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Hope Bay Belt Project Scientific Research - Project Description

TMAC Resources Inc. (TMAC) is requesting a three year renewal of the Hope Bay Belt Project Land and Water Scientific Research Licence to allow the continuation of both compliance and baseline monitoring throughout the Hope Bay Belt ("Belt") until January 2020.

The Hope Bay Belt is a north-south oriented mineralized zone approximately 100 km long and 20 km wide located near Hope Bay, Melville Sound, Nunavut. TMAC's Hope Bay Project includes the permitted Doris North Gold Mine Project ("Doris"; Nunavut Impact Review Board Amended Project Certificate No.003; Type A Water Licence 2AM-DOH1323) as well the Boston and Madrid deposits which are currently in the exploration phase permitted under existing Type B Water Licences 2BB-BOS1217 and 2BE-HOP1222. A comprehensive range of scientific research supporting these projects will be conducted in fulfillment of compliance requirements of existing and anticipated permits, licences, leases and authorization, as well as to support applications for future development. This research is a continuation of that evaluated and conducted previously (NIRB file number of 09YN022; NRI Scientific Research Licence # 04 005 16R-M).

The research objectives of this program remain the same as those previously licenced; namely to conduct monitoring and baseline research in support of the permitted Hope Bay Belt Projects and to support future development applications. Study areas will also remain the same as previously licenced, and are focused on the Hope Bay Belt and the surrounding area. The scope of activities undertaken will comply with existing regulatory authorizations held by TMAC for the Hope Bay Belt Projects, including the Amended Doris Project Certificate, water licences, land use permits, and fisheries authorizations. Data will be compiled into baseline or monitoring reports.

The Belt is fly in/fly out access, and research personnel will be housed in existing camps and comply with project-applicable waste and water management procedures as outlined in licences/permits and approved management plans for the Hope Bay Belt projects. Field survey work may be conducted by helicopter, fixed wing plane, truck, boat, snowmobile or foot, depending on work scope. Sampling and compliance monitoring will focus on areas of both present and proposed development, access

corridors, including in the marine environment, as well as in reference areas located further from infrastructure.

Hope Bay Project land and water research program necessarily includes all studies required for mine permitting and compliance. The proposed research is outlined below and a map of the study area has been included with this submission. Study components may include:

1. Air quality and dust
2. Meteorology and wind
3. Noise
4. Geotechnical
5. Ground temperature
6. Groundwater
7. Geochemistry
8. Hydrology
9. Bathymetry
10. Aquatics (marine and freshwater)
 - a) Water column structure
 - b) water and sediment quality
 - c) aquatic biology
 - d) fish and fish habitat
11. Soils and vegetation
12. Wildlife
13. Archaeology

1. Air quality and dust

Air quality monitoring may be conducted year-round and include use of a passive air sampling system (PASS) to monitor nitrogen dioxide (NO₂), sulphur dioxide (SO₂) and ozone (O₃) and Partisol ambient air samplers (or other active air samplers) to quantify Total Suspended particulate (TSP), Particulate Matter with aerodynamic diameters or less than 10 micrometers (PM₁₀) and Particulate Matter with an aerodynamic diameter of less than 2.5 microns (PM_{2.5}). Dust deposition may be quantified using dustfall canisters, as well as snow core sampling during winter. Air quality and dustfall monitoring will predominantly focus on fulfilling compliance commitments related to the Doris North Project, and will include dustfall monitoring around Doris infrastructure, reference sites, and possibly baseline characterization locations.

Incinerator stack testing may also be conducted where triggered under the Canada Wide Standards to monitor emissions of dioxins, furans and mercury concentrations.

2. Meteorology

Meteorological monitoring is a requirement set out in the Amended Doris Project Certificate N0.003. Meteorology data would be collected by meteorological stations that would continuously record information on winds, light, precipitation, humidity, temperature and other meteorological characteristics. Dedicated wind towers may be installed on site to assess potential wind resources.

3. Noise

Noise monitoring requirements are set out in the Amended Doris Project Certificate No. 003 and specified in the Doris Noise Abatement Plan (HBML 2012). Noise level data collection would involve the use of temporary sound meters. Meters are placed at various locations from infrastructure for a short period of time (e.g., 24 hours) to record ambient sound levels. Noise monitors may also be used to collect data on sound related to specific activities or in specific locations.

4. Geotechnical

Geotechnical assessments of ground conditions in areas of proposed future development may be conducted. These studies may include general surface evaluations or core sampling of substrates, overburden and rock, with the use of drills.

5. Ground temperature

Ground temperature monitoring will be conducted in compliance with project requirements and to support future development applications and project management procedures. Ground temperature may be measured at various depths with thermistor strings.

6. Groundwater

Groundwater characterization studies may involve installation and monitoring of near surface and deep groundwater monitoring wells. Shallow groundwater flow and chemistry monitoring will use small diameter pipes installed in the active layer in areas of interest surrounding historical, existing or potential development. Deep groundwater wells have been installed near deposit areas and monitoring of these sites may be conducted in future years, and/or additional wells installed.

7. Geochemistry

Geochemical characterization of rock and rock seepage will be conducted support of compliance activities and future development applications. Sampling may include collection of rock and tailings for chemical characterization as well as metal leaching and acid rock drainage assessments. Geochemical sampling may also include monitoring of seepage water surrounding development areas. Geochemical characterization studies will focus on development areas.

8. Hydrology

Lake level hydrometric stations are currently installed in various lakes and monitor water levels year round to support compliance with existing permits and licences, and to characterize the existing environment in support of future permitting applications. Lake level hydrometric stations will continue to be monitored and surveyed as needed and new stations may be installed to support project development.

Stream hydrometric stations are installed in the open water seasons in streams near to current proposed development and may be installed in reference locations. Field visits include water level surveying and stream discharge measurements. Data will be used to support compliance programs and future development applications.

9. Bathymetry

Lakes, marine bays, and other waterbodies in the study area could be mapped for bottom depths. Bathymetric surveys are generally conducted by small boat or from the ice surface, using depth sounders or ground penetrating radar and GPS technology to survey bottom depth in a gridded manner. Data will be collected to comply with the Type A water licence and Fisheries Authorization No Net Loss Plan requirements, as well as to determine appropriate under ice water withdrawal volumes and to inform water balance models and fisheries habitat assessments of waterbodies surrounding development areas.

10. Aquatics (marine and freshwater)

Aquatic studies may be conducted in both freshwater and marine systems surrounding the development areas as well as at reference locations. Studies may include characterization of water column structure and oceanographic process, water and sediment quality, aquatic biology and fish communities of both marine and freshwater systems.

Aquatic studies are conducted to comply with Hope Bay Belt water licences, the Aquatic Effects Monitoring Plan, under the Metal Mining Effluent Regulations and associated Environmental Effects Monitoring Program. These studies are also conducted to ensure potability and suitability of water used on the Belt, and to compile baseline data in support of future development applications.

a) Water Column Structure

Marine and freshwater systems may be profiled for temperature, oxygen content, conductivity, pressure (depth), pH, and other parameters. Sampling will be conducted in the field at near-development and reference sites using handheld field probes or by sample collection similar to water quality sampling described below.

Oceanographic process may also be characterized with current meters installed for defined periods of time in marine bays. These studies would inform models of water dispersion and flushing rates, supporting confirmation of project compliance or future development proposals.

b) Water and Sediment Quality

Water samples could be collected around the project site and from lakes, streams or marine bays close to development areas as well as at reference sites. Samples may be collected year-round and would be analyzed for a variety of parameters.

Sediment samples could also be collected to characterize sediment properties.

c) Aquatic Biology

Samples may be collected for quantification and characterization of algal, zooplankton (small animals living in the water column) and benthic (small animals living in or on the sediments) communities. Sampling locations would be a subset of those sampled for water quality.

d) Fish and Fish Habitat

Fish (including shellfish) communities could be studied in some of the streams, lakes and oceans using various methodologies to determine species presence, densities, and various biometrics, such as age, sex, condition, or tissue metal content. Sampling will include required monitoring and compensation programs under Fisheries Authorization No Net Loss Plans as well as to characterize the existing environment surrounding potential development areas. Such sampling would occur only with any required additional permits such as Fisheries and Oceans Canada Licence to Fish for Scientific Purposes and an Animal Use Protocol.

Fish habitat may be characterized in terms of water quality and physical limnology, habitat mapping, electro-fishing, sediment and benthos sampling or current characterization.

11. Soils and Vegetation

Plant species and soil types could be characterized through ground based surveys. Plants would be identified and counted, and samples of those consumed by wildlife could be removed for analysis. Soils and terrain from around the site could be identified, described, and analyzed for content and properties. Aerial photographs may also be collected for mapping purposes.

Samples collected may be used to inform or confirm remediation or management actions and/or be used to characterize the existing environment in areas of potential future development.

12. Wildlife

Wildlife mitigation and monitoring requirements related to Hope Bay Belt projects are set out in the Amended Doris Project Certificate, the KIA Framework Agreement, and have been agreed to through discussions with NIRB, the Kitikmeot Inuit Association, Environmental and Climate Change Canada, the Government of Nunavut Department of Environment and the Canadian Wildlife Service. Wildlife surveys and monitoring will focus on species identified in the Doris Wildlife Mitigation and Monitoring Program, as well as those considered as possibly valued ecosystem components related to future project development applications. Studies groups may include caribou, muskox, carnivores, small mammals, upland birds, waterfowl and raptors. Marine seabirds and mammals could also be included. A Wildlife Research Permit will also be obtained for these studies.

Wildlife studies may include:

- Camera monitoring of large mammals
- Aerial (fixed-wing, helicopter or drone) surveys for mammals, waterfowl and raptors
- Ground-based surveys for birds as well as other wildlife
- Den surveys for bear, wolverine, wolves, or foxes
- DNA hair collection for large mammals
- Track surveys for wolverine

12. Archaeology

Archaeological studies will be conducted in areas of proposed development or use. Studies may include aerial evaluation of an area's likelihood to contain archaeological sites, as well as foot-based screening surveys and may include mitigation where necessary and approved by the territorial archaeologist. Permits to conduct these studies are applied for from the Government of Nunavut Department of Culture and Heritage.