Environmental Protection Operations Directorate
Prairie & Northern Region
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Yellowknife, NT X1A 2P7

ECCC File: 6100 000 009/008
NWB File: 2AM-LUP1520

December 13, 2019

via email at: licensing@nwb-oen.ca

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

Dear Richard Dwyer:

RE: 2AM-LUP1520 – Lupin Mine Incorporated – Lupin Mine – Type A Water Licence

Environment and Climate Change Canada (ECCC) has reviewed the information submitted to Nunavut Water Board (NWB) regarding the above-mentioned water licence application. You will find our Final Written Submission, attached.

ECCC's specialist advice is based on our mandate pursuant to the *Canadian Environmental Protection Act* and the pollution prevention provisions of the *Fisheries Act*.

If you need more information, please contact Eva Walker at (867) 669-4744 or eva.walker@canada.ca.

Sincerely,

A McLandress

Andrea McLandress
Regional Director

Attachment:

cc: John Olyslager, Acting Head, Environmental Assessment North (NT and NU)
Eva Walker, Environmental Assessment Coordinator

Environment and Climate Change Canada
Environnement et Changement climatique Canada

Lupin Mine
Type A Water License Permit Application

Final written submission by Environment and Climate Change Canada

December 16, 2019

Canada

Executive Summary

Lupin Mine Incorporated ('the proponent') has applied for a Type A Water Licence (WL) for the Lupin Mine ('the project'). The Lupin Mine is located in the Kitikmeot Region, 285 km southeast of Kugluktuk in Nunavut, approximately 40 km north of the border of the Northwest Territories. The Lupin Mine is an underground gold mine in operation from 1982 to 2005, when it went into Care and Maintenance.

The mine is currently in the active closure period (closure phase), the 2.5 year period during which active on-site reclamation work is to be completed (2019 to 2021). In 2022 the mine will enter into the passive closure period (post-closure phase), which runs for five years following the completion of active reclamation work. The proponent applied for closed mine status under the *Metal and Diamond Mining Effluent Regulation* (MDMER) in January 2019, and should become a recognized closed mine in 2022.

ECCC has participated in the Type A Water Licence process, providing specialist advice based to the Nunavut Water Board (NWB or the Board) on areas within our mandate. Specifically, advice on the pollution prevention provisions of the *Fisheries Act* (FA). ECCC's final written submission addresses our April 29, 2019 technical review comments and the proponent's May 13, 2019 responses. The proponent subsequently provided additional information both and after during the June 6-7, 2019 technical meeting.

Our final submission addresses the following:

- Thermal modeling results from the climate change modeling, along with recommendations to consider the results for all emission scenarios during the development of contingency plans for post closure;
- The approach for the Tailings Containment Area (TCA) closure and monitoring;
- Monitoring of the perimeter dam's stability and seepage;
- The criteria, duration and timing of the post closure monitoring plans; and
- Recommendations for the draft water licence related to the MDMER and recognized closed mine status.

Abbreviations

AES	Average Emissions Scenario
CEPA	*Canadian Environmental Protection Act*
CIRNAC	Crown Indigenous Relations and Northern Affairs Canada
ECCC	Environment and Climate Change Canada
FA	*Fisheries Act*
FCRP	Final Closure and Reclamation Plan
HES	High Emission Scenario
HHERA	Human Health and Ecological Risk Assessment
LMI	Lupin Mines Incorporated
LES	Low Emissions Scenario
MAA	Mean Annual Temperature
MBCA	*Migratory Birds Convention Act*
MDMER	*Metal and Diamond Mining Effluent Regulations*
NWB	Nunavut Water Board
QA/QC	Quality Assurance/Quality Control
SARA	*Species at Risk Act*
TC	Technical Comment
TCA	Tailings Containment Area
TSS	Total Suspended Solids
WL	Water Licence

Table of Contents

1.0 Introduction

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The mine is currently in the active closure period (closure phase), the 2.5 year period during which active on-site reclamation work is to be completed (2019 to 2021). In 2022 the mine will enter into the passive closure period (post closure phase), which runs for five years following the completion of active reclamation work. The proponent applied for closed mine status under the *Metal and Diamond Mining Effluent Regulation* (MDMER) in January 2019, and should become a recognized closed mine in 2022.

ECCC has participated in the Type A Water Licence process, providing specialist advice to the Nunavut Water Board (NWB or the Board) based on areas within our mandate. Specifically, advice on the pollution prevention provisions of the *Fisheries Act* (FA). ECCC's final written submission addresses our April 29, 2019 technical review comments, and the proponents May 13, 2019 responses. The proponent subsequently provided additional information both and after during the June 6-7, 2019 technical meeting.

Our submission addresses the following:

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2.0 Environment and Climate Change Canada's mandate, roles and responsibilities

ECCC's mandate determined by the statutes and regulations under the responsibility of the Minister of Environment and Climate Change, covers matters such as the preservation and enhancement of the quality of the natural environment (including water, air and soil quality and the coordination of the relevant policies and programs of the Government of Canada), renewable resources (including migratory birds and other non-domestic flora and fauna), meteorology and the enforcement of rules and regulations. ECCC's specialist advice is provided in the context of the *Canadian Environmental Protection Act* (CEPA) 1999, the pollution prevention provisions of the *Fisheries Act* (FA), *Species at Risk Act* (SARA) and the *Migratory Birds Convention Act* (MBCA).

ECCC administers the pollution prevention provisions of the FA, which prohibits the deposit of a deleterious substance into fish-bearing waters. ECCC also participates in the regulation of toxic chemicals and the development and implementation of environmental quality guidelines pursuant to CEPA 1999.

ECCC is responsible for protecting and conserving migratory bird populations and individuals under the MBCA. ECCC also administers SARA in cooperation with Fisheries and Oceans Canada (DFO) and the Parks Canada Agency (PCA) to prevent wildlife species from becoming extirpated or extinct, to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity, and to manage species of special concern to prevent them from becoming threatened, endangered or extirpated.

Additional information on ECCC's mandate can be found at: https://www.canada.ca/en/environment-climate-change/corporate/mandate.html

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3.0 Environment and Climate Change Canada's Technical Review Comments

This final written submission summarizes the results of ECCC's technical review of information provided to date. This information includes:

- ECCC's technical review comments, submitted to the NWB April 29, 2019;
- proponent's responses to ECCC and Crown Indigenous Relations and Northern Affairs Canada (CIRNAC)'s technical review, provided May 13;
- the NWB Technical Meeting on June 6 to 7, 2019; and
- the proponent's responses to commitments from the technical meeting.

The following sections outline the current status of ECCC's outstanding recommendations, identifies issues that have been resolved, issues which ECCC deems resolved pending further actions committed to by the proponent, and issues that remain outstanding.

3.1 Technical Comment Status

The following recommendations were made in the technical comment submission to the NWB on April 29, 2019.

Reference	**Recommendation**	**Status**
ECCC #1. Climate change modeling - Lupin Mine Site – Final Closure and Reclamation Plan; Section 2.1.2, p. 2-3	ECCC recommends that the proponent provide further information on the source, rationale and details of the climate change information provided in the Final Closure and Reclamation Plan. Additionally, ECCC recommends that the proponent provide relevant climate projections for the region to end of century from a range of emission scenarios (low to high future forcing) from multiple climate models to reflect uncertainty in future climate projections.	Resolved with commitment
ECCC #2. Tailings closure approach and monitoring - Lupin Mine Site Final Closure and Reclamation Plan - Closure Plan for Tailings Containment Area	ECCC recommends that the proponent conduct field investigations during the Closure Phase to obtain updated data on the behaviour and effectiveness of the tailings saturated cover design.	Resolved

Reference	Recommendation	Status
ECCC#3 Perimeter Dams - Lupin Mine Site Final Closure and Reclamation Plan - Closure Plan for Tailings Containment Area	ECCC recommends that the proponent investigate and provide a report on the stability and potential for seepage for perimeter dams given the likelihood of the frozen cores thawing due to climate change. ECCC recommends that the proponent consider potential changes to the physical configuration of the dams in the future as a result of climate change. ECCC also recommends that a report of the survey of the frozen cores of the dams be provided to the Board, and that it include discussion of any implications for closure.	Partly resolved
ECCC#4 Duration of Permanent Monitoring and Timing Clarification - Lupin Mine Site Final Closure and Reclamation Plan, - Impoundment and Containment Systems; Section 5.0 Monitoring Tables 18 and 20 - Lupin Mine Site Final Closure and Reclamation Plan - Interim Closure and Reclamation Plan	ECCC recommends that the proponent provides clarification of the post-closure phase monitoring activities and duration, and identifies the thresholds for water quality and tailings cover performance that would trigger moving to reduced monitoring frequency or intensity. ECCC recommends that monitoring of the TCA cover and water be done over a period that is sufficient to demonstrate physical and chemical stability and acceptable quality for the long term.	Partly Resolved
ECCC #5 One Meter Esker Cover - Lupin Mine Site Final Closure and Reclamation Plan	ECCC recommends that the proponent demonstrates how the 1 m cover will be adequate to prevent ARD/ML activities within the tailings after they have been covered and post closure (i.e. in perpetuity) under expected climate conditions. ECCC also recommends that the proponent outline the risks/uncertainty associated with the use of a permeable cover for the tailings materials, and what consideration has been given to physical isolation of the tailings with an impermeable cover	Resolved
ECCC #6 Waste rock, tailings and acid rock drainage/metal leaching - Lupin Mine Site Final Closure and Reclamation Plan Section 4.3.2.1 Acid Rock Drainage and Metal Leaching; Section 4.3.2.3 Contaminated Soils; 4.3.2.7 Waste Rock	ECCC recommends that the proponent provide a rationale for the cover depth selected, and identify options for installing a thicker cover layer that could isolate the waste rock from the active layer and effectively prevent further metal leaching from the waste rock. ECCC also recommends that the proponent identify monitoring to be done in the closure and post closure phases that will identify the extent and pathways of any residual ARD/ML from the waste rock. ECCC recommends the proponent provide further options for mitigation measures, such as consolidation of ARD/ML materials and capping, or surface water management and	Resolved with commitment

Reference	Recommendation	Status
- ARD/ML Assessment of Waste Rock at Lupin Mine	treatment, to prevent ARD/ML in passive runoff, seepage or other forms of drainage going into water bodies frequented by fish.	
ECCC #7 Asbestoses Disposal - Lupin Mine Site Final Closure and Reclamation Plan Section 2.1.7 Environmental Site Assessment; Table 14; Section 4.3.2.9 Buildings and Equipment; 4.3.2.11 Landfills and Other Waste Disposal Areas Lupin Mine Site, Nunavut, Canada Waste Management Plan (Solid and Hazardous) (Care and Maintenance)	ECCC recommends that the proponent consider disposal of the asbestos containing materials underground or provide a rationale why this is not feasible. If ACM is to be disposed of in one of the landfills, ECCC recommends that the proponent identify how the above-mentioned guidelines can be incorporated into the disposal plan, and that the proponent provide details regarding how the ACM will be packaged, and the proposed final cover depth.	Resolved

3.2 ECCC 1 – Climate Change Modeling

Reference(s)

- Lupin Mine Site – Final Closure and Reclamation Plan; Section 2.1.2, p. 2-3.
- 2 AM-LUP Technical Meeting Commitment Number 13 Response – Lupin Mine Tailings Containment Area Dams Thermal Modelling Results (Dated October 15, 2019).
- Bush, E. and Lemmen, D.S., editors (2019): Canada's Changing Climate Report; Government of Canada, Ottawa, ON. 444 p.
- Flato, G., Gillett, N., Arora, V., Cannon, A. and Anstey, J. (2019): Modelling Future Climate Change; Chapter 3 in Canada's Changing Climate Report, (ed.) E. Bush and D.S. Lemmen; Government of Canada, Ottawa, Ontario, p. 74–111.

ECCC's Comment

The proponent indicates that the thermal modeling results they provided for the end of the century Low Emission Scenario (LES) or for the Average Emission Scenario (AES) are more realistic than the High Emission Scenario (HES) result:

> *"The LES scenario uses a MAAT [*mean annual air temperature*] increase of 2.2°C from 1995 to 2100. CCCR, 2019, states that the warming trend observed in Canada from 1948 to 1996 was 1.2°C, representing an average warming rate of 0.025°/yr. Accordingly, the LES is considered to be more realistic than the HES."* p. 6

and

> "*The thermal modelling conducted by Stantec found that the LES and AES did not result in long-term progressive permafrost thaw within the Lupin Mine TCA dams. The LES and AES are considered to be more realistic climate warming emission scenarios compared to the HES, based on reported observations of temperature changes in the latter half of the 20th century in Canada*." p. 10

The similarity in the warming rates between the observational record and that of the LES cannot be used as a basis to conclude that the LES is more realistic than higher emission scenarios. The rate of warming observed from the past cannot be extrapolated or used as a guide to gauge the range of potential future climate change because:

> 1) the observed or historic rates of warming and trends do not necessarily represent regional/local climate response to global warming, because other factors, such as natural variations of the climate, may come into play; and
>
> 2) past greenhouse gases emissions may not represent potential future emissions and related changes in the climate system.

Climate projections from multiple climate models for a range of plausible future emission scenarios (low to high future forcing) are required to reflect uncertainty in future climate projections, and to ensure that the range of potential future climate change is considered. It is not possible to assign a likelihood for a particular future forcing scenario. The scenarios are not predictions. Instead, they represent possible future conditions based on global scale socio-economic considerations. The low emission (RCP2.6) scenario is consistent with limiting global temperature increase to roughly 2˚C above the pre-industrial value. The lower emission scenario requires rapid cuts in human emissions globally (Flato et al., 2019). Scenarios with limited warming will only occur if global carbon emissions are reduced to near zero early in the second half of the current century, and if emissions of other greenhouse gases are reduced substantially (Bush and Lemmen, 2019).

The projections used by the proponent for the HES show a mean annual air temperature increase of 7.8˚C by 2081 to 2100. The proponent's subsequent thermal modeling suggested a possible thaw

depth of 14 m by 2081 to 2100. For the LES, the proponent indicates that projected temperature may increase by 2.1˚C (by 2081 to 2100). This resulted in a modelled thaw depth of 3 m.

ECCC Recommendations

ECCC recommends that, given projection uncertainties described, both LES and HES along with the AES should be considered for the Lupin Mine site. All implications for closure should be considered, and contingency plans based on these scenarios should be developed.

ECCC recommends that the proponent consider the high emission scenarios along with the low emission scenario for thermal modelling, and develop contingency plans for post closure of the Lupin mine site that considers both possible scenarios.

3.3 ECCC 2 and ECCC5 – Tailings Closure Approach and Monitoring

Reference(s)

- Responses to ECCC-TC2 and ECCC-TC5 in the 2019 Application for Water Licence Renewal/Amendment, and Final Closure and Reclamation Plan Technical Comment Responses May 17, 2019.
- Stantec Technical Memo 2AM-LUP1520 Technical Meeting Commitment Number 10 Response – Cover Data from Lupin Mine Tailings Containment Area. Oct. 15, 2019.
- Lupin Mine Site Final Closure and Reclamation Plan, July 2018. Golder Associates Section 4.3.2.8 Tailings Impoundment and Containment Systems; Section 6.1 Post Remediation Site Conditions.
- Closure Plan for Tailings Containment Area, January 2005. I. Holubec Consulting Inc. Section 8.

ECCC's Comment

ECCC's Technical Comment Submission noted that the proposed Tailings Containment Area (TCA) monitoring in the post-closure phase will not pick up any changes below the cover surface, because only visual inspections are proposed for the post closure phase. ECCC's Technical Comments also noted that conducting an evaluation of the tailings areas that have been covered the longest would provide a supporting indication of performance of the proposed 1 m esker cover and saturated cover design.

ECCC recommended that the proponent conduct field investigations during the closure phase to obtain updated data on the behaviour and effectiveness of the tailings saturated cover design. The proponent committed to excavate a test pit in Cell 1 to conduct a visual inspection of the cover and evaluate its performance. The test pit data would supplement data from the thermistors and moisture meters in place. The proponent also stated that transducers would also be installed within existing stand pipes to collect data on water level variations within the cover for performance evaluation purposes. Field

investigations were completed in summer 2019 and a report submitted Oct.15, 2019. Two test pits were excavated, in Cell 1 and Cell 2, and standpipe water quality was sampled. The engineer concluded:

> "*The test pit observations and standpipe water level measurements indicate that there is a saturated layer of cover above the tailings in the cells that were studied. Oxidized tailings were not observed within the test pits. In general, the water quality results from 2002 and 2019 are comparable. Based on these observations and measurements, the cover appears to be functioning as permitted*."

Monitoring in the post-closure phase (passive closure period) will need to be sufficiently robust to identify any changes to the performance of the tailings cover system. The current proposal is for monitoring during the passive closure period that includes monthly site inspections during the open water period for 5 years. Thermistors and soil moisture and temperature probes will be used to monitor the tailings cover during this phase. The proponent proposes gradually decreasing the frequency of site inspections and or specific monitoring requirements, based on test results confirming predictions of chemical and physical stability. If results are not as predicted, then additional monitoring and/or remediation works will be undertaken by the proponent.

ECCC considers the request for field investigations to be resolved.

ECCC Recommendation:

ECCC recommends that the details of the TCA monitoring should be included in the post-closure monitoring plan that is to be submitted within one year of licence approval by the Minister.

3.4 ECCC 3 – Perimeter Dams

Reference(s)

- Response to ECCC-TC3 in the 2019 Application for Water Licence Renewal/Amendment, and Final Closure and Reclamation Plan Technical Comment Responses May 17, 2019.
- Stantec Technical Memo dated Oct. 15, 2019; 2AM-LUP1520 Technical Meeting Commitment Number 11 Response – Geophysical Survey Lupin Mine Tailings Containment Area Dams.
- Stantec Technical Memo dated Nov. 13, 2019; 2 AM-LUP Technical Meeting Commitment Number 12 Response – Risk Assessment on Two Dams in the Lupin Tailings Containment Area.
- Stantec Technical Memo dated Nov. 14, 2019; 2 AM-LUP Technical Meeting Commitment Number 6 Response – Geotechnical Review on the Long-Term Stability of TCA Dams.
- Lupin Mine Site Final Closure and Reclamation Plan, July 2018. Golder Associates Section 4.3.2.8.
- Closure Plan for Tailings Containment Area, January 2005. Holubec Consulting Inc. Sections 5.0 and 7.0.

ECCC's Comment

ECCC' Technical Comment Submission had recommended that the proponent provide an assessment on the stability and potential for seepage for perimeter dams, because of the likelihood of the frozen cores thawing due to climate change. ECCC and CIRNAC requested that a report of the survey of the frozen cores of the dams be provided and that it include discussion of any implications for closure.

The proponent provided the results of a one-time geophysical survey conducted in August 2019 for dam 3D and dam 4 to confirm the condition of frozen cores.

The risk assessment report concluded that:

> *"Based on the existing instrumentation and survey data, the dams have a continuous frozen core and are deemed to be performing as licensed. Further evaluation indicated that in the event of the HES scenario where the frozen cores would thaw due to climate change, the dams will remain geotechnically stable. Based on previous work completed (Holubec 2006 and EcoMetrix 2006) as part of the TCA closure plan, the potential water quality impacts to the downstream receiving environment due to TCA seepage was generally estimated to be low, as the predicted increase in concentration in the discharge is estimated to be very low based on small unsaturated areas and the overall runoff dilution. The overall risks to Dam 3D and 4 associated with the HES thermal model are deemed low, and in turn, the risks associated with the LES thermal model are deemed very low."*

Further analysis was done on slope stability and necessary actions were identified for dam M and dam K. The remainder of the dams at the mine site were evaluated and determined to be stable.

The Final Closure and Reclamation Plan (FCRP) notes that as a part of closure activities the QA/QC program will include "*Inspection and monitoring of the existing instruments to ensure the tailings dams are performing according to the Final TCA ARP*". This would include thermistors in the dams, as listed in Table 20 of the FCRP. The proponent is currently proposing a five-year passive closure period monitoring program. The proponent will submit a post-closure monitoring plan, which would provide details of existing and future instrumentation monitoring.

ECCC notes that the proponent has responded to the commitments that they made during the technical meeting and has provided to ECCC the required information about the dams.

ECCC Recommendation:

ECCC recommends that

- The time frame for ongoing monitoring of the dams extend beyond the 5 year passive closure period, and reflect the full duration of monitoring for the site; and
- Dam stability monitoring be included in the post closure monitoring plan.

3.5 ECCC 4 – Duration of Permanent Monitoring and Timing Clarification

Reference(s)

- Response to ECCC-TC4 in the 2019 Application for Water Licence Renewal/Amendment and Final Closure and Reclamation Plan Technical Comment Responses May 17, 2019.
- Golder Technical Memorandum submitted Nov. 15, 2019 Draft Water Licence Framework Rev0.
- Lupin Mine Site Final Closure and Reclamation Plan, July 2018. Golder Associates Section 4.3.2.8 Tailings Impoundment and Containment Systems; Section 5.0 Monitoring Tables 18 and 20,
- Lupin Mine Site Final Closure and Reclamation Plan, July 2018. Golder Associates. Appendix G Reclaim Model.
- Interim Closure and Reclamation Plan Oct. 2017, Section 7 Closure Monitoring Plan.

ECCC's Comment

ECCC and other interveners identified the need for monitoring of sufficient duration to confirm effectiveness of the remediation measures *before* the monitoring program ends. The closure plans and the Draft Water Licence Framework (Schedule J Table 1) show the passive closure stage monitoring ending after 5 years (2026). A longer duration of monitoring is needed to account for any lag time in geochemical processes which affect water quality or for any lag time in thermal conditions. A longer duration of monitoring may allow the proponent to gather sufficient monitoring information to indicate the successful establishment of stable conditions. Thresholds may be identified that allow monitoring to be done on a reduced frequency during the post-closure period.

In their response to ECCC-TC4 regarding monitoring duration, the proponent noted that:

> "*LMI proposes to submit within one year of approval of the renewed/amended licence a Post Closure Monitoring Plan that incorporates where appropriate, regulatory review comments, ongoing field work, HHERA results and any other direction from the NWB*."

ECCC concurs with development of this plan, and notes that it should extend beyond the previously proposed five year passive closure period.

The approach outlined in the October 2017 Interim Closure and Reclamation Plan (ICRP) presented a longer-term monitoring process than what was outlined in the FCRP, which would form a reasonable basis for making decisions that are based on data. The ICRP states that:

> *"The postclosure monitoring will provide the means of assessing when the stated goal of the reclamation measures has been reached…This closure phase of monitoring is anticipated to last for 10 years after site closure and reclamation and every three years after that to the 25 year mark."* and that "*post-closure monitoring activities are separated into two phases; Phase 1*

– Annual Monitoring (years 1 through 10) and Phase 2 – Decreasing Frequency with monitoring during years 12, 15, 21 and 24 for a total of 14 years of monitoring over a 25 year period."

With respect to the TCA, ongoing physical and chemical monitoring of the cover conditions and performance should continue until there is substantiated confidence that long-term stability and quality of the saturated tailings has been accomplished. The duration of monitoring would require that it be long enough to demonstrate that the performance of closure measures is as predicted.

ECCC Recommendation:

ECCC recommends that:

- The proponent include thresholds for water quality and tailings cover performance that would trigger moving to reduced monitoring frequency or intensity in the proposed post-closure monitoring plan.
- Monitoring of the TCA cover and water quality be done over a duration that is sufficient to demonstrate physical and chemical stability and acceptable quality for the long term.

3.6 ECCC 6 – Waste Rock Tailings and Acid Rock Drainage/Metal Leaching

Reference(s)

- Response to ECCC-TC6 in the 2019 Application for Water Licence Renewal/Amendment, and Final Closure and Reclamation Plan Technical Comment Responses May 17, 2019.
- Golder Technical Memorandum dated Oct. 15, 2019; Conceptual Design for the Waste Rock "Dome" at Lupin Mine.
- Stantec Report Dated Aug. 14, 2019; 2AM-LUP1520 Technical Meeting Commitment Number 3 and 4 Responses – Waste Rock Information from Lupin Mine Tailings Containment Area.
- Golder Report dated Oct. 2019; Human Health and Ecological Risk Assessment Lupin Mine, Nunavut.
- Lupin Mine Site Final Closure and Reclamation Plan, July 2018. Golder Associates Section 4.3.2.1 Acid Rock Drainage and Metal Leaching; Section 4.3.2.3 Contaminated Soils; 4.3.2.7 Waste Rock.
- URS (URS Corporation). 2005. ARD/ML Assessment of Waste Rock at Lupin Mine; February 2005.

ECCC's Comment

The proponent has provided a conceptual design document for the consolidation and covering of the waste rock into a "dome" of about 23.2 ha at the mill and camp area. As noted in the Golder Technical Memo, "*The mine/mill/camp/airstrip complex is located on a local topographic high. As illustrated in*

Figure 1, runoff and seepage from the complex currently reports to multiple sub-watersheds as follows: -Upper Sewage Lake; Boot Lake; East lake & Contwoyto Lake." Permafrost underlies the site, and precipitation tends to flow laterally (across the waste rock) and emerge as toe seeps from existing waste rock piles.

The consolidated rock dome will be capped with a 1.0 m thick layer of esker sand and gravel to limit infiltration and seepage and to reduce the exposed surface area of the waste rock. Expected seepage and runoff was predicted for under current climate conditions and for predicted 2081 to 2100 intermediate climate conditions. The predicted seepage volume as a percentage of annual precipitation was 15.8% for current conditions and 25% in the 2081 to 2100 conditions.

An updated Human Health and Ecological Risk Assessment (HHERA) was done to evaluate potential effects associated with the "dome's" seepage. Exposure pathways were identified for contaminants of potential concern coming from waste rock. The report concluded that "*The ARD-impacted seepage may result in long-term impacts to surface water quality in receiving surface water bodies (Boot Lake, East Lake and Lower Sewage Lake). Impacts to surface water quality in Contwoyto Lake are expected to be negligible*". The analysis was done using 50th percentile mass loading inputs from the waste rock, and identified cobalt, copper and pH as the potential contaminants of concern in Boot Lake, East Lake, and Lower Sewage Lake. The HHERA recommended that water quality monitoring be conducted in Boot Lake, East Lake, and Lower Sewage Lake, to assess current conditions, to subsequently track behaviour in comparison to predictions, and to identify any issues (Section 6.3).

ECCC notes that the HHERA analysis uses only the median mass loading inputs; therefore the analysis may not be conservative. Monitoring should to be done to confirm predicted contaminant concentrations and duration of peak concentrations / loadings, as well as to indicate the need for any remedial measures.

ECCC's Recommendation:

ECCC recommends that:

- The proponent sample the adjacent lakes – East, Boot and Lower Sewage –prior to waste rock dome construction and continue periodic monitoring for a full suite of metals and pH to confirm the predicted seepage quality and behavior.
- The Proponent monitor water quality of visible seems or flows existing the waste rock pile.
- The proponent identify thresholds that would require remedial measures for seepage quality in monitored flow or seeps.

3.7 ECCC 7 – Asbestos Disposal

Reference(s)

- Response to ECCC-TC7 in the 2019 Application for Water Licence Renewal/Amendment, and Final Closure and Reclamation Plan Technical Comment Responses May 17, 2019.
- Lupin Mine Site Final Closure and Reclamation Plan, July 2018. Golder Associates Section 2.1.7; Table 14; Section 4.3.2.9; Section 4.3.2.11.

ECCC's Comment

The proponent has indicated that they will be following appropriate guidelines for the disposal of asbestos containing materials.

ECCC considers this issue resolved.

3.8 ECCC 8 – Draft Water Licence

Reference(s)

- Golder Technical Memorandum submitted Nov. 15, 2019 Draft Water Licence Framework Rev0.

ECCC's Comment

The proponent has provided a draft Water Licence Framework which includes proposed effluent quality limits (Section E.5), and a list of definitions which includes the "Recognized Closed Mine" under the MDMER. ECCC notes that:

1. Schedule J Table 1 of the draft Framework identifies the anticipated discharge timing for each phase. During the Closure Phase (2020 to 2021) there will be discharge in 2020 from the Pond 2 station (LUP-10), which is the regulated discharge point for the water licence and the MDMER. By the post-closure phase (2022 to 2026) there will be passive discharge during open water, assuming that the spillway is in place.

2. Effluent quality limits proposed in Section E.5 are equal to or less than the current MDMER discharge limits. Moreover, these discharge limits will be changing as of June 1, 2021. At that time, MDMER limits for arsenic will be reduced to 0.3 mg/L average or 0.6 mg/L maximum grab. Similarly, limits for cyanide will drop to 0.5mg/L average and 1.0 mg/L maximum grab concentration. A limit for un-ionized ammonia will also come into effect; this limit will be 0.5 mg/L average or 1.0 mg/L maximum grab concentration. Until the proponent meets the requirements to become a Recognized Closed Mine under Section 32(2) of the MDMER, which takes at least 3 years to reach, there may be discharges from the TCA which could be subject to these new limits.

3. With respect to the definition of “Recognized Closed Mine” in Schedule A Definitions, this is defined by the proponent as being found under Section 1 of the MDMER. This definition was repealed in June 2018 and it may be more appropriate to refer to a Recognized Closed Mine as meeting the conditions of Section 32 of the MDMER.

ECCC notes that any effluent discharges from the TCA will be subject to the MDMER until Recognised Closed Mine status is attained. During this time, any water in the TCA will have to be retained or discharged in compliance with the MDMER. ECCC reminds the proponent that when the closed mine status is attained any seepage or discharges from the site must comply with the general prohibitions of subsection 36(3) of the *Fisheries Act.* .

ECCC’s Recommendation

ECCC recommends

- The proponent note the proposed effluent quality criteria under Schedule 4 that come into force June 1, 2021 in the event that there will be discharges after June 1, 2021.
- The proponent update the definition of “Recognized Closed Mine”.

4.0 Acknowledgements

ECCC would like to thank the NWB for this opportunity to provide input to the review process for the Lupin Mine Project Type A Water Licence renewal application process.

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