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

Water Resources Division
Resource Management Directorate
Nunavut Regional Office
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Your file - Votre référence
2AM-MEL1631

Our file - Notre référence
GCDocs#97736161

September 17, 2021

Richard Dwyer
Manager of Licensing
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU, X0B 1J0
Sent via e-mail: licensing@nwb-oen.ca

Re: Crown-Indigenous Relations and Northern Affairs Canada's (CIRNAC) Review of the Meliadine Mine Water Quality Management Optimization Plan for Type "A" Water Licence No. 2AM-MEL1631

Dear Mr. Dwyer,

Thank you for the August 20, 2021 invitation to review the Meliadine Mine Water Quality Management Optimization Plan (WQ-MOP), submitted by Agnico Eagle Mines Limited, for Type "A" Water Licence No. 2AM-MEL1631.

Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) examined the WQ-MOP pursuant to its mandated responsibilities under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Department of Crown-Indigenous Relations and Northern Affairs Act*. Please find CIRNAC comments and recommendations in the attached Technical Memorandum.

If there are any questions or concerns, please contact me at (867) 975-4689 or john.onita@canada.ca or Andrew Keim at (867) 975-4550 or andrew.keim@canada.ca

Sincerely,

John Onita,
Regional Water Coordinator

Canada

Technical Review Memorandum

Date: September 20, 2021

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

From: John Onita – Regional Water Coordinator, CIRNAC

Subject: **Crown-Indigenous Relations and Northern Affairs Canada's (CIRNAC) Review of the Meliadine Mine Water Quality Management Optimization Plan for Type "A" Water Licence No. 2AM-MEL1631**

Region: ☐ Kitikmeot ☒ Kivalliq ☐ Qikiqtani

A. BACKGROUND

As documented in Appendix "A", Section 1.0, of the WQ-MOP, the Licensee states in Paragraph 3 that:

"On 24 March 2020, Agnico Eagle submitted an emergency request for an amendment to their Type "A" Water Licence (No. 2AM-MEL-1631), specifically seeking the following amendment:

- *Authorization to temporarily discharge water from Containment Pond 1 (CP1) to Meliadine Lake that contains a maximum average TDS concentration up to 3,500 mg/L, which exceeds the current limit described in Part F, Item 3 of the current Water Licence of 1,400 mg/L*

The emergency request issued by Agnico Eagle was based on the determination that the water storage capacity of CP1 would be exceeded if dewatering was not conducted prior to or in conjunction with the 2020 spring freshet. If the dewatering was not permitted, and the water storage capacity of CP1 was exceeded, this could represent a significant risk to site infrastructure, as well as human and environmental health.

On 29 April 2020, the Nunavut Water Board (2020) recommended approval of Licence Amendment 1 for Agnico Eagle's Type "A" Water Licence, which permits the following:

- *The time-limited discharge (May 2020 – October 2020) of effluent from the Containment Pond 1 (CP1) into Meliadine Lake through the Meliadine Lake Diffuser (Monitoring Program Station MEL-14) and the water discharge shall not exceed 3,500 mg/L for the Maximum Average Concentration (MAC) of the Total Dissolved Solids (TDS)"*

NWB's approval of the Emergency Amendment 1 was based on conditions specified by NWB's (2020) Reasons for Decision which required the Licensee in part, to conduct a Water

Quality Study. Responding to the NWB's directive, the Licensee adopted a "Phased Approach" for the WQ-MOP framework it developed which was described as:

- Phase 1: Develop Interim TDS Targets for effluent discharge into Meliadine Lake.
- Phase 2: Conduct Validation Study against the Interim TDS Targets and provide information on receiving environment assimilation capacities.
- Phase 3: Finalize Meliadine Mine Benchmarks by integrating the results of Phase 1 and Phase 2 and provide recommendation on acceptable TDS Targets for Meliadine Lake.

The Licensee implemented its WQ-MOP validation framework as itemized above and concluded as follows:

- *TDS concentrations measured in the discharge were consistently below the MAC of 3,500 mg/L in each of the weekly sampling events and ranged between 1,340 and 3,100 mg/L measured TDS [Appendix B, Section B5.0, Page 40].*

- *The discharge was not acutely toxic in 18 rounds of acute toxicity tests conducted on Daphnia magna and Rainbow Trout, as the LC_{50} values were >100% discharge in each of the tests. No survival data for either species indicate that full strength discharge is approaching concentrations causing mortality [Appendix B, Section B5.0, Page 40].*

- *Adverse toxicological effects were not identified during the chronic toxicity testing at MEL-14 from July to September. The additional round of chronic toxicity testing of MEL14 in October at a measured TDS concentration of 2,740 mg/L (2,500 mg/L calculated TDS) did not indicate impairment on fathead minnow, Hyalella Azteca, or Daphnia magna. However, chronic effects to Lemna minor frond count were noted in full strength effluent as well as the 48.5% and 24.2% concentrations when compared to the laboratory controls. The October Lemna minor frond count results does not align with the previous rounds of testing with IC_{50} greater than 97% at TDS concentrations ranging between 1,700 and 1,850 mg/L measured TDS (1,200 and 1,400 mg/L calculated TDS). Although this test result was anomalous, it remains protective of a TDS concentration of 1,000 gm/L [Appendix B, Section B5.0, Page 40].*

- *Consistent with the low TDS concentration results reported in the receiving environment, adverse toxicological effects were not identified during the monthly chronic toxicity testing programs of the receiving environment, In the few cases where statistically significant differences were identified, they were found not to be linked to degree of discharge influence, but rather to other sources of variance [Appendix B, Section B5.0, Page 40].*

Based on these conclusions, the Licensee is recommending to the NWB as per Phase 3 of the WQ-MOP that:

"The interim TDS targets for the discharge and receiving environment developed under Phase 1 be ratified as regulatory targets for TDS as Effluent Quality Criterion (EQC) for discharge and Site-Specific Water Quality Objective (SSWQO) for the receiving environment that will be applicable to future operating conditions at the Meliadine Mine. Specifically:

- *The MAC of TDS of 3,500 mg/L and the maximum grab concentration (MGC) of TDS of 4,500 mg/L for discharge from CP1 to Meliadine Lake (i.e., EQC); and*
- *The benchmark concentration of TDS of 1,000 mg/L to be achieved at the edge of the mixing zone in Meliadine Lake, which would also be consistent with the SSWQO for longer-term management of the receiving environment of Meliadine Lake". [Appendix B, Section B5.0, Page 41].*

CIRNAC provides the following comments and recommendations pertaining to the Meliadine Mine WQ-MOP review. A summary of the subjects of recommendations can be found in Table 1. Documents reviewed as part of this submission can be found in Table 2 of Section B. Detailed technical review comments can be found in Section C.

Table 1: Summary of Recommendations

Recommendation Number	Subject
R-01	Effluent's Impacts on Water Quality

B. DOCUMENTS REVIEWED AND REFERENCED

The following table (Table 2) provides a list of the documents reviewed under the submission and reference during the review.

Table 2: Documents Reviewed and Referenced

Document Title	Author, File No., Rev., Date
210820 2AM-MEL1631 Water Quality MGMT Optimization Plan-IMLE_Rev4b-IMLE; Pahse 3: Meliadine Mine Effluent Discharge Benchmarks for Total Dissolved Solids	Golder Associates Ltd; August 10, 2021
160415 2AM-MEL1631 Water Licence OVCE	Nunavut Water Board; April 1, 2016
Evidence of eutrophication in Arctic lakes	P. Ayala-Borda, C. Lovejoy, M . Power, M. Rautio - Arctic Science, 2021 - cdnsciencepub.com
Development of a Total Dissolved Solids (TDS) Chronic Effects Benchmark for a Northern Canadian Lake	Peter M Chapman and Cathy A McPherson; Integrated Environmental Assessment and Management — Volume 12, Number 2—pp. 371–379

C. RESULTS OF REVIEW

1. Effluent's Impacts on Water Quality

Comment:

The Licensee reports in Appendix B, Section B 3.4, Paragraph 2; of the WQ-MOP that the effluent discharged from monitoring station MEL-14 (or CP1) into Meliadine Lake, significantly reduced the reproduction rate of *Daphnia magna*. This observation was the result of a 21-day chronic toxicity test conducted on *Daphnia magna* from August to October in 2020. The Licensee's observation reads:

"Survival and growth results from August to October 2020 do not indicate impairment of the endpoints in the discharge, edge of mixing zone, mid-field, and reference stations. However, reproduction was reduced in the MEL-14 station in comparison to its laboratory negative control resulting in IC_{25} values for three sampling events of 37.6% (95% confidence interval [CI] from 4.9% to >100%), 93.8% (CI 4.6% to >100%), and 61.6% (CI 10.2% to >100%). The mean reproduction endpoint in the discharge, edge of mixing zone, and mid-field stations from June to August encompassed a similar range of responses as the reference stations, suggesting that the variability observed in MEL-14 reproduction results was not due to the discharge. In September, the reproduction at edge of mixing zone and mid-field stations encompassed a similar range of responses as the reference stations; however, reproduction at MEL-14 in September and October was lower than those observed in the laboratory controls" [Table B15]

CIRNAC observes that the Licensee seems to acknowledge that the reproduction rate of *Daphnia magna* was significantly reduced by the toxic effects of the effluent from MEL-14, at the same time suggesting that this chronic toxic effect on *Daphnia magna* was not caused by the effluent from MEL-14. CIRNAC further observes that the effluent inhibited the reproduction rates of *Daphnia magna* at several other monitoring stations other than MEL-14 as indicated in Tables B16 and B17.

For example, outcomes of statistical comparisons observed for the *Daphnia magna* endpoints reported in Appendix B, Section B3.4, Pages 36 and 37 of the WQ-MOP; confirms that the effluent had the same toxic effects on *Daphnia magna* at other stations:

a) *"Significant inhibition effects for the reproduction endpoint were observed at the MEL-13-01 station in September 2020 relative to responses observed in the three reference stations and the pool references. Similarly, MEL-13-07 showed significant inhibition effects for the reproduction endpoint relative to responses observed in MEL-03-02 and MEL-05-04 reference stations and the pooled references"* [Page 36, Table B16]

b) *"Significant effects for the reproduction endpoint were observed at the MEL-02-05 station in September 2020 relative to responses observed in the MEL-05-04 reference station, but not to MEL-03-02, MEL-04-05, or the pooled reference station response"* [Page 36, Table B17]; [All stations are Effluent Receiving Environment beyond mixing zone]

c) *"Significant effects for the reproduction endpoint were observed at the MEL-05-04 reference station in September 2020 relative to response observed in the synthetic control"* [Table B17]

CIRNAC is concerned that a yearly discharge of TDS levels at 3,500 mg/L as the Licensee has recommended, would affect the water quality of the Meliadine Lake. This is because, TDS occur naturally in water bodies and are determined by natural factors such as geology and soil in the watershed, atmospheric precipitation, and the water balance (evaporation-precipitation) according to Chapman and McPherson (2016). In other words, a yearly (from 2020 to 2031 end of water licence) addition of the recommended interim TDS target of 3,500 mg/L to the naturally occurring TDS levels in Meliadine Lake, would exponentially increase the TDS concentration in the Lake to levels that would impair the reproduction rates of some aquatic species in the Lake. The chronic toxic effects of the effluent from MEL-14 on the reproduction rate of *Daphnia magna*, is an empirically documented evidence backing CIRNAC's concerns on this issue.

Supporting this CIRNAC's hypothesis of effluent's negative impacts on Meliadine Lake's Water Quality, are these candid scientific observations by the Licensee:

- *Consistent with the low TDS concentration results reported in the receiving environment, adverse toxicological effects were not identified during the monthly chronic toxicity testing programs of the receiving environment, In the few cases where statistically significant differences were identified, they were found not to be linked to degree of discharge influence, but rather to other sources of variance [Appendix B, Section B5.0, Page 40].*

- *Survival and growth results from August to October 2020 do not indicate impairment of the endpoints in the discharge, edge of mixing zone, mid-field, and reference stations. However, reproduction was reduced in the MEL-14 station in comparison to its laboratory negative control resulting in IC_{25} values for three sampling events of 37.6% (95% confidence interval [CI] from 4.9% to >100%), 93.8% (CI 4.6% to >100%), and 61.6% (CI 10.2% to >100%). The mean reproduction endpoint in the discharge, edge of mixing zone, and mid-field stations from June to August encompassed a similar range of responses as the reference stations, suggesting that the variability observed in MEL-14 reproduction results was not due to the*

discharge. In September, the reproduction at edge of mixing zone and mid-field stations encompassed a similar range of responses as the reference stations; however, reproduction at MEL-14 in September and October was lower than those observed in the laboratory controls" [Appendix B, Section B3.4, Paragraph 2]

In the above referenced observations by the Licensee, the *underlined statements* confirms CIRNAC's hypothesis that other naturally occurring factors in Meliadine Lake can influence the effects of the discharge on aquatic communities. Empirical evidence suggests that TDS is one of these naturally occurring factors in Lake ecosystems (Chapman and McPherson, 2016). Therefore, the recommended continuous addition of higher (3,500 mg/L) load of TDS effluent into Meliadine Lake for a prolong period of Ten years (2021-2031), would adversely affect the ecosystem structure and function of the Lake as demonstrated by the chronic toxic effects on the *Daphnia magna* reproduction rate.

As a Zooplankton, *Daphnia magna* occupies a median trophic level in Lake food chains. Meaning that, *Daphnia magna* is one of the primary grazers in Lake ecosystems as it feeds primarily on phytoplankton species such as algae and help to control phytoplankton excessive growth in the Lakes which could lead to negative water quality problems. Conversely, fish and other species that occupy higher trophic levels in the Lake's food chains, depends on *Daphnia magna* (Zooplankton) biomass for food.

If it becomes a realistic scenario that TDS level of 3,500 mg/L would be added to the naturally occurring TDS level in Meliadine Lake at a continuous rate of **1,031,177 m³ per year** (e.g., as the Licensee did in 2020); for a prolong period of Ten years (2021-2031) (e.g., as the Licensee has recommended); *Daphnia magna*'s population in Meliadine Lake would be negatively impacted due to the chronic toxic effect of the discharge on the reproduction rate of *Daphnia magna*. If this happens, it would directly and/or indirectly affect the fish population in the Lake because the population of one of its food sources (*Daphnia magna*) would have declined and could probably, affect fish or other aquatic species' population in Meliadine Lake. Then, the phytoplankton (algal) growth would increase (because of *Daphnia magna's* population crash) and could cause severe water quality problem that could lead to algal bloom which would deplete oxygen in the Lake. This is how the recommended interim TDS target of 3,500 mg/L would directly and/or indirectly, affect the *ecosystem structure and function* in Meliadine Lake if ratified.

CIRNAC is not in support of the recommendation to ratify the interim TDS discharge of 3,500 mg/L into Meliadine Lake because of the following reasons:

a) It would directly and/or indirectly affect the *reproduction rates* of aquatic species in Meliadine Lake as a long-term effect. Chances are that the chronic toxic effect on the reproduction rate of *Daphnia magna* might not be the only example in Meliadine Lake

where aquatic species would be susceptible to the reproduction inhibitory effect of the effluent, if per-adventure, a TDS discharge of 3,500 mg/L is ratified.

b) Not enough empirical evidence supporting aquatic communities' response in *pelagic* lake ecosystems (like the zones sampled in Meliadine Lake) to TDS levels of 3,500 mg/L and above. Regulatory bodies around the world have been very cautious in dealing with TDS regulation due to uncertainties associated with its accountability (e.g., the debate around the preferences either for calculated TDS values or measured TDS values). The government of the state of Alaska is the only regulatory body that has pegged TDS discharge limits to the range of 500 mg/L to 1,500 mg/L (Chapman and McPherson, 2016). Therefore, the short collection period for experimental data that the Licensee collated from a three months study (July 3 - October 4), is not scientifically significant to draw such a significant scientific conclusion suggesting that TDS discharge of 3,500 mg/L and above is safe for aquatic species of the Meliadine Lake, let alone use the conclusion as a reference for adoption in all of Nunavut's Lakes where the Licensee would be doing future business.

c) No information on Meliadine Lake's carrying capacity to absorb more than 1,031,177 m^2 yearly effluent discharge for ten consecutive years from 2021 (i.e., 2021-2031 end of existing water licence). A continuous discharge of effluent at 1,031,177 m^2 for ten years has the tendency to increase the water volume of Meliadine Lake above its natural holding capacity over the discharge period (June to October), which could potentially lead to flooding in wetlands around the vicinity of Meliadine Lake.

d) Yet-to-be quantified potential water quality concerns for Meliadine Lake. The gross water quality problems that the recommended TDS discharge of 3,500 mg/L would cause to Meliadine Lake is yet to be fully quantified and communicated. For example, a 7-day *Lemna minor* (duckweed) growth test to evaluate the effluent's receiving environment water quality was conducted by the Licensee for the months of June, July, August and September in 2020. *Lemna minor*, according to the Licensee, was selected ahead of the 72-hour green algae growth test which was also recommended by the NWB, because it was identified as the more sensitive organism of the two species (Appendix A, Page 13). Results of the 7-day growth test shows that the effluent stimulated growth of *Lemna minor* in various monitoring stations within the receiving environments in Meliadine Lake. The following observations were reported by the Licensee about the effluent's growth stimulation effect on *Lemna minor* in receiving environments (stations):

I. *"Significant effects (stimulation) for the growth endpoint were observed at the MEL-13-10 station in September 2020 relative to responses observed in the MEL-03-02 and MEL-05-04 reference stations and the pooled reference station response. Additionally, significant effects (stimulation) for the frond count were observed in the MEL-03-02 and MEL-05-4 stations"* [Appendix B, Page 28]

II. *"Significant effects (stimulation) for the frond count and growth endpoints were observed at the MEL-02-05 station in August 2020 relative to responses observed in the three reference stations and the pooled reference station response"* [Appendix B, Page 28]

III. *"Significant effects (stimulation) for the frond count and growth endpoints were observed at the MEL-03-04, MEL-04-05, and MEL-05-04 stations in August 2020 relative to responses observed in the site/synthetic control response"* [Appendix B, Page 28]

IV. *"Significant effects (stimulation) for the frond count and growth endpoints were observed at the MEL-04-05 station in September 2020 relative to responses observed in the site/synthetic control response. Additionally, significant effects (stimulation) for the frond count endpoint were observed at the MEL-05-04 station relative to responses observed in the site/synthetic control response"* [Appendix B, Page 28]

As observed and documented by the Licensee, the discharged effluent from CP1 significantly increased *Lemna minor's* growth/biomass within the shortest experimental period of 3-4 months (June-September). The clearest interpretation of this growth stimulation effect on aquatic plants is that the effluent is providing some essential nutrients that stimulates growth in aquatic plants.

This effluent's growth stimulation effect on aquatic plants is concerning to CIRNAC because it can cause an induced eutrophication condition to occur in Meliadine Lake which could, lead to poor water quality disaster. *Induced Eutrophication* is caused by excessive nutrients in water bodies.

CIRNAC is concerned that this demonstrated nutrient-effect of the effluent on aquatic plant species was not considered by the Licensee as a water quality problem that the discharge is capable of causing in Meliadine Lake. Given that eutrophication on its own occur naturally in water bodies as a result of the photosynthetic response of algal species to sunlight, it becomes a worrisome problem to CIRNAC that permitting additional loads of potential nutrient sources into Meliadine Lake (as the effluent has demonstrated on *Lemna minor)*,

would stimulate or trigger an unprecedented algal growth in the Lake to a degree that a catastrophic algal-bloom condition can occur in Meliadine Lake which would deplete the dissolve oxygen (DO) content in the Lake and, probably, cause the deaths of aquatic species over a continuous long-term effluent discharge period of ten years. For example, as a "supporting information for the Interim TDS targets", the Licensee reports in Appendix "A", Page A-4, that the maximum concentrations of MEL-14 effluent constituents recorded from samples collected from September 2017 to October 2019 were as follows:

- Calculated TDS = 1,213 mg/L
- Measured TDS = 1,760 mg/L
- Carbonate[(b)] = 34 mg/L
- Chloride = 660 mg/L
- Sodium = 236 mg/L
- Calcium = 220 mg/L
- Sulphate = 90 mg/L
- Magnesium = 36 mg/L
- Potassium = 17 mg/L
- Nitrate (as N) = 15 mg/L
- Reactive Silica = 3.60 mg/L
- Calculated Water Hardness (as $CaCo_3$) = 698 mg/L

Based on the effluent's constituent concentrations confirmed herein by the Licensee, it is obvious that the MEL-14 effluent, indeed, contains essential nutrients with potential growth stimulation effects on aquatic plants. This is because:

- *Calcium* can combine with *Nitrate* to form *Calcium-Nitrate,* which would, probably, induce a nutrient-effect on Meliadine Lake [$Ca+NO_3 \rightarrow Ca(NO_3)_2$]

- *Potassium* can combine with *Nitrate* to form *Potassium-Nitrate,* which would, probably, induce a nutrient-effect on Meliadine Lake [$K+NO_3 \rightarrow KNO_3$]

- *Sodium* can combine with *Nitrate* to form *Sodium-Nitrate,* which would, probably, induce a nutrient-effect on Meliadine Lake [$Na + NO_3 \rightarrow NaNO_3$]

- *Potassium* can combine with *Sulphate* to form *Potassium-Sulphate,* which would, probably, induce a nutrient-effect on Meliadine Lake [$K + SO_4 \rightarrow KSO_4$]

- *Magnesium* can combine with *Sulphate* to form *Magnesium-Sulphate,* which would, probably, induce a nutrient-effect on Meliadine Lake [$Mg + SO_4 \rightarrow MgSO_4$]

- *Potassium* can combine with *Chloride* to form *Potassium-Chloride,* which would, probably, induce a nutrient-effect on Meliadine Lake [$K + Cl \rightarrow KCl$]

All six (6) itemized potential nutrient-effect scenarios presented herein, are potential anthropogenic chemical pathways through which the nutrient balance in Meliadine Lake could be altered, should the Licensee's recommendation that the interim TDS discharge of 3,500 mg/L into Meliadine Lake be ratified. If these scenarios happen, anthropogenic induced Eutrophication would, probably, become a reality in Meliadine Lake. The *algal-bloom* would, probably, become a reality in Meliadine Lake.

Algal-bloom would, probably, affect water use in Meliadine in the following ways:

- Production of dangerous toxins that can sicken or kill people and aquatic species.
- Creation of dead zones in Meliadine Lake's ecosystems.
- Increases treatment costs of Meliadine Lake's water for drinking purposes.

Recent empirical evidence suggests that Eutrophication, as we speak, is already occurring naturally in Nunavut's Lakes as a result of climate change (Ayala-Borda *et a*l., 2021). For example, a study conducted in the Greiner Lake watershed, in Cambridge Bay, Nunavut in August of 2018 and 2019 respectively; suggests that Lake ERA5 (located upstream of any direct human influence) may have been eutrophic for the last 30 years, as satellite imagery of the Lake shows (Ayala-Borda *et a*l., 2021).

CIRNAC reasons that, with the Lakes in Nunavut already susceptible to natural *Eutrophication* as the study by Ayala-Borda *et al.,* (2021) suggests, overloading of Nunavut's Lakes with additional nutrient sources like the interim TDS discharge target of 3,500 mg/L suggested by the Licensee, would exacerbate the nutrient burden of Nunavut's Lakes beyond their assimilation capacities which could, lead to an unprecedented anthropogenic induced eutrophication happening in Nunavut's Lakes.

Recommendation:

(R-01) CIRNAC recommends that:

- (R-01a): The NWB rejects the Licensee's recommendation to ratify the interim TDS targets for the discharge and receiving environment developed under Phase 1 as regulatory targets for TDS at the Meliadine Mine. Specifically:

    i. The maximum average concentration (MAC) of TDS of 3,500 mg/L and the maximum grab concentration (MGC) of TDS of 4,500 mg/L for discharge from CP1 to Meliadine Lake (i.e., effluent quality criterion (EQC).

- (R-01b): The NWB (as a matter of urgency) order the Licensee's *immediate reverse* to implementing existing Water Licence permitted TDS discharge limit of 1,400 mg/L into Meliadine Lake.

- (R-01c): In line with Part E, Item 15; of the Water Licence, the Licensee provide within 60 days, effluent discharge time-table for Control Pond No.1 (CP1), showing periodic

and consistent discharge regime as a mitigation measure against anticipated capacity overflow of CP1 due to impacts of precipitation on CP1's holding capacity.

- (R-01d): In line with Part E, Item 12; of the Water Licence, the Licensee updates the Water Management Plan to include a Nutrient Balance Model showing the seasonal and yearly nutrient dynamics in Meliadine Lake at TDS discharge limit of 1,400 mg/L until Water Licence expiration (2031).

- (R-01e): The Licensee conduct yearly Water Quality study to evaluate effluent's impacts on receiving environment in Meliadine Lake; using NWB (2020) approved 7-day *Lemna minor* and 72-hour green algae growth tests at 1,400 mg/L TDS discharge limit.

- (R-01f): The Licensee conduct yearly Water Quality study to evaluate effluent's impacts on receiving environment in Meliadine Lake; using NWB (2020) approved 21-day *Daphnia magna* survival, reproduction and growth tests at 1,400 mg/L TDS discharge limit.

D. REFERENCES

Department of Crown-Indigenous Relations and Northern Affairs Act (2000)

Nunavut Water Board Type "A" Water Licence 2AM-MEL1631; NWB, April 1, 2016

Nunavut Waters and Nunavut Surface Rights Tribunal Acts (2016); *Nunavut Water Board*

P. Ayala-Borda, C. Lovejoy, M . Power, M. Rautio; Evidence of eutrophication in Arctic lakes - *Arctic Science*, 2021 - cdnsciencepub.com

Peter M. Chapman and Cathy A. McPherson; Development of a Total Dissolved Solids (TDS) Chronic Effects Benchmark for a Northern Canadian Lake; *Integrated Environmental Assessment and Management* — Volume 12, Number 2—pp. 371–379

Water Quality MGMT Optimization Plan-IMLE_Rev4b-IMLE; Pahse 3: Meliadine Mine Effluent Discharge Benchmarks for Total Dissolved Solids; *Golder Associates Ltd*; August 10, 2021