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NIRB file # - 12MN001
NWB File No: 2AM-DOH1323/
Amendment No.1
NRCan # - NT- 006

September 18, 2015

Kelli Gillard
Technical Advisor, Technical Services
Nunavut Impact Review Board
P.O. Box 1360
Cambridge Bay, NU, X0B 0C0
Via electronic mail to: info@nirb.ca

Phyllis Beaulieu,
Manager of Licensing
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1J0
Via electronic mail to: Phyllis.Beaulieu@nwb-oen.ca

Re: Request for Public Comment Regarding TMAC Resources Inc.'s Application for NLCA 12.10.2(b) Exception – Hope Bay Phase 2 Project

Dear Ms. Gillard and Ms. Beaulieu,

In response to the Nunavut Impact Review Board's (NIRB) and the Nunavut Water Board's (NWB) letters, both dated August 21, 2015, Natural Resources Canada (NRCan) has reviewed TMAC Resources Inc.'s (TMAC) amendment application which outlined proposed amendments under section 12.8.2 of the NLCA to the NIRB Project Certificate [No. 003] and Nunavut Water Board (NWB) Type A Water Licence 2AM-DOH1323 (known collectively as the "2015 amendment application") for proposed modification to the Doris North Gold Mine Project (the Project).

NRCan has identified three information requests for the NIRB's and the NWB's consideration, which are included in the attachment to this letter.

NRCan appreciates the opportunity to provide information requests. Should you have any questions, please do not hesitate to contact Kate Cavallaro at (613) 996-0055 or by email at Kathleen.Cavallaro@nrcan.gc.ca.

Sincerely,

[Original signed by]

Susan Masswohl
A/Director, Environmental Assessment Division
External Relations

Science and Policy Integration
Natural Resources Canada

cc: Rob Johnstone, NRCan (Minerals and Metals Sector)
Matthew Spence, Director General, Northern Projects Management Office

Natural Resources Canada's Information Requests for the Review of Doris North Mine Amendment Application

1. Area of Expertise: Permafrost

Documents Reviewed:

2015 Amendment Application (June 2015):

- Package 1 – Project Summary
- Package 2 – Project Description
- Package 3 – NIRB and NWB Application
- Package 4 – Identification of Potential Environmental Effects and Proposed Mitigation
- Package 5 – Management and Other Plans
- Package 6 – Engineering and Design Documents

Introduction:

TMAC's amendment application included a revised project description which identifies a revision of the design of the Tailings Impoundment Area (TIA), which is a key change from the 2013 amendment application. The project (approved in 2006) consisted of subaqueous tailings disposal with a water cover at closure. The 2013 amendment application also proposed subaqueous tailings disposal with a reduced water cover at closure. Subsequent modification to mine plans and an anticipated increase in tailings volume necessitated a further modification to the TIA to handle an increased tailings volume. The revised project description now consists of subaerial tailing deposition and a dry cover at closure.

NRCan's permafrost review focussed on the revised plans for the TIA and potential issues of stability of the foundation and tailings containment structures. NRCan requests additional clarifications to aid in its technical review as outlined below.

NRCan Information Request 1 (NRCan IR-1):

Subject: Design and stability of the proposed Tailings Impoundment Area (TIA)
Reference: Package 2 (3.5), Package 6 (P6-13), Package 5 (P5-2 sec 2.9, 3.7, 5.9; P5-3 sec 2.4, 2.6, 2.8)

Rationale:
A significant modification to the Project is the design of the TIA. The approved Project consisted of subaqueous disposal of tailings and a water cover at closure. The planned extension of underground mining means that a greater volume of tailings will be produced and these cannot be accommodated in the TIA that was originally approved. Subaerial deposition (slurry deposition) of floatation tailings is now proposed. Tailings will be deposited in the south end of the TIA between the South Dam and an Interim Dike (new feature). Closure will include a dry cover. Leach tailings which are potentially acid generating will be disposed of as mine backfill.

It is NRCan's understanding that the approved TIA was considered to be a walk-away-solution for tailings disposal with no need to ensure integrity of the dams in perpetuity. Under the revised

plan for the TIA, the dams and dikes will need to remain in perpetuity. It is therefore not clear whether a site presence and monitoring will be required over the long-term following closure to ensure stability of the TIA including dams and dikes.

Freezing of the tailings pile and the foundation (i.e. current unfrozen lake bed sediments) is anticipated and will enhance performance of the TIA. It is unclear whether the potential for frost heave within the tailings (or the foundation materials) and its potential effect on performance of the protective cover (due to deformation) and the pile stability has been considered in the impact analysis. It is also not clear whether pore water expulsion during freezing of the tailings and potential migration of contaminants into the underlying talik and shallow groundwater has been considered in the impact analysis.

Information Request:

a. Please clarify whether frozen conditions in the tailings pile and foundation are required to ensure long-term performance of the TIA.
b. Please clarify whether a site presence and ongoing monitoring beyond closure is required to ensure the integrity of the TIA, including dams and dikes, over the long-term.
c. Please clarify whether the potential for frost heave, associated with freezing of the tailings and the underlying foundation materials, has been considered in the stability analysis including the potential for deformation and impacts on performance of the protective cover.
d. Please clarify whether pore water expulsion during freezing of tailings and potential impacts on shallow groundwater has been considered in the impact analysis.

2. **Area of Expertise:** Hydrogeology

Documents Reviewed:

2015 Amendment Application (June 2015):

- Package 1 – Project Summary
- Package 2 – Project Description
- Package 3 – NIRB and NWB Application
- Package 4 – Identification of Potential Environmental Effects and Proposed Mitigation
- Package 5 – Management and Other Plans
  - P5-2 Interim Closure and Reclamation Plan
  - P5-3 Water Management Plan
  - P5-4 Waste Rock and Ore Management Plan
- Package 6 – Engineering and Design Documents
  - P6-3 Groundwater Inflow and Quality Model
  - P6-4 Landfill
  - P6-10 Site-Wide Water and Load Balance
  - P6-12 Tailings Geochemistry
  - P6-13 Tailings Management System

Introduction:

TMAC's revised project description (June 2015) outlines several changes from the 2013 amendment application which could have an impact to groundwater. These changes include: (1) revision of the design of the Tailings Impoundment Area (TIA) to subaerial deposition with

dry cover at closure; (2) disposal of cyanide leach tailings as backfill into the underground mine; and (3) the use of Quarry 3 for the disposal of non-hazardous waste.

Following from the permafrost gap analysis (NRCan IR 1), additional clarification is needed with respect to whether frozen conditions in the tailings pile and foundation are required to achieve acceptable seepage rates from the TIA and to minimize impacts to groundwater. Clarification is also needed on whether pore water expulsion during freezing of tailings will have an impact on shallow groundwater. A response to the permafrost Information Requests 1-1 and 1-4 will likely provide sufficient information to clarify these issues. However, an additional IR with respect the TIA is presented below as NRCan IR 2.

Numerical groundwater modeling has been completed using the modeling software FEFLOW to model the talik beneath Doris Lake. The model is well documented and provides detailed information on groundwater inflows into the underground mine. According to the proponent, by year 6, after the last stope is mined, the total inflow to the mine is predicted to be approximately 1,630 m^3/d. Approximately 70% of the mine inflow is associated with water from Doris Lake with the remainder coming from deep regional groundwater. However, NRCan was unable to locate information on groundwater flow into the underground mine once mining has ceased. An additional IR with respect to the post-mining groundwater flow regime in the vicinity of the underground mine is presented as NRCan IR 3.

The Quarry 3 Landfill is a non-hazardous waste facility, situated in a quarry within the watershed of the TIA. The landfill will be constructed on competent bedrock within a region of continuous permafrost and will be hydrogeologically isolated due to the presence of permafrost. Any leachate generated is expected to be minimal, non-contaminated, and will accumulate in a sump incorporated into the landfill design. In the event that contaminated leachate is produced, it will accumulate in the sump and be sampled before being pumped or flowing naturally to the TIA prior to discharge to the environment. NRCan did not note any gaps in the proponent's assessment of potential impacts to groundwater resulting from this landfill.

NRCan Information Request 2 (NRCan IR-2):

Subject: Seepage from the proposed Tailings Impoundment Area (TIA)
Reference: Package 2 (3.5, 3.6), Package 5 (P5-2), Package 6 (P6-13)

Rationale:
NRCan requests clarification as to whether the proponent has considered how the proposed change to subaerial tailings deposition may affect shallow groundwater quality in the active layer of the permafrost. In addition to monitoring permafrost conditions and ground stability, it may be necessary to monitor seepage rates and groundwater quality of seepage water from the TIA. Such monitoring could be used to ensure that predicted seepage rates and groundwater quality are accurate.

Information Request:

Please clarify whether long-term monitoring of seepage rates and shallow groundwater quality in the vicinity of the TIA will be included in the monitoring plans.

NRCan Information Request 3 (NRCan IR-3):

Subject: Post-mining groundwater flow regime around the underground mine
Reference: Package 5 (P5-2), Package 6 (P6-3)

Rationale:
NRCan requests clarification as to how groundwater flow into the underground mine will change once mining has ceased. NRCan requests clarification on how groundwater inflow rates will change and an approximate time frame for when the groundwater system will reach a post-mining state of equilibrium. This information will assist in confirming that the long-term potential contaminants in the underground mine (resulting from disposal of waste) do not have an effect on local groundwater that surrounds the underground mine. Such contamination could potentially occur if there is a groundwater flow reversal once a mine has filled with surface water and groundwater.

Information Request:
a. Please provide clarification on the post-mining groundwater flow regime in the vicinity of the underground mine.
b. Please provide information on the time required for the underground mine to fill and clarification on post-mining groundwater regime (flow directions and rates) and potential impacts to the groundwater quality.