was intended.

Conveyance design methodology is described in the SRK Back River Project – Hydrology Report, dated September 2015 and published as Appendix V2-7B of the Back River Project Final Environmental Impact Statement Supporting Volume 2: Project Description and Alternatives. In Section 3.4, Peak Flows, it uses an Index Flood Method to present a conservative representation of (instantaneous) peak flows and achieves similar results with an SCS method for smaller watersheds less than 200 km^2. It recommends that different methodologies be applied for (1) natural catchments versus (2) mine site catchments. The SCS curve numbers presented for natural catchments include snowmelt contributions whereas when the SCS method applied to mine site catchments "will need to be implemented using CN values for each type of infrastructure, extreme rainfall depths and snowmelt flows."

The hydrology report describes a methodology for computing daily snowmelt based on 30 years of NASA-derived daily meteorological data and snowmelt expressions from the US Army Corps of Engineers. Daily snowmelt was calculated for the 30 -year record. The maximum daily snowmelt values for each of the 30 years were averaged to produce an average maximum daily snowmelt of 28 mm/day. This rate was added to the peak flow determined for the mine site catchment using the SCS method.

Reviewers appreciate the innovative approach which utilized the NOAA-derived meteorological data and agree that a design rainfall event be coincident with an averaged maximum snowmelt rate rather than a melt rate with a specified return period. However, the results presented do not give the maximum daily snowmelt estimated for the 30-year period of assessment, which would reflect "sunny day" maximum snowmelt.

It also does not consider diurnal effects yielding peak snowmelt rates significantly higher than daily rates and which may be important for the basins being assessed.

Information Request 7

7.1 CIRNAC recommends that the Applicant elaborate on the criteria presented in the WMP to determine the design conveyance capacities for diversion dam berms and culverts. Specifically, clarity is requested on when and how snowmelt is to be included and how design discharges are to be computed. This information is needed for designs to be developed that are consistent with the criteria, and for reviewers to be assured that the criteria are followed.

7.2 CIRNAC also recommends that the Applicant provide the watershed areas for the five culverts presented in Table 6.5-1 and compare the listed 100-year design flows with the 100-year discharges from the index curve and SCS methods presented in Figures 3.7 and 3.8 from SRK's 2015 hydrology report. The comparison can provide a reasonableness check on the peak flows determined by other methods.

8.0 WATER AND LOAD BALANCE MODEL 2020 UPDATE

Comment 8

The prior Back River Water and Load Balance Model (WLBM) was dated April 2015 by SRK Consulting (Canada) Inc. The current WLBM is dated June 2020 by SRK Consulting (Canada) Inc. and published as Appendix E of the 2020 WMP.

The current WLBM does not identify or reference the prior WLBM and does not describe the history of model development or recent changes to model methodology or results. The study history is important as it allows reviewers to focus on changes to data and methodologies (presumably agreeable as submitted previously) rather than starting from the beginning. Similarly, to avoid duplication of prior reviews, it would be efficient for the study to include a summary of information that has changed since the prior submittal.

Information Request 8

8.1 CIRNAC recommends that the Applicant provide a history of the WLBM documents previously submitted to support prior regulatory applications.

8.2 CIRNAC also recommends that the Applicant provide summaries of differences in model inputs, methods and outputs between the current (2020) and previous (2015) models.

9.0 WATER AND LOAD BALANCE MODEL LIMITATIONS AND CLIMATE CHANGE ADJUSTMENTS

Comment 9

Section 8.2 of the current WLBM discusses hydraulic hydrologic input limitations. These include climate change effects as follows:

"the intensity of snowmelt may increase as a result of higher temperatures". These changes will be captured in the sizing of containment infrastructure." and

"monthly and annual volumes of water produced on site from precipitation may increase", which has been addressed through incorporation of climate change rates of change."

Information Request 9

CIRNAC recommends that the Applicant provide descriptive information on how the identified climate change impacts will be captured in the sizing of containment infrastructure, and has been addressed through incorporation of climate change rates of change.

10.0 WATER WITHDRAWAL ERRORS

Comment 10

Section 2.3.3 of the Modification Package shows an additional withdrawal request of 195,750 m3/yr from Goose Lake in Table 2.3-1, a value that agrees with the calculation of the total. However, the discussion states the same value as 145,750 m3/yr in the text. Some information may be missing on Table 6.4-1 include the available capacity of the Saline Water Pond and the Llama WRSA Pond.

Information Request 10

Technical review of water management will require certainty regarding withdrawals and pond capacities. There are conflicting numbers and errors in the relevant tables. CIRNAC recommends that the Applicant confirm the correct values for the above referenced information.

11.0 HYDRODYNAMIC MODEL SCOPE

Comment 11

Section 6.1 of the Water Management Plan states that:

Sabina is required to provide an updated Hydrodynamic model. Sabina intends to submit this updated Hydrodynamic model as part of the NWB process associated with the 2020 Modification Package, or as part of the 2020 NWB Annual Report.

The requirement can be found in Part E, Item 15b of the Type A Water Licence (2AM-BRP-1831).

Information Request 11

CIRNAC recommends that the Applicant confirm whether the Pieters and Lawrence report titled "Assessment of Stratification in the Proposed Back River Project Llama Pit Lake" is the updated hydrodynamic model referred to above. If not, please provide the

terms of reference for the hydrodynamic modelling scope and the expected delivery date of the work for effective technical review by interested parties.

12.0 SALINE WATER POND PERMAFROST

Comment 12

The Back River Water Management Plan Section 7.1 states that a saline water pond will be used for saline water pumped out of Llama open pit and/or underground works. Umwelt Lake has a volume of ~0.24 Mm^3. This is insufficient to store the estimated volume of saline water, so a dam will be constructed to form the Saline Water Pond with a higher capacity. The dam is specified as lined, but the pond as a whole is not to be lined and the management of saline soils after closure is discussed.

The following excerpts from the WMP highlight the uncertainty and risk regarding the storage of saline water:

"Sabina commits to continue looking for alternative strategies/locations for temporary storage of saline water, before pumping it to the Umwelt Reservoir.

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

The SWP with larger thermal mass and higher-salinity water may be much more effective in melting permafrost than the former Umwelt Lake.

Information Request 12

CIRNAC recommends that the Applicant;

a) Provide detailed information on the current state of permafrost or talik beneath Umwelt Lake;
b) Explain how downward migration of saline water from the SWP and potential talik enlargement will be monitored;
c) Provide information on the degree the SWP is expected to freeze completely or partially to potentially create a more concentrated brine.

13.0 WATER AND LOAD BALANCE

Comment 13

Appendix D of the SRK Water and Load Balance shows extreme maximum values for many water quality constituents in Umwelt Pond, aka the Saline Water Pond. It may be that these are spurious values, but if valid represent particularly toxic water. Further results on the expected quality of the Saline Water Pond are required to understand the potential evolution of the water chemistry and its salinity at the time of transfer to the pit lake.

Information Request 13

CIRNAC recommends that the Applicant provide time series model predictions of the water quality in the Saline Water Pond for the same constituents plotted in the SRK Water and Load Balance Section 7.3.

14.0 LAKE MIXING MODEL

Comment 14

The meromixis analysis (Pieters and Lawrence report) was provided a single value of bottom water salinity (31,400 mg/L) and simulated four mixing scenarios during filling of the pit lake. This salinity is comparable to the expected groundwater inflow to Llama Pit. The potential range in Saline Water Pond salinity is important to the final pit lake stability. A challenging scenario for the future pit lake stability would be a saline water pond that is unsafe to discharge, but not as saline as expected due to dilution with surface water, for example in the source pit.

Another potential problem would be a greater quantity of saline water than expected. For example, a pause in operations could change the quantity and salinity of SWP water. Water management at the mine site during an unexpected work stoppage event could result in a longer period of saline water accumulation than currently modelled.

Information Request 14

CIRNAC recommends that the Applicant provide the specific reasoning for the choice of the Saline Water Pond salinity at the time of filling the pit lake, and discuss how the final salinity might vary in the SWP both under the present mine plan and in a situation where operations paused for a period of time. The response to this information request including water and load balance predictions in the SWP would address this information request for the present mine plan. A brief and qualitative comment on the potential evolution of SWP quantity and salinity (key inputs to the pit lake model) during a pause in operations would also aid the technical review.

15.0 MISSING DOCUMENTS SECTIONS AND DETAILS

Comment 15

The proposed Water Licence Modification include changes to the tonnages of tailings and waste rock. Waste rock increase by 27.6 Mt (47% increase) and tailings decreased by 7.4 Mt (37% decrease). The Tailings Management Plan and Waste Rock Management Plan will support effective review of mass balance changes in mine waste management associated with the requested Water Licence Modification:

The referenced documents below required for technical review appear not be included in the information Modification Package:

- WL SD-09 – Tailings Management Plan – referred to in the Modification Package,

- WL SD-08 – Waste Rock Management Plan – referred to in the Modification Package.

Information Request 15

CIRNAC recommends that the Applicant provide updated versions of the following documents to reflect the mass balance changes in mine waste management associated with the requested Water Licence Modification:

a) WL SD-09 – Tailings Management Plan – referred to in the Modification Package

b) WL SD-08 – Waste Rock Management Plan – referred to in the Modification Package

16.0 GOOSE PROPERTY WASTE AND WATER MANAGEMENT

Comment 16

With reference to Table 3.1-1 Back River Project Mine Plan Comparison and Table 2.3-1 Back River Project Current and Proposed Water Summary, CIRNAC would like to understand what is driving the increase in freshwater usage as outlined in the Water Licence Modification request. Further, with the intended increase in water use, the process plant throughput is indicated as reducing from 6,000 tpd to 3,000 – 4,000 tpd. This proposed increase in freshwater usage for the Goose Property from 468,000 m^3/yr to 882,450 m^3/yr (nearly a 2-fold increase) will likely result in a proportionate increase of the wastewater to be discharged to the environment.

Information Request 16

16.1 CIRNAC recommends that the Applicant provide rationale on the step increase in amount of water to be used.

16.2 CIRNAC recommends that the Applicant provide information on how the proportionate increase of the wastewater due to increased water use has been captured in the Water Management Plan.

17.0 GOOSE PROPERTY WASTE ROCK MANAGEMENT

Comment 17

With reference to Table 3.1-1 Back River Project Mine Plan - Comparison shows an increase in the waste rock from 59 Mt to 86 Mt an increase of approximately 27 Mt. It is not clear where and how the additional waste rock will be stored.

Information Request 17

CIRNAC recommends that the Applicant provide clear information to explain where and how this additional tonnage of waste rock will be placed and stored.

18.0 MASS BALANCE ASSESSMENT

Comment 18

Modification package appendix B Water Management Plan, sub appendix E PAGE 17 states:

"Based on the tailings properties, the slurry discharge will consist of 3,400 m^3/d of water and 2,500 m^3/d of solids. The volume of water entrained in tailings voids is a function of the void ratio and tailings density and is equal to 1,458 m^3/d based on the average tailings disposal rate".

The calculation by the Applicant appears inaccurate for a production rate of 3,000 t/day. According to the tailings phase relationship CIRNAC calculated; Volume of Solids = Mass of Solids divided by the Solids Specific Gravity assuming the unit weight of water is ~1t/m^3. (i.e. (3,000/2.88)*1 = 1,014m^3/day, not the "2,500 m^3/day" quoted). Is it possible that the quoted value of 2,500m^3/day refers to the total slurry volume = Mass of Solids divided by the Tailings Settled Dry Density (i.e. 3000/1.2 m^3/day) not just the solids volume? Applicant is encouraged to confirm the referenced calculated values.

Information Request 18

CIRNAC recommends that the Applicant confirm that the referenced values are accurate, and that appropriate values have been used in the site wide water and mass balance assessment.

19.0 RECALAMATION PLAN AND COST ESTIMATE

Comment 19

The October 13, 2020 Amendment cover letter indicates that the Applicant is working with Kitikmeot Inuit Association and CIRNAC on an updated Interim Closure and Reclamation Plan (ICRP) and cost estimate.

Information Request 19

CIRNAC recommends that the Applicant provide timing for when the updated ICRP and associated cost estimate will be available for review.

D. REFERENCES

Nunavut Waters and Nunavut Surface Rights Tribunal Act (2016)

Department of Crown-Indigenous Relations and Northern Affairs Act (2020)