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ENVIRONMENT AND CLIMATE CHANGE CANADA'S TECHNICAL REVIEW COMMENTS TO THE NUNAVUT WATER BOARD

RESPECTING THE BACK RIVER GOLD MINE PROJECT PROPOSED BY SABINA GOLD AND SILVER CORPORATION

April 4, 2018

Canada

Executive Summary

Sabina Gold & Silver Corporation (the Proponent) is proposing to construct, operate and decommission a conventional gold mine, the Back River Project (the Project), approximately 400 kilometers south of Cambridge Bay in the Kitikmeot region of Nunavut. The proposed Project includes four ore deposits at the Goose site, which will be mined using open pit and underground mining methods. The life of the Project, from mobilization to post closure, is expected to be 27 years.

Environment and Climate Change Canada (ECCC) has participated in all phases of the Water Licence review process thus far and has provided comments on the initial review-completeness check, including follow-up responses to the Proponent following the completeness check. ECCC is continuing its participation in this Water Licence review process by way of this submission to the Nunavut Water Board (NWB).

This submission summarizes the results of ECCC's technical review of the Type A Water Licence Application package provided by the Proponent. In Nunavut, ECCC provides specialist expert information or knowledge to the NWB in accordance with the expertise that ECCC has available, as required under Article 13 of the Nunavut Agreement. The comments and recommendations provided relate to ECCC's mandate in the context of the *Canadian Environmental Protection Act*, the pollution prevention provisions and Metal Mining Effluent Regulations of the *Fisheries Act.*

ECCC's comments and recommendations are related to water quality closure objectives, water quality for chloride, nitrite and arsenic in the receiving environment, total versus dissolved fractions of metals, seep surveys, closure monitoring, mitigation of in-water works, the Aquatic Effect Management Plan and Metal Leaching/Acid Rock Drainage of ore piles and at the Waste Rock Storage Area.

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1.0 List of Acronyms

AEMP – Aquatics Effects Management Plan
CCME – Canadian Council of the Ministers of the Environment
CEPA – *Canadian Environmental Protection Act*
ECCC – Environment and Climate Change Canada
EEM – Environmental Effects Monitoring
ICRP – Interim Closure and Reclamation Plan
MAD – Main Application Document
ML/ARD – Metal Leaching/Acid Rock Drainage
MLA – Marine Laydown Area
MMER – *Metal Mining Effluent Regulations*
NWB – Nunavut Water Board
SSWQO – Site-Specific Water Quality Objective
SWP – Saline Water Pond
TF – Tailings Facility
TIA – Tailings Impoundment Area
TSS – Total Suspended Solids
WL – Water Licence
WMP – Water Management Plan

2.0 Introduction

Sabina Gold & Silver Corporation (the Proponent) is proposing to construct, operate and decommission a gold mine, called the Back River Project (the Project), approximately 400 kilometers (km) south of Cambridge Bay in the Kitikmeot region of Nunavut. The proposed Project includes four ore deposits at the Goose site, which will be mined using open pit and underground mining methods. The four mining areas within the Goose Property include Umwelt, Llama, Goose Main and Echo. The project will also include a Marine Laydown Area (MLA) to offload and store sealifted supplies and fuel. An ice road will be used to connect the Goose and MLA properties. The life of the Project, from mobilization to post closure, is expected to be 27 years.

The Proponent submitted a Type A Water Licence (WL) application to the Nunavut Water Board (NWB) for the Project in October 2017. After an internal review by the NWB, the Type A WL application was sent out to parties for an initial review and completeness check on December 8, 2017. Environment and Climate Change Canada (ECCC) has participated in all phases of the review thus far and has provided comments on the initial review-completeness check, including follow-up responses to the Proponent following the completeness check. The technical review for the Type A WL application commenced February 23, 2018. ECCC is continuing its participation in this WL process by way of this final written submission to the NWB.

ECCC is responsible for leading the implementation of the Government of Canada's environmental agenda and is committed to contributing to the realization of sustainable development in Canada's North. Science plays a fundamental role in enabling ECCC to deliver on its mandate by informing environmental decision-making and regulations, and by supporting the delivery of services to Canadians. ECCC provides specialist expert information or knowledge to the NWB in accordance with the expertise that ECCC has available, as required under Article 13 of the Nunavut Agreement.

A brief summary of the legislation from which ECCC's mandate is derived is provided in Section 3.0. ECCC's comments on the outstanding issues are found in Section 4.0 and finally, a summary of ECCC's recommendations can be found in Section 5.0. Appendix 1 provides additional context on ECCC's legislation as well as other federal guidelines.

ECCC's comments and recommendations are related to water quality closure objectives, chloride, nitrite and arsenic in the receiving environment, total versus dissolved fractions of metals, seep surveys, closure monitoring, mitigation of in-water works, the Aquatic Effect Management Plan and Metal Leaching/Acid Rock Drainage from ore piles at the Waste Rock Storage Area.

3.0 ECCC's Mandate, Roles, and Responsibilities

The mandate of ECCC is determined by the statutes and regulations under the responsibility of the Minister of Environment and Climate Change. In delivering this mandate, ECCC is responsible for the development and implementation of policies, guidelines, codes of practice, inter-jurisdictional and international agreements, and related programs. ECCC's specialist advice is provided in the context of the *Canadian Environmental Protection Act* (CEPA) and the pollution prevention provisions of the *Fisheries Act*.

ECCC administers the pollution prevention provisions of the *Fisheries Act*, which prohibits the deposit of a deleterious substance into fish-bearing waters. ECCC also administers the *Metal Mining Effluent Regulations* (MMER), which apply to both new and existing metal mines and are used to regulate the deposit of mine effluent, waste rock, tailings, low-grade ore and overburden into natural waters frequented by fish.

ECCC also participates in the regulation of toxic chemicals and the development and implementation of environmental quality guidelines pursuant to CEPA. Additional information on ECCC's mandate is found in Appendix 1.

4.0 ECCC's Technical Review Comments

This technical report summarizes the results of ECCC's technical review of the WL application and additional information provided by the Proponent during the WL process thus far, such as information provided during telephone meetings held between ECCC and the Proponent on February 27th and March 14th 2018 to discuss the Aquatic Effects Management Plan (AEMP). The initial meeting (February 27th) was a planning meeting to address all the issues raised by ECCC in our review and identify what tasks were needed to resolve them. The second meeting was focused on study design and details. ECCC looks forward to further meetings with the Proponent. Meeting minutes for both these meetings are available on the NWB registry.

ECCC based its analysis on the principle that the Project should be constructed, operated, and decommissioned in a manner that ensures the highest level of environmental protection so that the well-being of Canadians is enhanced and the natural environment is conserved. To that end, ECCC has undertaken a science-based review of areas within ECCC's mandate with the aim of providing expert advice on the Proponent's assessment of the Project's potential effects and proposed mitigation measures. ECCC's technical review comments and recommendations are not to be interpreted as any type of acknowledgement, compliance, permission, approval, authorization, or release of liability related to any requirements to comply with federal or territorial statutes and regulations.

Subsection 36(3) of the federal *Fisheries Act*, administered by ECCC prohibits the discharge of deleterious substances to waters frequented by fish, or to a place where those substances might enter such waters. Therefore, the Proponent must ensure that, at all times during the Project, deleterious substances are prevented from entering into fish-bearing waters or any tributaries

4.1 Freshwater Environment

4.1.1 ECCC #1 – Closure Objectives and Criteria : Receiving Water Quality

Reference:

- 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.

Issue:

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:

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.

4.1.2 ECCC #2 - Saline Water Pond Closure Site Specific Water Quality Objective

References

- 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

Issue:

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(s):

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.

4.1.3 ECCC #3 – Nitrite

References:

- 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

Issue:

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 NO_3-N. Furthermore, Table 7-8 MAD Appendix E-2 shows maximum NO_2-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(s):

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.

4.1.4 ECCC #4 - Arsenic

References:

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

- MAD Appendix E-1 SSWQO Arsenic

Issue:

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:

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.

4.1.5 ECCC #5 - Dissolved versus Total Fractions of Metals

References

- 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

Issue:

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:

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

4.2 Monitoring, Mitigation and Management Plans

4.2.1 ECCC #6 – Seep Surveys

Reference:

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

Issue:

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:

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.

4.2.2 ECCC #7- Closure Monitoring

References:

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

Issue:

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:

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.

4.2.3 ECCC #8 - Mitigation for In-Water Works

References:

- 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

Issue:

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:

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.

4.2.4 ECCC #9 - Aquatics Effects Management Plan

References:

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

Issue:

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:

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.

4.2.5 ECCC #10 - Ore Stockpile Metal Leaching and Acid Rock Drainage

Reference:

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

Issue:

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:

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.

4.2.6 ECCC #11 – Waste Rock Storage Freeze Back

References:

- 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

Issue:

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(s):

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.

4.3 Errata

Reference:

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

Issue:

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:

ECCC recommends that the Proponent correct these errata.

5.0 Summary of Recommendations

5.1 Freshwater Environment

4.1.1 ECCC #1 – Closure Objectives and Criteria : Receiving Water Quality

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.

4.1.2 ECCC #2 – Saline Water Pond Closure Site Specific Water Quality Objective

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.

4.1.3 ECCC #3 – Nitrite

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.

4.1.4 ECCC #4 – Arsenic

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.

4.1.5 ECCC #5 – Dissolved versus Total Fractions of Metals

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

5.2 Monitoring, Mitigation and Management Plans

4.2.1 ECCC #6 – Seep Surveys

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.

4.2.2 ECCC #7 – Closure Monitoring

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.

4.2.3 ECCC #8 – Mitigation for In-Water Works

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.

4.2.4 ECCC #9 – Aquatics Effects Management Plan

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.

4.2.5 ECCC #10 – Ore Stockpile Metal Leaching and Acid Rock Drainage

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.

4.2.6 ECCC #11 – Waste Rock Storage Freeze Back

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.

APPENDIX 1: Relevant Legislation, Regulations and Guidelines

Introduction

The mandate of Environment and Climate Change Canada (ECCC) is determined by the statutes and regulations assigned to the federal Minister of Environment and Climate Change by Parliament or by the Government of Canada. Delivering this mandate requires ECCC, among other things, to develop and implement policies, guidelines, codes of practice, inter-jurisdictional and international agreements and related programs. The following lists specific legislation and national environmental policies and programs administered by ECCC that influence the content of Environmental Assessment (EA) submissions.

In EAs, ECCC generally carries out its responsibilities by providing recommendations, advice, and information within its mandate. This is provided to both the proponent and decision-makers and may be used in the development of potential conditions that may accompany an EA approval. This document is intended to summarize ECCC's mandate.

For purposes of reliability and accuracy and for interpreting and applying regulations or policy, it is recommended that the reader refer to the original document. Official versions of legislation can be found on the Department of Justice website (http://laws.justice.gc.ca/eng/).

Legislation

Department of the Environment Act

General responsibility for environmental management and protection is attributed to ECCC, through the Minister, under the *Department of the Environment Act* (DOE Act). This responsibility extends to and includes all matters over which Parliament has jurisdiction, which matters have not, by law, been assigned to any other department, board, or agency of the Government of Canada relating to:

- the preservation and enhancement of the quality of the natural environment (e.g., water, air, and soil);
- renewable resources including migratory birds and other non-domestic flora and fauna;
- water;
- meteorology; and
- co-ordination of policies and programs respecting preservation and enhancement of the quality of the natural environment.

The DOE Act requires the Minister to advise heads of federal departments, boards and agencies on matters pertaining to the preservation and enhancement of the quality of the natural environment.

Canadian Environmental Protection Act

The *Canadian Environmental Protection Act* (CEPA) is aimed at preventing pollution and protecting the environment and human health while contributing to sustainable development. CEPA shifts the focus away from managing pollution (after it has been created) to preventing pollution. CEPA provides the federal government with tools to protect the environment and human health, establishes strict deadlines for controlling certain toxic substances, and requires the virtual elimination of toxic substances, which are bioaccumulative, persistent and result primarily from human activity.

One of CEPA's major thrusts is the prevention and management of risks posed by harmful substances. CEPA manages impacts of environmental emergencies, vehicle engines and equipment emissions, fuels, hazardous wastes, disposal at sea, and other sources of pollution. Two CEPA sections, Environmental Emergencies and the National Pollutant Release Inventory Reporting Requirements, are described below.

Environmental Emergencies

Part 8 of CEPA related to environmental emergencies (sections 193 to 205) provides various authorities to address the prevention of, preparedness for, response to, and recovery from environmental emergencies caused by uncontrolled, unplanned or accidental releases and to reduce any foreseeable likelihood of releases of toxic or other hazardous substances listed in Schedule 1 of the Environmental Emergency (E2) Regulations. ECCC provides advice regarding emergency plans for projects it reviews to ensure they are consistent with the requirements of CEPA.

Fisheries Act - Pollution Prevention Provisions

ECCC administers Section 36(3) and (4) of the *Fisheries Act*, the purpose of which is to prevent pollution by prohibiting the deposit of harmful substances into waters frequented by fish, unless authorized by regulations under the Act or other federal legislation. The "general prohibition" in this section states, in part, that no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish, unless authorized by, and deposited in accordance with, regulations under the *Fisheries Act* or other federal legislation.

Meeting the requirements of the *Fisheries Act* is mandatory, irrespective of any provincial or territorial regulatory or permitting system. The release of substances with the potential to be "deleterious," as identified in Subsection 34(1) of the *Fisheries Act*, from the construction, operation, reclamation or decommissioning stages of the project in any waters frequented by fish, may constitute violations of the *Fisheries Act*.

Metal Mining Effluent Regulations

Guidelines for the Assessment of Alternatives for Mine Waste Disposal

Using a natural water body frequented by fish for mine waste disposal requires an amendment to the *Metal Mining Effluent Regulations* (MMER), which is a federal legislative action. The MMER, developed under subsections 34(2), 36(5) and 38(9) of the *Fisheries Act* and enacted in 2002, are used to regulate the deposit of mine effluent, waste rock, tailings, low-grade ore and overburden into natural waters frequented by fish. Environment and Climate Change Canada administers MMER, which apply to both new and existing metal mines. MMER are available at http://laws-lois.justice.gc.ca/eng/regulations/SOR-2002-222/.

Schedule 2 of the MMER lists water bodies designated as tailings impoundment areas (TIAs). A project proponent seeking to use a natural water body as a TIA must conduct an assessment of alternatives for mine waste disposal. The alternatives assessment must objectively and rigorously assess all feasible options for mine waste disposal. The project proponent must demonstrate through the EA and the alternatives assessment that the proposed use of the water body as a TIA is the most appropriate option for mine waste disposal from environmental, technical and socio-economic perspectives. It should also be demonstrated that the option offers the greatest overall benefit to current and future generations of Canadians, as per the Cabinet Direction on Regulatory Management. Part 2 of the guidelines describes the requirements of an assessment of alternatives.

It is strongly recommended that this assessment be undertaken during the EA to streamline the overall regulatory review process and minimize the time required to proceed with the MMER amendment process. Generally speaking, at least one of these alternatives should not impact a natural water body that is frequented by fish. It is important to note that a decision by the proponent to conduct the alternatives assessment after the EA has been completed could more than double the target timeline that has been established for the processing of Schedule 2 amendments.

Environmental Effects Monitoring

The MMER regulate the quality of effluent discharged by mines producing base metals, precious metals, iron ore, uranium, and other metals. The MMER include limits on pH and concentrations of arsenic, copper, cyanide, lead, nickel, zinc, total suspended solids and radium 226. The Regulations also require that effluent be non-acutely lethal to rainbow trout. Mines are required to conduct Environmental Effects Monitoring (EEM) to evaluate the effects of mining effluent on the aquatic environment, specifically fish, fish habitat, and the use of fisheries resources.

EEM is a science-based performance measurement tool used to evaluate the adequacy of the MMER in protecting fish, fish habitats and the use of fisheries resources. The metal mining industry is required to meet their regulatory requirements, which include conducting:

- water quality studies
- effluent characterization studies
- sublethal toxicity testing
- biological monitoring studies in the receiving environment

These biological monitoring studies and chemical/toxicological analyses are conducted to assess and investigate the effects caused by their effluent discharges.