Your file - Votre référence
2AM-DOH1323

December 8, 2015

Our file - Notre référence
IQALUIT-#1007383

Phyllis Beaulieu
Manager of Licensing
Nunavut Water Board
GJOA HAVEN, NU X0E 1J0

Sent via email: licensing@nwb-oen.ca

Dear Ms. Beaulieu,

Re: Technical Review of TMAC Resources Inc.'s Application to Amend Water Licence No. 2AM-DOH1323 (Amendment Application No. 1)

Thank you for your email of November 5, 2015 inviting interested parties to provide technical comments on the above mentioned water licence application. Comments and recommendations have been provided for the Nunavut Water Board's consideration pursuant to Aboriginal Affairs and Northern Development Canada's (the department) mandated responsibilities under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Department of Indian Affairs and Northern Development Act*.

Two technical review memorandums are provided, one prepared by Amec Foster Wheeler on the department's behalf and another prepared by departmental personnel.

Please note that the department has contracted Amec Foster Wheeler to provide an Independent Closure Cost Estimate. This estimate has been calculated using the RECLAIM 7.0 Model for Reclamation and Closure Security Estimate and is based on a geotechnical site inspection that was conducted this past August and a review of TMAC Resources Inc.'s (TMAC) licence amendment application. A copy of this estimate is being provided with the department's technical review memo for consideration. A total closure cost estimate of $47,818,382 was calculated, compared to $25,061,000 estimated in the TMAC Model. The Geotechnical Site Inspection Report will be submitted during the week of December 14, 2015.

Please do not hesitate to contact me by telephone at 867-975-4555 or email at David.Abernethy@aandc-aadnc.gc.ca for further information.

Sincerely,

David Abernethy

Regional Coordinator
Water Resources Division

Canada

Resource Management Directorate
Aboriginal Affairs and Northern Development Canada
IQALUIT, NU X0A 0H0

Encl. AMEC Foster Wheeler Memorandum
AANDC Water Resources Division Memorandum

Cc. John Roberts, TMAC Resources Inc.

Memorandum

To: David Abernethy, Regional Coordinator, Water Resources Division, Resource Management Directorate, Aboriginal Affairs and Northern Development Canada

From: Chris Milley, Senior Environmental Consultant, Amec Foster Wheeler

Date: December 8, 2015

Signature: 

Re: **Aboriginal Affairs and Northern Development Canada Technical Review of TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM- DOH1323 (Amendment No. 1), for the Doris North Project**

INTRODUCTION

This report documents the technical review of TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM- DOH1323 (Amendment No. 1), for the Doris North Project. The purpose of this review was to document specific technical issues that may require further consideration. This technical review followed an initial completeness review in which additional information was requested from TMAC Resources Inc. Information provided in response to the Information Requests was also included in the technical review.

Aboriginal Affairs and Northern Development Canada's (AANDC) mandate in the North is significant and far-reaching, and includes resource, land and environmental management responsibilities. As part of this mandate, AANDC is taking a comprehensive approach to the protection of environmentally sensitive lands and waters in the North, ensuring that conservation keeps pace with development and that development decisions are based on sound science and careful assessment. In this capacity, AANDC seeks to ensure that regulatory permits are consistent with environmental protection objectives. The specific purpose of the licence amendment application review is to ensure that the potential impacts are comprehensively assessed.

The review team was by led technical consultants from Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited (Amec Foster Wheeler). The team was comprised of the following consultants:

- Christopher Milley, B.Sc., MSc, MMM – Project Manager

- Andy Small, M.Sc., P.Eng. - Project Reviewer
- Jane Doucette, P.Eng. - Technical Expert (Senior Geotechnical Engineer)
- Tracy Cochrane, M.Sc., P.Geo. - Technical Expert (Senior Geoscientist)
- John Pugh, M.Eng, P.Eng. - Technical Expert (Geo-environmental Engineer)
- Scott Burley, M.Sc. – Technical Expert (Environmental Scientist)
- Beth Cameron, M.Sc. – Technical Expert (Environmental Scientist)

The following documents were reviewed:

Package 1: Project Summary and Submission Outline
- P1-1 Plain Language Summary (translated)
- P1-2 Maps

Package 2: Project Description
- P2-1 Project Description with Executive Summary (translated)

Package 3: NIRB and NWB Application Documents
- P3-1 NIRB Amendment Application Documents
- P3-2 NWB Amendment Application Documents
- P3-3 NPC Conformity Determination

Package 3: Environmental Effects Assessment
- P4-1 Environmental Effects Assessment

Package 5: Management and Other Plans
- P5-2 Interim Closure and Reclamation Plan
- P5-3 Water Management Plan
- P5-4 Waster Rock and Ore Management Plan

Package 6: Engineering and Design Documents
- P6-23 Groundwater inflow and Quality Model
- P6-5 Reclamation and Security
- P6-6 Roberts Bay Discharge Systems: Water Management Options
- P6-7 Roberts Bay Discharge Systems: Surface Infrastructure
- P6-8 Roberts Bay Discharge System: Pump and Pipe Requirements
- P6-10 Site-Wide Water and Load Balance
- P6-12 Tailings Geochemistry
- P6-13 Tailings Management System
- P6-14 Waste Rock and Ore Geochemistry, Static Testing
- P6-15 Waste Rock and Ore Geochemistry, Kinetic Testing

Package 7: Proponent Information

Interim Closure and Reclamation Plan. July 2015 Detailed Cost Estimate

The team also reviewed the document titled 151009 2AM-DOH1323 B 1 TMAC IR Tables-IAAE, prepared by TMAC Resources Inc. in response to Information Requests submitted as part of a Completeness Review by AANDC and other interested parties.

The review documents prepared by Amec Foster Wheeler consist of a Geotechnical Site Assessment Report (which is currently in Draft form and will be submitted under separate cover on Friday December 11th, 2015), an Independent Reclamation Cost Estimate Report and this Technical Review Memorandum. The Geotechnical Site Assessment Report and the Independent Reclamation Cost Estimate Report are submitted separate to this memorandum.

Contents

Executive Summary:

Amec Foster Wheeler has reviewed the documents provided by TMAC Resources Inc. (Proponent) in support of their application to amend the Type A Water Licence, No. 2AM- DOH1323 (Amendment No. 1), for the Doris North Project. While there is general satisfaction with the level and quality of information provided, there are a few matters that require further consideration, or where additional information is needed to fully assess the application. The use of a Concordance Table, which would provide a thematic map of where information is located within the document set, could have been beneficial to the review process, and would have ensured a timely and effective review of the documents from an environmental theme perspective.

Greater attention should have been made to explaining the assumptions used in modeling environmental conditions, processes and effects. Without understanding the assumptions made by the Proponent, it is not possible to properly assess the robustness of the models used.

Technical Comments are presented in five general themes.

Theme	Overview of Issues
Protection of groundwater quality	The documents do not provide sufficient information to ensure confidence in the assessment of groundwater protection measures. There are five technical comments related to this theme.
Management and treatment of water	There is insufficient justification for the measures proposed to manage and treat water in future years. There is one technical comment in this theme.
Management of waste rock	There is no justification for assumptions that waste rock may be used for construction outside the containment area, nor is there sufficient explanation of the waste rock segregation strategy. There are two technical comments related to this theme.
The Tailings Impoundment Area (TIA) Interim Dyke	There is insufficient information on the design of the TIA Interim Dyke to determine if it will be effective in changing environmental/climatic conditions. There is one technical comment related to this theme.
Closure Cost Estimate	There is insufficient explanation on how water will be prevented from building up and/or removed from areas adjacent to the thermal rock pads after closure.

General Comments:

The licence amendment application (Application) documents contain relevant information which is generally complete. However, they are structured in a way that does not facilitate reviewers addressing specific environmental issues, such as water quality. TMAC Resources Inc. (Proponent) should provide a Concordance Table in order to simplify locating specific information. This Concordance Table should identify the various documents and sections containing information relevant to specific environmental themes. This would provide reviewers with an easy-to-follow information map of the overall application documents.

As in most environmental assessment and planning documents, the Proponent has relied on models to analyze environmental processes and/or to predict future environmental conditions. Most models require assumptions regarding the parameters or processes. This is the case in the Proponent's Application, for example in the Site-Wide Water and Load Balance. In order to determine the validity of the predictions about future environmental conditions to be fully assessed, it is important to fully understand and assess the assumptions made for the models that have been used. However, in some instances the Proponent has not provided an explanation of the assumptions made within their models. This potentially can be problematic, since the effective range of the models applicability may be limited to the conditions in which test studies have been conducted. Analysis of model assumptions is necessary to understand the limitations of the model and, subsequently the appropriateness of the design and contingency plans (i.e., Will the designs effectively work outside of present normal conditions?).

In general the Technical Comments relate to matters of:

- Protection of groundwater quality - The documents do not provide sufficient information to ensure confidence in the assessment of groundwater protection measures;
- Management and treatment of water – There is insufficient justification for the measures proposed to manage and treat water;
- Management of waste rock - There is no justification for assumptions that waste rock may be used for construction outside the containment area, nor is there sufficient explanation of the waste rock segregation strategy;
- The Tailings Impoundment Area (TIA) Interim Dyke - There is insufficient information on the design of the TIA Interim Dyke to determine if it will be effective in changing environmental/climatic conditions; and
- Closure Cost Estimate - There is insufficient explanation on how water will be prevented from building up and/or removed from areas adjacent to the thermal rock pads after closure.

Technical Comments:

In addition to the General Comments above, Amec Foster Wheeler has reviewed the documents and provides the following specific comments:

1. Protection of Groundwater Quality

Technical Comment Number: TC1	TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM-DOH1323 (Amendment No. 1) for Doris North Project
Technical Comment Source	AANDC
Issue	Water Quality Predictions – Input for Process Water
Reference	P6-10, Site-Wide Water and Load Balance; and P6-12, Tailings Geochemistry
Observation	The methodology for the determination of process water source terms (the amount and chemical form of contaminants released from a specific source for a specific period of time) has not been provided. The Proponent has not made it clear whether the source terms and the sample results are comparable, i.e. whether the results are an aggregate of analyses over a period of time or if they are from a single sample. Section 4.2.4, P6-10 shows the process effluent source terms used and it is stated that they are based on historical geochemical studies. Section 4.5, P6-12 shows the individual sample results. It is not clear how the values used in the water quality model were derived from the sample results.
Recommendation	AANDC requests that the Proponent provide an explanation of the methodology for selection of the process water source terms used in the site-wide water and load balance model and confirm that the sources are comparable to the individual sample results.

Technical Comment Number: TC2	TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM-DOH1323 (Amendment No. 1) for Doris North Project
Technical Comment Source	AANDC
Issue	Groundwater Quality Predictions
Reference	P6-3, Groundwater Inflow and Quality Model; P6-10, Site-Wide Water and Load Balance; and AANDC IR#5 to the NWB
Observation	No discussion has been provided regarding the potential loadings to the underground mine water from water that has come in contact with mine walls, backfilled waste rock or tailings during operations. Should sulphide oxidation occur on the exposed rock walls, waste rock and/or underground tailings; it would represent a source term that is not accounted for in the loading model used to develop water quality predictions.
Recommendation	AANDC requests that the Proponent provide an explanation of the rationale for the absence of underground mine source terms in the model. AANDC further requests that the Proponent describe the potential for acid rock drainage (ARD) and metal leaching (ML) from mine walls, waste rock and underground tailings as well as their potential impacts to mine water quality and downstream receptors.

Technical Comment Number: TC3	TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM-DOH1323 (Amendment No. 1) for Doris North Project
Technical Comment Source	AANDC
Issue	Groundwater Quality Post-Closure
Reference	P6-3, Groundwater Inflow and Quality Model; and NRCan IR#3 to the NIRB
Observation	The Proponent indicates that groundwater quality will not be affected by project activities but this has not been substantiated by the documents provided for review. The documents do not include discussion on mine flooding after operation of the mine is finished, potential impacts of mine flooding on groundwater quality, and potential for groundwater discharge to Doris Lake after mine closure. It is noted that Proponent's response to NRCan IR#3 indicates that mine inflow calculations will be provided; however, they have not yet been received.

Recommendation	AANDC requests that the Proponent provide the rationale to support their conclusion that the project will not have an adverse effect on groundwater quality.

Technical Comment Number: TC4	TMAC Resources Inc.'s Application to Amend the Type A Water Licence, No. 2AM-DOH1323 (Amendment No. 1), for Doris North Project
Technical Comment Source	AANDC
Issue	Water Quality Predictions – Input for Exposed Tailings Beaches
Reference	P6-10, Site-Wide Water and Load Balance; P6-12, Tailings Geochemistry; and AANDC IR#2 to the NWB
Observation	Although the majority of the methodology for the selection of source terms for tailings beaches are provided in Section 4.2.6, P6-10, the humidity cell test (HCTs) results were not provided. It is noted that the median laboratory release rates were used from the HCTs but not the rationale for using these rates.
Recommendation	AANDC requests that the Proponent provide the basis for the selection of the median HCTs release rates and demonstrate that this is appropriate (or conservative) for both operations and post-closure.

Technical Comment Number: TC5	TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM-DOH1323 (Amendment No. 1) for Doris North Project
Technical Comment Source	AANDC
Issue	Water Quality Predictions – Input for Ore and Waste Rock Stockpiles
Reference	P6-10, Site-Wide Water and Load Balance, Section 4.2.9
Observation	Contaminant loadings from ore and waste rock stockpiles were defined from water quality samples taken from stockpiles that were in place in 2010 and 2011. Median concentrations were selected from the 2011 to 2014 dataset; hence, the data represent waste rock that has been exposed for a maximum of 3 to 4 years after placement. The mine plan calls for 6 years of operations, which allows more time for sulphide oxidation and acid generation and metal leaching. The selection of median rates could underestimate loadings from these stockpiles. In addition, there is no discussion regarding the characteristics of the existing stockpiles on surface compared to what is expected in the future.
Recommendation	AANDC requests that the Proponent provide details regarding the basis for selecting source terms for waste rock and ore stockpiles and what can be expected in the future.

2. Management and Treatment of Water

Technical Comment Number: TC6	TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM-DOH1323 (Amendment No. 1) for Doris North Project
Technical Comment Source	AANDC
Issue	There is a concern that the Tailings Impoundment Area (TIA) may not have sufficient storage capacity for water in the event effluent fails discharge criteria and must be stored until a water treatment plant is built.
Reference	P6-10, Site-Wide Water and Load Balance; and AANDC IR#8 to the NWB
Observation	It is understood that the Proponent does not anticipate the need for water treatment to meet effluent discharge criteria. However, we are concerned that the TIA may not have sufficient storage capacity to hold water that requires treatment before discharge while contingency measures are being developed, as this is not specifically discussed in the application. For instance, it could take 2 years or more to design and build a water treatment plant at this remote location.
Recommendation	AANDC requests that the Proponent address the following issues: • Explain what management processes/water treatment plans are intended to proactively identify problems and install mitigative measures. • Explain what contingency plans are in place in the event that effluent does not meet discharge criteria. For example, how long can the mine operate without discharging water to the environment, if the underground mine and TIA effluent fail discharge criteria and need to be stored in the TIA? This contingency measure should consider maximum TIA inflows.

3. Management of Waste Rock

Technical Comment Number: TC7	TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM-DOH1323 (Amendment No. 1) for Doris North Project
Subject	Waste rock for use in construction
Technical Comment Source	AANDC
Issue	Basis for criteria for using rock outside of the containment system
Reference	P5-4, Waste Rock and Ore Management Plan; and P6-14, Waste Rock and Ore Geochemistry, Static Testing
Observation	It is understood that all rock excluding diabase will be treated as mineralized rock, will be stored separately and eventually return underground (Section 3.1, P5-4). Diabase will be stored in a separate stockpile within a designated waste rock storage area and can be considered for construction use outside of the pollution control area if it meets certain criteria (e.g. sulphur < 0.2%). There is no basis for the criteria provided. It is noted that 27% of diabase samples were classified as potentially acid generating (PAG) and 54% were classified as uncertain (Section 3.2, P6-14).
Recommendation	AANDC requests that the Proponent explain the basis for criteria selection to determine whether diabase can be used for construction outside the containment area.

Technical Comment Number: TC8	TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM-DOH1323 (Amendment No. 1) for Doris North Project
Technical Comment Source	AANDC
Issue	Monitoring mineralized rock
Reference	P5-4, Waste Rock and Ore Management Plan, Table 4
Observation	The waste rock segregation approach seems to rely on visual observations with confirmatory testing based on tonnage (min. 1 sample/10,000 tonnes rock). There is no discussion describing how the visual inspections will lead to segregation decisions.
Recommendation	AANDC requests that the Proponent provide an explanation of the basis for the waste rock segregation plan and the potential for acid rock drainage and metal leaching from "non-mineralized" rock.

4. Tailings Impoundment Area (TIA) Interim Dyke

Technical Comment Number: TC9	TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM-DOH1323 (Amendment No. 1) for Doris North Project
Technical Comment Source	AANDC
Issue	There is concern regarding the filtering capability of the Interim Dyke (proposed to be constructed from run of quarry) to retain tailings; also if mitigative measures are required (retrofitting upstream face with finer rock layer or geotextile), this will only be done after some tailings have passed into the Reclaim Pond. There is insufficient consideration of the effects of buildup of hydrostatic head on the Interim Dyke's upstream side if the rock becomes blinded.
Reference	P6-13,Tailings Management System; P6-10, Site-Wide Water and Load Balance; and AANDC IR#22 to the NIRB
Observation	The design of the Interim Dyke is such that the drainage rate through the Dyke exceeds the volume of supernatant water that will get added every day (SRK 2015 – Site-Wide Water and Load Balance Model Report) The Proponent has stated that the stability design has considered a hydrostatic head behind the Interim Dyke. The Proponent has further stated that some tailings may enter the Reclaim Pond and that this should not significantly affect water quality. The placement of layers on the upstream face while the Tailings Impoundment Area (TIA) is being used may be difficult to control and ineffective.
Recommendation	AANDC requests that the Proponent provide greater detail on how they will undertake the placement of layers on the upstream face while the TIA is in operation.

5. Closure Cost Estimate

Technical Comment Number: TC10	TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM-DOH1323 (Amendment No. 1) for Doris North Project
Technical Comment Source	AANDC
Issue	There is concern that water may build up adjacent to the toe of the thermal rock fill pads, and thus alter the thermal properties of the permafrost maintenance system.
Reference	Interim Closure and Reclamation Plan. July 2015 Detailed Cost Estimate
Observation	In previous geotechnical inspections it is stated that water should not be allowed to pond against the edges of the thermal rock fill pads. When this occurs ponded water must be pumped away, particularly after precipitation /melt events, since the standing water can change the thermal characteristics of the system and promote permafrost degradation. Generally, the proposed decommissioning of the rock fill pads is simply to regrade the surface. This does not address scenarios where water has historically ponded against the thermal pads. There is no explanation as to how this will be handled after closure.
Recommendation	AANDC requests that the Proponent provide an explanation of measures that will be implemented to ensure that water will not pond against the edges of the thermal rock fill pads after closure.

Information Request Comments

Amec Foster Wheeler has also reviewed the responses provided by TMAC Resources Inc. to initial Information Request prepared as part of the document Completeness Review. The provided responses are satisfactory. The information provided by the Proponent met the specific Information Requests, and there are no outstanding issues related to the Completeness Review.

The following tables provide background and responses to the Information Requests.

1. Water Quality

Regulatory Authority:	NWB	Information Request No.	AANDC 1
Information Request From:	Aboriginal Affairs and Northern Development Canada		
Information Request for:	TMAC Resources Inc.		
General Issue:	Water Quality		
References:	P2-1, Project Description with Executive Summary		

Issue/Concern or Information Deficiency:	On-site laboratory removed from scope of application
Rationale:	Existing water Licence includes commitment to build an on-site laboratory. Page v of Executive Summary states that "The revisions that TMAC is requesting to TIA water management (which include treatment, if needed) will ensure that discharge meets required criteria and as such, the on-site laboratory previously proposed by Miramar Hope Bay and described in the Project Certificate is no longer necessary." It is not clear how the improved water predictions with the revised TIA plan lead to the removal to the on-site laboratory as on-going water quality monitoring will be required.
Information Request:	Provide clarification or the methodology and rationale on how the improved water predictions can be verified if on-site water quality monitoring laboratory is not required.
TMAC Response	The on-site laboratory identified in the Project Certificate was required to confirm water quality met discharge criteria prior to discharge. Under the current Project Certificate and Water Licence, Tailings Impoundment Area (TIA) effluent is permitted to discharge seasonally into a low flow, sensitive freshwater creek, and so frequent monitoring during discharge was required. With the change to a marine discharge strategy, there will no longer be a discharge to the creek, so monitoring to the extent that an onsite lab would be needed is no longer required. Further, with the change in mill process from Merrill Crowe to resin in leach, and tailings disposal wherein leach tailings are disposed of underground instead of co-disposed in the TIA, source terms have changed and metals levels in the TIA effluent will be significantly reduced. Based on the water and load balance (document P6-10 submitted with the Application), metals are not predicted to be of concern; routine analysis provided by an off-site laboratory is sufficient to confirm effluent quality.
Comment	The response from TMAC meets the information request requirements. No further action is required.

Regulatory Authority:	NWB	Information Request No.	AANDC 2
Information Request From:	Aboriginal Affairs and Northern Development Canada		
Information Request for:	TMAC Resources Inc.		
General Issue:	Water Quality		
References:	P6-10, Site-Wide Water and Load Balance		
Issue/Concern or Information Deficiency:	Supporting document not included in the application		
Rationale:	Basis for process water source terms referenced in Section 4.2.4, P6-10 and for exposed tailings sources terms referenced in Section 4.2.6, P6-10 is a supporting document are not included in application. As a result there is insufficient information upon which to base an informed decision.		
Information Request:	Please provide "Geochemical Characterization of Tailings from the Doris Deposits, Hope Bay", dated April 2015 by SRK		
TMAC Response	"Geochemical Characterization of Tailings from the Doris Deposits, Hope Bay", dated June 2015 by SRK was provided with the Application as document P6-12. This is an updated version of the April 2015 version document; the document		

	reference date should have been listed as June 2015, not April 2015. The primary differences between the April version and June versions are editorial, not technical.
Comment	The response from TMAC meets the information request requirements. No further action is required.

Regulatory Authority:	NWB	Information Request No.	AANDC 3
Information Request From:	Aboriginal Affairs and Northern Development Canada		
Information Request for:	TMAC Resources Inc.		
General Issue:	Water Quality		
References:	P6-10, Site-Wide Water and Load Balance		
Issue/Concern or Information Deficiency:	Supporting document not included in the application		
Rationale:	Basis for some groundwater quality assumptions referenced in Section 4.2.3, P6-10, is in a supporting document not included in the application. As a result there is insufficient information upon which to base an informed decision.		
Information Request:	Please provide "Hydrogeological Modeling of the Proposed Doris Mine, Hope Bay Project", dated May 2015 by SRK		
TMAC Response	"Hydrogeological Modeling of the Proposed Doris Mine, Hope Bay Project", dated June 2015 by SRK was provided with the Application as document P6-3. This is an updated version of the May 2015 version document; the document reference date should have been listed as June 2015, not May 2015. The primary differences between the May version and June versions are editorial, not technical.		
Comment	The response from TMAC meets the information request requirements. No further action is required.		

Regulatory Authority:	NWB	Information Request No.	AANDC 4
Information Request From:	Aboriginal Affairs and Northern Development Canada		
Information Request for:	TMAC Resources Inc.		
General Issue:	Water Quality		
References:	P6-14, Waste Rock and Ore Geochemistry, Static Testing		
Issue/Concern or Information Deficiency:	Supporting document not included in the application		
Rationale:	Report makes several conclusions (e.g. kinetic test results) by referring to a supporting document not included in the application. As a result there is insufficient information upon which to base an informed decision.		
Information Request:	Please provide "Static Testing and Mineralogical Characterization of Waste Rock and Ore from the Doris Deposit, Hope Bay - Supporting Data", dated May 2015 by SRK		
TMAC Response	"Static Testing and Mineralogical Characterization of Waste Rock and Ore from the Doris Deposit, Hope Bay - Supporting Data", dated June 2015 by SRK was provided with the Application as document P6-14. This is an updated version of the May 2015 version document; the document reference date should have been listed as June 2015, not May 2015. The primary differences between the May version and June versions are editorial, not technical		
Comment	The response from TMAC meets the information request requirements. No further action is required.		

Regulatory Authority:	NWB	Information Request No.	AANDC 5
Information Request From:	Aboriginal Affairs and Northern Development Canada		
Information Request for:	TMAC Resources Inc.		
General Issue:	Water Quality		
References:	P6-14, Waste Rock and Ore Geochemistry, Static Testing		
Issue/Concern or Information Deficiency:	Lack of document describing water inflow to underground mine		
Rationale:	The basis for the quantity of Doris Lake water and groundwater into the mines is not provided. As a result there is insufficient information upon which to base an informed decision.		
Information Request:	Please provide the study describing the groundwater inflow predictions to the mine, including inflows from Doris Lake and groundwater.		
TMAC Response	The groundwater inflow predictions to the mine, including inflows from Doris Lake and groundwater, can be found in document P6-3 provided with the application: "Hydrogeological Modeling of the Proposed Doris Mine, Hope Bay Project", SRK 2015.		
Comment	The response from TMAC meets the information request requirements. No further action is required.		

2. Water Management and Treatment

Regulatory Authority:	NWB	Information Request No.	AANDC 6
Information Request From:	Aboriginal Affairs and Northern Development Canada		
Information Request for:	TMAC Resources Inc.		
General Issue:	Water Management & Treatment		
References:	P4, Identification of Potential Environmental Effects and Proposed Mitigation, Executive Summary		
Issue/Concern or Information Deficiency:	Potential effects from additional water losses from Doris Lake into the underground mine		
Rationale:	Water losses from Doris Lake are "predicted to result in serious harm to fisheries and an Offset Plan and DFO Authorization will be obtained"; however, that statement contradicts the following statement in Section 2.5.3: "it is anticipated that the drawdown of water from Doris Lake will not result in adverse effects on fish and fish habitat as natural variability in water level and ice thickness is similar to maximum predicted drawdown depth.		
Information Request:	Please provide information describing how estimated the losses from the lake are determined; what will happen to the lake as a result of these loses.		
TMAC Response	Information describing the groundwater inflow modelling is discussed in document P6-3, (Hydrogeological Model), submitted with the Application. As presented in document P4-1 (Effects Assessment, pg. 2-26) included with the Application, water balance modelling indicates that water removal from Doris Lake for industrial use, combined with seepage from the lake into the under round mine while mining in the talik, will drop the surface water level of the lake and decease the flow in the lake outflow. The hydrologic assessment indicates a lake level decrease of up to 0.23 m during winter; this change is within the natural range of water level and ice thickness and is not expected to result in adverse effects to fish and fish habitat in Doris Lake. To confirm this assessment, TMAC completed a field study on Doris Lake in fall 2015 and included a detailed habitat survey around the entire perimeter of the lake, focusing on the 1.5 to 4 m zone, the primary area of concern immediately below natural lake ice, where eggs and larvae left by fall-spawning fish overwinter. If the lake is drawn down below the natural range, eggs and alevins close to the ice could perish. In addition, hydroacoustics, gillnetting, angling, underwater video, and visual observations were used to further categorize lake habitats and to identify spawning fish locations within the lake. These field data will be summarized in Q4 2015 as part of the self-assessment process to determine effects. The field information will be assessed in conjunction with existing fisheries and hydrological baseline data to accurately quantify potential effects and if the analysis of the field program results do in fact indicate that the drawdown of Doris Lake will cause serious harm that cannot be avoided or mitigated, an offsetting plan will be developed		
Comment	The response from TMAC meets the information request requirements. No further action is required.		

Regulatory Authority:	NWB	Information Request No.	AANDC 7
Information Request From:	Aboriginal Affairs and Northern Development Canada		
Information Request for:	TMAC Resources Inc.		
General Issue:	Water Management & Treatment		
References:	P6-7, Roberts Bay Discharge System: Surface Infrastructure, Section 4		
Issue/Concern or Information Deficiency:	No sensitivity analyses reported (e.g. wet and dry years)		
Rationale:	It would be helpful to see sensitivity analyses reported for the hydrologic modelling. The report discussion is primarily based on average flows and reported conservative assumptions, but the basis for these assumptions are not demonstrated in detail. As a result there is insufficient information upon which to base an informed decision.		
Information Request:	Please provide an analysis of the hydrological effects on the design in wet and dry years and show how the system can handle the differing conditions.		
TMAC Response	The SRK water and load balance does include a stochastic analysis of variable hydrologic conditions illustrating the system sensitivity (P6-10 Water and Load Balance) included in the amendment application		
Comment	The response from TMAC meets the information request requirements. No further action is required.		

Regulatory Authority:	NWB	Information Request No.	AANDC 8
Information Request From:	Aboriginal Affairs and Northern Development Canada		
Information Request for:	TMAC Resources Inc.		
General Issue:	Water Management & Treatment		
References:	Multiple documents		
Issue/Concern or Information Deficiency:	Details of proposed treatment plant and/or management plan if fail guidelines		
Rationale:	A commitment is made to treat water before discharge if required, however no details are provided that might describe this contingency measure and/or what would trigger this type of action (beyond guideline failures, which may not provide sufficient warning to have a new treatment system in place). Depending on the type of treatment that may be needed, there could be a significant lead time. It is understood that current predictions are that no treatment will be needed beyond the existing management plans, however little rationalization is provided.		
Information Request:	Please provide a description of the management processes that will be in place to help ensure that sufficient early warning signals are built into the environmental management system such that the need for treatment, if required, can be pro-actively identified and installed before water quality criteria failures.		
TMAC Response	Water treatment has been identified by TMAC as a contingency measure in the event that conditions develop and water quality is not suitable for discharge to Roberts Bay. Together, the MMER, Water Management Plan and the Tailings Operation and Maintenance Surveillance Manual will detail the sampling frequency that will be implemented to enable detection of changes in water quality over time so that appropriate adaptive management action can be taken. A revised Water Management Plan was submitted with the application (document P5-3): the current approved Plan has been updated to reflect the proposed project changes, and will be revised again should the need for treatment arise. The Tailings OMS manual (analogous to the Tailings Management Plan) will be submitted to the NWB prior to the commencement of TIA operations. Should water treatment of tailings effluent water be required, TMAC will design and commission a waste water treatment facility.		
Comment	The response from TMAC meets the information request requirements. No further action is required.		

3. Report Presentation

Regulatory Authority:	NWB	Information Request No.	AANDC 9
Information Request From:	Aboriginal Affairs and Northern Development Canada		
Information Request for:	TMAC Resources Inc.		
General Issue:	Report Presentation		
References:	P5-4, Waste Rock and Ore Management Plan		
Issue/Concern or Information Deficiency:	Possible section missing		
Rationale:	A title page is provided for Module B, but there is no additional information provided. As a result there is insufficient information upon which to base an informed decision.		
Information Request:	Please provide the contents for Module B or indicate if this title page should be removed from the document.		
TMAC Response	The title page for Module B of the Waste Rock and Ore Storage Management Plan refer to Type B Water Licence for Madrid. The application for Madrid water licence is currently undergoing review and is outside the scope of the Doris application. Once the BB licence is administered, Module B will be updated to address terms and conditions of the BB licence. The Module B title page was included in the Waste Rock and Ore Storage Management Plan to illustrate the new modularized format of the Hope Bay management plans. Parties are directed to Module A for Doris-specific waste rock and management.		
Comment	The response from TMAC meets the information request requirements. No further action is required.		

Regulatory Authority:	NWB	Information Request No.	AANDC 10
Information Request From:	Aboriginal Affairs and Northern Development Canada		
Information Request for:	TMAC Resources Inc.		
General Issue:	Groundwater Management		
References:	P5-4 Waste Rock and Ore Management Plan & P5-2 Interim Closure and Reclamation Plan		
Issue/Concern or Information Deficiency:	Potential effects to groundwater and water bodies (e.g., Doris Lake) from the backfilling of materials impacted by ANFO and hydrocarbon spills.		
Rationale:	According to sections 2.3 and 2.5 of the Waste Rock and Ore Management Plan, material contaminated by ANFO and any fuel or lubricant spills will be hauled to the waste rock storage pile where it will be eventually used as backfill in the mine. However, section 1.4 of the Interim Closure and Reclamation Plan states that "no hydrocarbon contaminated soils will be disposed of underground." The backfilling of material impacted by ANFO or hydrocarbon substances can negatively impact the quality of groundwater and nearby water bodies.		
Information Request:	Please explain why materials impacted by ANFO and hydrocarbon substances will not be remediated on surface (e.g., landfarm) or removed to a hazardous waste management facility.		
TMAC Response	Placement of hydrocarbon-impacted materials underground is allowed for under the Current Water Licence 2AM-DOH1323 Part L, Item 6 (l). The 2015 Interim Closure and Reclamation Plan will be updated accordingly. Placement of ANFO-impacted material underground has been standard practice in mining for many years. As stopes are excavated underground, adjacent pillars need to be supported so that other parts of the orebody can be safely excavated. This represents an environmentally and technically acceptable way to eliminate the possible surface impacts of rock containing blasting products, as in the case at Doris, or which are acid generating. It also represents a beneficial use of waste material that if it were left on the surface could have negative environmental effects		
Comment	The response from TMAC meets the information request requirements. No further action is required.		

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Memorandum

Our file - Notre référence
IQALUIT-#1003083

To: Phyllis Beaulieu, Manager of Licensing, Nunavut Water Board

From: Amjad Tariq, Regulatory and Science Advisor, Water Resources, AANDC; and
David Abernethy, Water Resources Regional Coordinator, AANDC

Date: December 8, 2015

Re: Amendment Application No. 1 to Water Licence No. 2AM-DOH1323

Applicant: TMAC Resources Inc.
Project: Doris North Gold Mine
Region: Kitikmeot

Comments:

A. Background

On November 5, 2015, the Nunavut Water Board (NWB) invited interested parties to provide technical review comments on TMAC Resources Inc.'s (the proponent) application to amend the type A water licence for their Doris North Gold Mine, No. 2AM-DOH1323 (Amendment No. 1).

Interested parties were asked to provide comments by December 7, 2015. This deadline was extended to December 8, 2015 following a one day extension request that was submitted by Aboriginal Affairs and Northern Development Canada (AANDC or the department).

In addition to providing technical review comments, AANDC has commented on the proponent's October 8, 2015 written response to information requests that were provided in the September 18, 2015 Completeness Review and Initial Technical Assessment submission. Although the proponent is welcome to comment on all information request follow-up comments, clarification is required for information request nos. 11 and 13. Specific recommendations to the NWB are provided in information request nos. 14 and 16.

B. Results of review

On behalf of AANDC's Water Resources Division, the following comments and recommendations are provided below. The Table of Contents organizes Technical Comments and Information Requests by subject matter.

Table of Contents

1. Technical Comments

a. Tailings Management Strategies

Technical Comment Number: TC11	TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM-DOH1323 (Amendment No. 1) for Doris North Project
Subject	Tailings Management Strategies
Technical Comment Source	AANDC
Issue	In Section 3.3 (P6-13, Appendix B), the proponent states that, 'Alternative #4 – Subaerial hydraulic tailings deposition with a dry cover at closure:….The negatives include fugitive tailings dust, ice entrainment and possible limited availability of reclaim water.' 'Alternative #5 – Subaerial filtered (dry-stack) tailings deposition with a dry cover at closure……Drawbacks of this strategy includes…..compaction of the tailings and a requirement to manage fugitive tailings dust until such time as the closure cover is in place.' In section 4 (P6-13, Appendix B), the proponent states that,'The preferred tailings disposal strategy is sub-aerial slurry tailings deposition.'
Reference	P6-13 Tailings Management System: Appendix B – Tailings Management Strategies Alternatives Assessment Section 3.3 Alternate Tailings Desposition Methods (Package 6 Part 8, page 3-4, pdf page 13-14); and Section 4. Preferred Tailings Management Alternative **(**Package 6 Part 8, page 6, pdf page 16)
Observation	Fugitive tailings dust emissions associated with sub-aerial disposal of tailings during operational phases can be a major environmental concern. Wind-blown dust may impact the surrounding freshwater resources. The subaerial disposal of tailings has been proposed as 'subaerial hydraulic tailings (Alternate # 4)' and 'subaerial filtered or dry-stack tailings (Alternate #5)'. In order to understand the behavior of the dry tailings disposal in the Tailings Impoundment Area during operation, physical laboratory test results on tailings should be provided. These tests include particle size analysis (grain size distribution) and hydraulic conductivity test. In particular, a grain size distribution test of the tailings will provide the information on the level of fugitive dust emissions during the project's operational phases. The physical characterization of tailings will further help in the selection of an appropriate control technology to be implemented for dust suppression during the operational phases.
Recommendation	Please provide the physical test results of tailings including particle size analysis (grain size distribution) and hydraulic conductivity. The behavior of the sub-aerial tailings during project operations in light of the physical

	tests should be documented. Please provide information on the level of dust suspension (during operations) in light of the grain size distribution of the tailings. Details on the particular control measure(s) to be implemented should also be documented.

b. Sewage Treatment

Technical Comment Number: TC12	TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM- DOH1323 (Amendment No. 1) for Doris North Project
Subject	Sewage Treatment
Technical Comment Source	AANDC
Issue	In Section 3.2.8 (P6-10), the proponent states that, 'The sewage effluent rate was estimated assuming a unit rate of 0.15 m^3/day per person and a camp size of 280 people, which is 42 m^3/day (15,500 m^3/year). In Section 4.2.5 (P6-10), the proponent states that, 'Concentrations of treated effluent discharged to the TIA during operations are based on typical performance estimates from packaged sewage treatment plants. Table 4-4 provides the estimated sewage concentrations applied to the sewage effluent of 42 m^3/day during operations and for one year after closure.'
Reference	P6-10 Site-Wide Water and Load Balance: Section 3.2.8 Water Use (Package 6 part 5, page 10, pdf page 19); and Section 4.2.5 Sewage Water (Package 6 part 6, page 18, pdf page 3)
Observation	Table 4-4 (Sewage Effluent Source Term) provided by the proponent lists the estimated concentrations of the parameters of the treated sewage. In addition, the parameters required in the Water Licence, No. 2AM-DOH1323, have not been reported (i.e., pH, BOD_5, TSS, fecal coliforms, oil and grease, etc.). Details on the Packaged Sewage Treatment Plants in terms of contaminant removal efficiency and the actual concentration of the required parameters (including pH, BOD_5, TSS, fecal coliforms, oil and grease, etc.) to be discharged in the TIA have not been provided.
Recommendation	Please provide details on the Packaged Sewage Treatment Plants in terms of contaminant removal efficiency and the actual concentrations of the required parameters (including pH, BOD_5, TSS, fecal coliforms, oil and

	grease, etc.) to be discharged in the TIA.

c. Water Treatment

Technical Comment Number: TC13	**TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM-DOH1323 (Amendment No. 1) for Doris North Project**
Subject	Water Treatment
Technical Comment Source	AANDC
Issue	In Section 2.2 (P5-3, Extent of Infrastructure requiring water management), the proponent states that, 'Water that comes into contact with ore and waste rock may not meet effluent water quality discharge limits following the settling of suspended solids. Additional treatment of the contact water is expected.' In Section 5 (P6-12, Summary and Conclusions) the proponent states that, 'Process water chemistry associated with the tailings slurry samples, analyzed to provide an indication of possible water chemistry to be discharged to the tailings facility, indicated elevated levels for several aqueous phase metals that varied by tailings type and ore zone.' In Section 5 (P6-12, Summary and Conclusions) the proponent states that, 'Process water chemistry between the Doris Central, Doris Connector and Doris North solutions was notably different with the Doris Central process water characterized by higher metals. Chromium was elevated in all three solutions; molybdenum, and iron were elevated in both Doris Central and Connector solutions; while cadmium, copper, and zinc were elevated in Doris Connector and Doris North Solutions. The Doris Central and Doris North flotation tailings water were also elevated in silver and lead, and aluminum and arsenic, respectively.'
Reference	P5-3 Water Management Plan, 2.2.Extent of Infrastructure Requiring Water Management (package 5 part 6, page 4, pdf page 12) P6-12 Tailings Geochemistry, Geochemical Characterization of Tailings from the Doris Deposits, Hope Bay Section 5 Summary and Conclusions (Package 6, Part 7 Page 30, pdf page 91)
Observation	The proponent has a plan to discharge process water and floatation tailings in TIA. In light of laboratory test results, the process water will contain elevated concentrations of metals (cadmium, copper, zinc, chromium, molybdenum and iron) and arsenic. The water that will come in contact with ore and waste rock will also be loaded with contaminants.

	The floatation tailings water will contain elevated concentration of lead, silver, aluminum and arsenic. The details on water treatment system (s) have not been provided. In light of the laboratory test results, the treatment system to be used should be capable of removing different contaminants; therefore, the contaminant removal efficiency of the proposed system should also be analyzed.
Recommendation	The details on water treatment system (s) should be provided. The efficiency of the proposed water treatment system (s) should be analyzed in terms of contaminant removal efficiency.

2. Information Requests

a. Water Management Plan

Information Request Number: AANDC 11	TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM-DOH1323 (Amendment No. 1) for Doris North Project
Subject	Water Management Plan
Technical Comment Source	AANDC
Issue	Water quality criteria for any potential discharge into the marine environment is included within the Water Licence.
Reference	P5-3 Water Management Plan, A 5.1 - Water Management During Operations Package 5, Part 6 Page 7 (pdf page 27)
Observation	The proponent states, 'During operations, mill effluent, surface runoff water, precipitation and contact water accumulating in the sediment control pond, pollution control pond (PCP) 1, landfill sump and Pad U (PCP 2) will be pumped to the TIA.', and, 'Excess water will be pumped from the TIA to the Marine Outfall Mixing Box located in the mill building, and then be pumped via a pipeline along existing corridors to the Roberts Bay Discharge System.' In order to discharge the effluent into the marine environment, water quality criteria should be the part of the Water Licence. In this regard, the proponent has used CCME water quality guidelines for marine aquatic life to evaluate the water quality requirements for the proposed discharge.
Information Request	Please provide proposed effluent discharge criteria for marine disposal both with respect to the CCME Canadian Water Quality Guidelines for the

	Protection of Aquatic Life as well as the Metal Mining Effluent Regulations.
TMAC Response	Effluent criteria are provided in Table 4.5-3 of document P4-1 (Effects assessment; 3rd column) for all considered marine Canadian Council of Ministers of the Environment (CCME) water quality (WQ) parameters. CCME guideline concentrations were outlined in Table 4.5-1 of document 4.5-3 (3rd column). Metal Mining Effluent Regulations (MMER) WQ parameters were not presented explicitly in document P4-1. Effluent discharge criteria are also presented in Table 5-2 of the water and load balance model (document P6-10) submitted with the Application, and Table A5 of the Water Management Plan (document P5-3).
AANDC Response	The proponent's response requires further consideration before setting effluent discharge criteria. For instance, the allowable concentration of Arsenic in the tailings impoundment area is 0.960 mg/L (Table 4.5-3 of document P4-1) and the MMER limit for Arsenic is 0.5 mg/L (Table A5 of document P5-3). The allowable concentrations of Cadmium and Mercury are greater than the CCME limits presented in Table A5.

b. Waste Rock and Ore Management Plan

Information Request Number: AANDC 12	TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM-DOH1323 (Amendment No. 1) for Doris North Project
Subject	Waste Rock and Ore Management Plan
Technical Comment Source	AANDC
Issue	Concern that the volume of the excavated material (waste rock) will be much larger than the available volume of the cavities for the underground disposal.
Reference	P5-4 Waste Rock and Ore Management Plan, 2.1.Metal Leaching and Acid Rock Drainage (ML/ARD) Potential-Waste Rock (Waste Classification) Package 5, Part 6 Page 5 (pdf page 41)
Observation	The proponent states: 'Mine planning indicates there is sufficient capacity to place all waste rock underground at closure.' However, a large quantity of waste rock can be sent back in to the cavities as backfill but all the waste rock may not be sent underground.
Information Request	Please provide an explanation on how all the waste rock can be placed underground as backfill at closure taking into consideration that the volume of excavated material will be much larger than the volume of the underground cavities.
TMAC Response	Refer to Table A1 of document P5-4, Waste Rock and Ore Management Plan, submitted with the Application. This table illustrates the mining

	schedule including production of ore and waste rock. Over the life of mine, about 3.9 M tonnes of ore and waste rock will be extracted from the underground mine (2,399,000 tonnes of ore and 1,523,000 tonnes of waste rock). The in-situ density of the rock is about 2.89 tonnes/m^3 yielding a total available void space of about 1.4 Mm^3. The 1.5 M tonnes of waste rock will be returned back underground as backfill, but will be subject to bulking during excavation, and subsequently compaction when placed underground. A reasonable swell factor of 1.34 can be assumed for this material which means that the waste rock will require a void space of 0.71 Mm^3 which is 52% of the available space. About 6% of the tailings are leach tailings and will be used for backfill. They will be compacted to a density of 1.4 tonnes/m3 and will occupy a void space of about 0.10 Mm^3. Therefore the total void space required for backfill in the mine is about 0.81 Mm^3 which is 60% of the available void space.
AANDC Response	AANDC is satisfied with the proponent's response.

c. Tailings Management Plan

Information Request Number: AANDC 13	**TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM-DOH1323 (Amendment No. 1) for Doris North Project**
Subject	Tailings Management Plan
Technical Comment Source	AANDC
Issue	Concern that the strategy proposed by the proponent will accumulate a large volume of potentially acid generating (PAG) material and detoxified tailings underground. The detoxified tailings with acidic pH and elevated concentration of Cd, Co, Cu, Fe, Mn, Ni, Pb, and Zn can contaminate underground water.
Reference	P6-13 Tailing Management System, 2.2 New Tailings Storage Requirements Package 6, Part 7 Page 4 (pdf page 104) Geochemical Characterization of Tailings from the Doris Deposits, Hope Bay 5 Summary and Conclusions Package 6, Part 7 Page 30 (pdf page 91)
Observation	About 6% (i.e. 150,000 tonnes or 116,000 m3) of the tailings are comprised of detoxified cyanide leach tailings, and this tailings stream will be sent underground where it will be mixed with underground waste rock for use as structural mine backfill.' The proponent states, that 'The detoxified tailings also showed a propensity for leaching of several metals in the humidity cell tests. In addition to arsenic, neutral pH metal leaching of ammonia, cadmium,

	copper, iron, selenium and silver was reported in the Doris North detoxified tailings, and cadmium and selenium in the Doris Central detoxified tailings. Acidic conditions developed in the Doris Central detoxified tailings after 202 weeks of testing. At acidic pH, increased metal leaching of Cd, Co, Cu, Fe, Mn, Ni, Pb, and Zn was noted.' The potential leaching of contaminates under low pH conditions can be a significant source of underground water contamination.
Information Request	Please provide an analysis of the combined impact of detoxified tailings and backfilled PAG waste rock on groundwater.
TMAC Response	The project is not anticipated to have significant adverse effects to groundwater quality outside the underground mine zone, given that the mine is located in permafrost. During operations, the underground workings will intersect groundwater flow and act as a sink; i.e. the volume and/or pressure within the collected groundwater will not result in flow out of the working into the groundwater regime. This groundwater collected in the mine operations will be managed as outlined in document P5-3 (the Water Management Plan) section A.4 to ensure effects to surface and groundwater quality and quantity is mitigated. The Site Water Management Plan will be updated on a regular basis as per terms and conditions of the current Type A Water Licence incorporating ongoing data collection, mining planning and operational needs. During operations, waste rock and detoxified tailings will be placed underground for mine stability and long term disposal. Depending on operational needs, these areas will be allowed to fill with groundwater to promote freeze back conditions and to get the reactive material under a water cover in a timely manner to minimize oxidation reactions. Time needed to fill the underground workings will depend on mine operations, and the remaining space after placement of waste rock and detoxified tailings. This timeframe is related to closure effort and will be part of technical discussions for the closure plan and ongoing effort during mine operations to revise and update the closure plan as per the current Type A Water Licence and KIA Commercial Lease Agreements. At closure, all the mine workings will be flooded and those areas outside the talik will freeze and those areas within the talik will go through a seasonal freeze/thaw cycle. The mine geometric design is such that the final expected groundwater elevation is well below any surface openings and therefore mine water outflow to the environment cannot occur.
AANDC Response	The proponent must ensure that the backfilling of acid generating materials with elevated concentrations of the contaminants will not contaminate groundwater. Evidence for non-contamination should also be provided in annual reports.

Information Request Number: AANDC 14	TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM- DOH1323 (Amendment No. 1) for Doris North Project
Subject	Tailings Management Plan
Technical Comment Source	AANDC
Issue	Concern that the strategy proposed by the proponent will accumulate a large volume of potentially acid generating (PAG) material and detoxified tailings underground. The detoxified tailings with acidic pH and elevated concentration of Cd, Co, Cu, Fe, Mn, Ni, Pb, and Zn can contaminate underground water.
Reference	P6-13 Tailings Management System, Doris North Project: Tailings Management Strategies Alternatives Assessment, 2.1 Tailings Make-up Package 6, Part 8 Page 1 (pdf page 11)
Observation	The proponent states, that 'This containment would be in the form of a thermal cover that would ensure that the tailings surface remain perpetually frozen, or a synthetic cover such as a High Density Polyethylene (HDPE) or Geosynthetic Clay Liner (GCL). Preliminary thermal modeling suggests that a thermal cover constructed from quarry rock would have to be in the order of 4 to 5 m thick.'
Information Request	Please provide a detailed design of the final cover system(s) to deal with potential acid generation and metal leaching processes. Measures to control surface and underground water contamination due to potential precipitation and possible temperature rise should also be documented.
TMAC Response	The tailings have been classified as non-acid generating with potential for neutral metal leaching. A source load associated with the tailings has been developed and incorporated into the site wide water and load balance model (Document P6-10, already submitted with the application). The model indicates that the design of the tailings cover does not need to reduce water infiltration or oxygenation as contamination of surface or subsurface waters are not predicted. Based on these results, TMAC believes that all of the information needed for the review is included in the Application. The design of the final cover will be provided to the NWB prior to its construction.
AANDC Response	AANDC recommends that the final cover system design be provided to the NWB for approval prior to its construction in light of the Proponent's commitment.

d. Interim Closure and Reclamation Plan

Information Request Number: AANDC 15	TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM-DOH1323 (Amendment No. 1) for Doris North Project
Subject	Interim Closure and Reclamation Plan
Technical Comment Source	AANDC
Issue	Concern about the assumed percentages for the cost estimate.
Reference	Interim Closure and Reclamation Plan, July 2015 – Detailed Cost Estimate, Appendix A. Cost Estimate Page 3 (pdf page 11)
Observation	The proponent has assumed the following percentages in the cost estimates without supporting justification: • re-slope to 3H:1V (30%); • grade top for positive drainage (60%); and • install erosion protection measures (10%)
Information Request	Please provide the basis for the assumed percentages.
TMAC Response	Assumptions used in the development of the cost estimate for the Interim Closure and Reclamation plan are included in the document appended to the Application as P5-2. TMAC is willing to address any specific questions the reviewer may have, as appropriate during the Technical Review.
AANDC Response	The proponent's response will be taken into account in light of the department's Independent Reclamation and Closure Cost Estimate.

e. Madrid Advanced Exploration

Information Request Number: AANDC 16	TMAC Resources Inc.'s Application to amend the Type A Water Licence, No. 2AM-DOH1323 (Amendment No. 1) for Doris North Project
Subject	Madrid Advanced Exploration
Technical Comment Source	AANDC
Issue	Impact of Madrid Advanced Exploration Project to Doris North Facilities
Reference	Application for a new type B water licence, No. 2BB-MAE----
Observation	According to the submitted application for a new type B water licence specific to the Madrid Advanced Exploration Program, the Doris North mill will be used to process two 50,000 tonne bulk ore samples from the Madrid North and Madrid South deposits and the tailings impoundment area will be used to manage the resultant tailings and all contact water that does not meet discharge criteria (including saline groundwater). The design of the Doris North facilities should take into consideration the impact of the Madrid Advanced Exploration Program if it is licensed by the Nunavut Water Board.
Information Request	Explain whether the proposed amendment to the Doris North Gold Project's type A water licence considers the impact of developing the Madrid Advanced Exploration Project.
TMAC Response	While the Doris facilities have the capacity to support use by future development in the Hope Bay Belt, the scope of the Amendment Application is limited to the Doris Mine. Consideration of future developments in the Hope Bay Belt, including the Madrid Advanced Exploration Project, and their associated impacts should be considered as either a separate application or a future amendment to an existing licence, as appropriate. Accordingly, TMAC respectfully requests that the consideration of Madrid use of Doris infrastructure be considered in the Madrid Type B water licence process.
AANDC Response	The proponent's application for a new type B water licence specific to the Madrid Advanced Exploration Project should only be processed if the proposed activities are included in the scope of an application to amend the current type A water licence specific to the Doris North Project. Because Doris North Project facilities will be utilized by the Madrid Advanced Exploration Project, the potential impacts of this shared use should be assessed under the type A water licence.