Environment Canada | Environnement Canada

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NWB file: 2AM-DOH1323

Phyllis Beaulieu,
Manager of Licensing
Nunavut Water Board
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Via email to licensing@nwb-oen.ca

RE: TMAC-Doris North Project - Technical Comments Regarding Application to Amend Type A Water Licence 2AM-DOH1323

Attention: Phyllis Beaulieu

Environment Canada (EC) has reviewed the information submitted to the Nunavut Water Board regarding the above-mentioned amendment application and is submitting comments in the attached table. EC's specialist advice is provided based on our mandate, in the context of the *Canadian Environmental Protection Act, 1999*, the pollution prevention provisions of the *Fisheries Act*, the *Migratory Birds Convention Act, 1994*, and the *Species at Risk Act*. The Proponent must ensure they remain in compliance with legislation during all phases and in all undertakings related to the project.

Should you have any questions regarding the foregoing please contact Mark Dahl at (204) 983-4815 or via email at mark.dahl@canada.ca.

Sincerely,

Susan Tiege
A/Manager, Environmental Assessment and Marine Programs Prairie and Northern Region

cc: Sarah-Lacey McMillan, A/Head, Environmental Assessment North (NT and NU):
EC Review Team
Attachment: EC Comment Table

TMAC Doris North Project
Environment Canada Technical Comments Regarding Application to Amend Water Licence 2AM-DOH1323

Technical Comment Number	EC-1
Subject/Topic	Sampling Locations - Incorporation of ocean currents and tides
Reference	EC IR #1 P4-1 Environmental Effects Assessment
Summary of Issue	Oceanographic conditions in Roberts Bay will dictate where the effluent plume goes after release and should be used to identify which areas of the Bay should be monitored for plume related effects. It is unclear if the Proponent used their understanding of the tides and currents in Roberts Bay to inform sampling site selection.
Importance of issue to impact assessment	The placement of sampling stations is critical to detecting and mitigating impacts. All available information should be used to ensure that sampling stations are placed where they are most likely to detect effects.
Detailed Technical Comment	The sampling locations that have been selected for baseline data collection in Roberts Bay cover a large area but are sparsely distributed. In response to EC IR#1, the Proponent states that they did not use plume modelling for sampling site selection, stating that sites were selected prior to the consideration of ocean discharge, with additional sites being selected later on. EC is concerned that the current sampling design may not be adequate to detect effluent related effects. Understanding the characteristics of the water body and factors such as currents and tides will aid in predicting how the effluent plume is likely to move in the system which will, in turn, provide useful information for identifying sampling locations that will most accurately be able to detect effects in the receiving environment.
Recommendation/Request	Discuss how the influence of ocean currents and tides on plume migration will be incorporated into the selection of sampling locations in Roberts Bay

Technical Comment Number	EC-2
Subject/Topic	Marine Water Quality Objectives
Reference	EC IR#2/EC IR#6

	Water Load and Balance – Table 6-3
Summary of Issue	The Proponent proposes to limit the assessment of parameters of concern to those with existing marine water quality guidelines under the Canadian Council of Ministers of the Environment (CCME). EC notes, however, that the effluent may contain contaminants for which there are no CCME marine water quality guidelines and that these contaminants should be assessed as they have the potential to impact the Roberts Bay receiving environment.
Importance of issue to impact assessment	Parameters for which there are no CCME marine water quality guidelines could cause significant impacts in the receiving environment. Modelling of all parameters of potential concern in the effluent, including those for which there are no marine water quality guidelines, will provide a better understanding of the quality and potential effects of the discharge and will inform management and mitigation decisions.
Detailed Technical Comment	The Proponent response to EC IR# 2 concluded that the only parameters which need to be considered are those which have CCME marine guidelines or *Metal Mining Effluent Regulations* (MMER) discharge limits. TMAC did not respond to EC's recommendation that all effluent constituents be modelled in order to identify the need for site specific water quality objectives for parameters that will exceed background concentrations. The Proponent has stated that they are committed to evaluating water quality parameters with established benchmarks and will add additional parameters if the monitoring framework reveals that the project is negatively impacting ambient water quality. Given that CCME marine water quality guidelines have only been developed for four metals and one nutrient this approach excludes a large number of parameters from evaluation. The Proponent also proposes to use the eight parameters listed in the MMER authorized limits for deleterious substances to evaluate effluent quality. If the proposed approach is accepted the Proponent will only provide predicted concentrations for nitrate, total cyanide, arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc at the marine outfall mixing box. The limited set of parameters proposed by the Proponent does not include all the potential contaminants that may enter the receiving environment when the effluent is released. All potential contaminants in both the TIA and the groundwater effluent should be modelled and evaluated. Modeled concentrations should be carried through to the combined marine outfall mixing box effluent to identify which parameters exceed guidelines available from other jurisdictions or are significantly elevated over background receiving environment conditions.
Recommendation/Request	Identify, analyze and model all contaminants of potential concern in the effluents and in the combined effluent. Discuss which parameters, including those for which there are no guidelines, have the potential

	to become elevated above background in the receiving environment. For each parameter of concern, discuss whether treatment or a site specific water quality objective is necessary.

Technical Comment Number	EC-3
Subject/Topic	Expected Groundwater Quality
Reference	Section 2.3.5 – Groundwater Quality Table 5 – Summary of Groundwater Quality from samples collected under Doris Mine (75th Percentile)
Summary of Issue	A review of the groundwater quality modelling indicates that not all contaminants with the potential to cause negative impacts on Roberts Bay were fully modelled.
Importance of issue to impact assessment	Modelling of contaminant concentrations in the effluent is critical to predicting potential negative effects to the receiving environment and will inform treatment and management decisions in order to mitigate impacts.
Detailed Technical Comment	The Proponent presents a summary of the groundwater parameters that were analyzed in Table 5. EC notes that modelling was not used to predict effluent quality at the marine outfall mixing box for some parameters even though their concentrations were found to be elevated and they have the potential to cause effects in the receiving environment. These parameters include ammonia (GW – 3.5 mg/L, Roberts bay median – 0.0025 mg/L), iron (GW – 4.81 mg/L, Roberts Bay median – 0.014 mg/L), Strontium (27.6 mg/L, not measured in Roberts Bay).
Recommendation/Request	EC recommends that the concentrations of ammonia, iron, and strontium from the groundwater be incorporated into the overall site water quality model and that the Proponent incorporate the modelling output into their description of how these parameters will be managed/treated in the effluent.

Technical Comment Number	EC-4
Subject/Topic	Effluent Quality Modelling for Free Cyanide, Mercury, and Selenium
Reference	Section 6.3 – Water Quality Results (Water Load Balance)
Summary of Issue	The Proponent did not model the concentration of free cyanide in the tailings impoundment area nor mercury or selenium in the mill effluent water.
Importance of issue to impact assessment	Cyanide, mercury and selenium have the potential to cause effects in the receiving environment and should be modelled in order to understand potential impacts.
Detailed Technical Comment	The Proponent has stated that mercury and selenium have not been included in modelling of TIA effluent

	because the high detection limits in the dataset could artificially elevate predictions of the TIA effluent. Additionally, free cyanide has been excluded due to lack of data for developing source terms. Without knowing the modelled concentrations of these parameters in the TIA, the eventual combined modelled discharge effluent at the marine outfall mixing box is not accurate. These parameters still need to be modelled in order to gain an understanding of the potential for effects in the receiving environment.
Recommendation/Request	Additional sampling should be completed and analyzed using lower detection limits for cyanide, selenium and mercury so that modelling for the TIA and marine outfall mixing box effluent is accurate. Should predicted concentrations of these parameter exceed guidelines the Proponent should describe how these parameters will be managed/treated in the effluent.

Technical Comment Number	EC-5
Subject/Topic	Dissolved versus total metal concentrations
Reference	2.3.5 – Groundwater Quality (Groundwater Model) Table 2.3.5 (Groundwater Model) Table 6-3 (Water and Load Balance)
Summary of Issue	Both dissolved metal and total metal concentrations were used in the report.
Importance of issue to impact assessment	Guidelines and MMER values are based on total metal concentrations, it should be noted that dissolved metal concentrations are not directly comparable.
Detailed Technical Comment	Groundwater data is reported as dissolved metal concentrations, while effluent quality from the TIA is reported as total metal concentrations. These two values are then combined to create the predicted monthly concentration at the marine outfall mixing box and then compared to the CCME Marine Water Quality Guidelines and MMER Maximum Authorized Monthly Mean Concentrations. Combining dissolved and total metal concentrations in the calculations is inappropriate. Dissolved metal concentrations are not directly comparable to total metal concentrations. In general dissolved metals represent only a portion of the metals found in the sample and would therefore provide an underestimation of the total metal concentrations.
Recommendation/Request	Describe how the data have been transformed or interpreted, specifically for the groundwater data, in order to allow comparison of dissolved values to guidelines based on total values. If this has not been incorporated, provide estimates of total concentrations for the dissolved parameters, with rationale for the method used.

Technical Comment Number	EC-6
Subject/Topic	CCME Marine Water Quality Guidelines and MMER Authorized Limits
Reference	Water Load and Balance – Table 6-3
Summary of Issue	Use of incorrect Total Chromium guideline and inappropriate use of MMER limits as objectives for As, Cu, Pb, Ni, and Zn.
Importance of issue to impact assessment	Appropriate guidelines should be used for comparison.
Detailed Technical Comment	Table 6-3 in the Water Load and Balance document identifies a marine guideline of 0.0575 mg/L for total chromium however the source of this guideline is unclear as there is no CCME marine guideline for total chromium. The CCME guidelines are for the hexavalent and trivalent forms, but not total chromium. Additionally, the MMER Maximum Authorized Monthly Mean Concentrations for arsenic, copper, lead, nickel, and zinc are listed under the "marine guideline" column. It should be noted that these values are not guidelines for the protection of marine aquatic life and are instead maximum discharge concentrations pertaining to effluent. This difference between CCME marine water quality guidelines which are designed to protect aquatic life in the receiving environment and MMER maximum authorized monthly mean discharge concentrations should be clearly identified.
Recommendation/Request	Discuss how the chromium marine guideline listed was arrived at and clearly differentiate between CCME guidelines and MMER discharge concentrations.

Technical Comment Number	EC-7
Subject/Topic	Toxicity Testing of Effluent
Reference	EC IR#6
Summary of Issue	Toxicity testing results and inputs not provided
Importance of issue to impact assessment	Analysis required to verify toxicity test results
Detailed Technical Comment	The Proponent's response to EC IR#6 states that 96 hour acute toxicity tests on 3-spine stickleback were completed in October of 2010. The test results are discussed, however, the laboratory results are not provided in the amendment application or in their response. It was also unclear whether the groundwater sample used for testing was an accurate representation of the anticipated groundwater quality that will be

	managed and discharged.
Recommendation/Request	Provide the laboratory reports on the ground water toxicity testing that was conducted in October of 2010. Discuss the location, depth and quality (provide chemical characterization analytical results) of the ground water sample used in the testing. Indicate what criteria were used to determine that the groundwater sample used was reflective of anticipated effluent quality. Discuss any additional testing that is proposed to assess the toxicity of "end of pipe" effluent.

Technical Comment Number	EC-8
Subject/Topic	Aquatic Effects Monitoring Program
Reference	Section 4.5.8.1 (Package 4) EC IR #8
Summary of Issue	Aquatic Effects Monitoring Program (AEMP) has not been updated for the amendment application and does not include appropriate monitoring sites in Roberts Bay
Importance of issue to impact assessment	Monitoring sites must be identified ahead of time in order to collect adequate baseline data so that effects can be detected once effluent discharge begins.
Detailed Technical Comment	The existing AEMP does not account for the changes to discharge location that are proposed in the amendment. Information relating to the AEMP study design is important at this stage in the process as it provides confidence in the Proponent's ability to detect changes and effects in the receiving environment. Baseline data must support the proposed study design.
Recommendation/Request	Provide the updated AEMP for review.

Technical Comment Number	EC-9
Subject/Topic	Water Licence Limits
Reference	Table 5-1 (Water Load and Balance)
Summary of Issue	Water Licence limits need to be updated for new discharge location and effluent management
Importance of issue to impact assessment	Impacts to the receiving environment are linked to concentrations of contaminants in the effluent; the effluent quality criteria identified in the water licence will determine loadings and environmental concentrations and effects.
Detailed Technical Comment	Table 5-1 of the Water Load and Balance document includes the current water licence limits for the Doris North Project. Water Licence limits should be revised to accommodate the proposed changes in discharge location and predicted changes in effluent composition.

	The Proponent does not identify end-of-pipe limits that are deemed achievable using Best Available Technology Economically Achievable; this information should be included in the amendment application along with a rationale for the proposed effluent quality criteria. Discharge criteria should be set to ensure that concentrations of parameters in the receiving environment remain at levels below protective water quality objectives.
Recommendation/Request	Discuss and propose potential changes to water licence criteria including: - Suitable sampling/compliance locations - Additional parameters to be included in the licence - Applicability of current licence limits to different discharge locations and effluent qualities

Technical Comment Number	EC-10
Subject/Topic	Sediment Quality and Effluent Buoyancy
Reference	EC IR #5 EC IR #9 Table 5 (Groundwater Model) Table 4.3-1 (Marine Environment)
Summary of Issue	Potential impacts to marine sediments during periods of groundwater only discharge
Importance of issue to impact assessment	Understanding the characteristics of the effluent will inform the understanding of potential effects on the receiving environment.
Detailed Technical Comment	The Proponent has indicated that they are relying on buoyancy of the effluent to mitigate potential impacts to sediment in the area of the diffuser. They have stated that the discharge will be less dense than the receiving environment and will therefore be buoyant and not interact with the sediments. Table 4.5-3 predicts the maximum salinity of the mixed groundwater and TIA effluent as 27.6‰. However, during the winter only the groundwater, with a salinity of 31.86 ‰ (Table 5 – modelling estimates), will be discharged to Roberts Bay and will therefore exceed the salinity of Roberts Bay. This higher salinity effluent will be denser than the surrounding marine water and when combined with a discharge rate of 81 L/s and the associated turbulence would cause scouring of sediments, disturbing the benthic community and increasing turbidity.
Recommendation/Request	Discuss how effluent will be managed such that it remains buoyant at all times. Discuss potential mitigation measures if effluent is more dense and saline than the receiving environment and how impacts to sediments will be minimized.