



Goliath Gold Project Preliminary Environmental Monitoring Program Addendum

Goliath Gold Project
Treasury Metals Inc.

Prepared for:

Treasury Metals Inc.

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GOLIATH GOLD PROJECT PRELIMINARY ENVIRONMENTAL MONITORING PROGRAM ADDENDUM

M1 INTRODUCTION

Information regarding the monitoring program was provided in Section 13 of the Follow-Up and Monitoring Program in the revised EIS (April 2018). As part of the Round 2 Information Request Process, in TMI_869-EA(2)-01, Treasury Metals was asked to provide a preliminary Environmental Monitoring Program (separate from the EIS Follow-up Program) that conforms to the requirements of the EIS Guidelines. This report should be reviewed in consideration of the Goliath Gold Follow-Up Addendum (provided under separate cover) which describes measures to confirm EIS predictions.

As per the EIS Guidelines for the Goliath Gold Project (provided as Appendix Y of the EIS [April 2018]), the goal of a monitoring program is to ensure that proper measures and controls are in place in order to decrease the potential for environmental degradation during all phases of project development. A finalized monitoring program is not required at this stage of the Project according to the EIS Guidance's for the Goliath Gold Project. The finalization of a detailed monitoring program will occur through consultation with Federal and Provincial government agencies, Indigenous communities, the public and other stakeholders, which will occur after the environmental assessment but will be consistent with the information presented in the EIS (April 2018). The final monitoring program will provide the key information such as contacts, protocols, measured parameters, schedules, intervention in case of non-compliance of legal requirements and production of monitoring reports.

The monitoring program describes monitoring activities at all stages of the Project, Treasury Metals' commitment to implementing these activities and the resources provided for this purpose. Pertinent legislation, regulations, industry standards, documents and legislative guides have been used in the development of the monitoring program.

As stated in Section 12.22 of the revised EIS (April 2018), Treasury Metals proposes to form an Environmental Management Committee to ensure that Indigenous communities most affected by the Project have input into the effectiveness of the Environmental Management Plans, Follow-up Programs, and Environmental Monitoring Program. This committee would be made up of members from Indigenous communities and would meet with representatives from Treasury Metals on a to-be-determined basis. Treasury Metals would present any reportable information on the management plans as well as the results of the Follow-up and Monitoring Programs. If the results of data collection do not meet prediction or issues arise that show mitigation measures have not been as effective as expected, the potential for further actions would be discussed with the committee. The Environmental Management Committee would also provide a forum for discussing other environmental matters with the potentially affected Indigenous communities such as upcoming permits, additional traditional knowledge that might have been collected, and any other environmental matters of relevance to the committee.

M1.1 Addendum Structure

In accordance with the EIS Guidelines and at the request of the Agency through the Round 2 information requests, Treasury Metals has created a preliminary Environmental Monitoring Program. As described in Section 16 of the EIS Guidelines (Appendix Y to the EIS [April 2018]):

"The goal of a monitoring program is to ensure the proper measures and controls are in place to decrease the potential for environmental degradation during all phases of project development, and to provide clearly defined action plans and emergency response procedures to account for human and environmental health and safety."

The preliminary Environmental Monitoring Program has been segregated into the different disciplines used throughout the EIS that are presumed to have a regulatory monitoring requirement or those that will include environmental monitoring. The Environmental Monitoring Program addresses:

- Geology and Geochemistry
- Noise and Vibration
- Air Quality
- Surface Water Quality
- Surface Water Quantity
- Groundwater Quality
- Groundwater Quantity
- Wildlife and Wildlife Habitat
- Fish and Fish Habitat
- Aboriginal Peoples

In addition to the monitoring that will be completed to satisfy the requirements of Section 16 of the EIS Guidelines, this Environmental Monitoring Program outlines the anticipated regulatory monitoring programs requirements for these environmental disciplines for all phases of the Project, recognizing that environmental permits have not been received. Accordingly, the regulatory aspects of the monitoring program are conceptual and will be finalized during the permitting stage of the Project.

M1.2 Geology and Geochemistry

M1.2.1 Overview and Objectives of Proposed Monitoring

As part of the process to respond to the Round 1 information requests, Treasury Metals re-evaluated the geochemistry of the rock to be mined at the Project and took a more conservative approach to the time for the onset of acidification as well as the quality of seepage likely to result from the WRSA and the TSF. Additional geochemical monitoring and analyses were recommended to confirm the conservative nature of the analysis presented in Section 6.3 of the revised EIS, and to better characterize the expected long-term geochemical conditions expected for the Project.

M1.2.2 Responsibilities

Treasury Metals will be responsible for implementing the Geochemical monitoring program.

M1.2.3 Sampling / Monitoring Methodology

- Conduct supplemental ML/ARD static testing analysis during the engineering / development phase to assess the potential influence of aged (2009 and 2010) drill core on previous ML/ARD investigations and more completely assess mercury as a contaminant of potential concern, as well as chloride and phosphorus.
- Continue operation of existing field cells (one for each lithology) as data warrants and consider initiation of additional field cells using blended lithologies to simulate field conditions.
- Initiate a supplemental kinetic testing program for waste rock and tailings to address gaps identified in the current dataset.
- Develop a program to identify suitable construction rock for the project; monitor this rock during extraction to confirm initial sampling program as appropriate.
- Monitor waste rock and tailings solids quality including ARD potential (such as through a static testing or a similar program in accordance with a defined sampling program utilizing industry-standard protocols), to ensure predictions are confirmed, mitigation measures are appropriate and environmental protection is maintained.

M1.2.4 Measurement Parameters

- Monitoring of mine rock prior to site preparation and construction, during site preparation and construction and operations will be to determine the ML/ARD potential of the rock.

M1.2.5 General Timelines and Schedule

- The supplemental ML/ARD static testing analysis will be conducted prior to the site preparation and construction phases
- Waste rock and tailings solids will be monitoring for ARD potential during the operations phase of the Project
- Monitoring mine rock to identify suitable construction rock for the Project will be conducted during extraction in the site preparation and construction phase and the operations phase.

M1.2.6 Intervention in case of Non-compliance with Regulatory Requirements

None required.

M1.2.7 Reporting

Results of the geochemical monitoring will be summarized in the annual report required by the Closure Plan pursuant to the *Mining Act*.

M1.3 Current Noise and Vibration

M1.3.1 Overview of Proposed Monitoring Program

The predicted effects of the Project on noise and vibration were presented in Section 6.4 of the revised EIS and indicate that residual noise levels would meet the relevant criteria established by MECP. As a result, there would likely be no regulatory requirement for noise monitoring (i.e. required by ECA (air and noise) under the EPA). Additionally, the predicted residual effects of noise and vibration associated with blasting activities are below the precautionary limits identifying the need for noise and vibration monitoring in NPC-119 (MOECC, 1978). Therefore, no noise and vibration monitoring for blasting activities is anticipated to be needed from a regulatory perspective.

Treasury Metals will meet all regulatory monitoring requirements, but does not propose an ongoing noise or vibration monitoring program. A location / activity specific monitoring program may be developed in response to complaints or for Corporate purposes.

M1.3.2 Responsibilities

Treasury Metals will be responsible for implementing the Geochemical monitoring program.

M1.3.3 Sampling / Monitoring Methodology

Ambient Noise

- An ongoing ambient noise monitoring program is not proposed (note that ambient noise monitoring is part of the Follow-Up Program).
- An ambient noise monitoring program may be developed in response to follow-up on complaints from local individuals, in which case a location / activity specific monitoring program may be developed, to allow comparison to applicable regulatory requirements.

Blasting Noise and Vibration

- An ongoing blasting noise and vibration monitoring program is not proposed (note that blasting noise and vibration monitoring is part of the Follow-Up Program).
- A blasting noise and vibration monitoring program may be developed in response to follow-up on complaints from local individuals, in which case a location / activity specific monitoring program may be developed, to allow comparison to applicable regulatory requirements.

M1.3.4 Measurement Parameters

Ambient Noise

- Although ambient noise monitoring is likely not required, if monitoring is needed under Provincial approvals or Corporate requirements, noise would likely be recorded in the following manner:
 - Hourly, A-weighted equivalent noise levels (L_{eq} , in dBA)
 - Minimum of 72-hours of monitoring at each location.

Blasting Noise and Vibration

- Although an ongoing blasting noise and vibration monitoring is likely not required, if monitoring is needed under Provincial approvals or Corporate requirements, monitoring will be conducted when open pit mining activities are in pit 1 (western most pit) and relatively close to the surface. During the program, noise will be recorded in the following manner:
 - Peak sound pressure (in dBA)
 - Peak particle velocity (cm/s)
 - Peak particle velocity (cm/s).

M1.3.5 General Timelines and Schedule

Ambient Noise

- Should monitoring be determined to be necessary, the frequency and duration of ambient noise monitoring campaigns will be in accordance with Provincial approvals or Corporate requirements (such as in response to complaints).

Blasting Noise and Vibration

- Should ongoing monitoring be determined to be necessary, the frequency and duration of blasting and vibration noise monitoring campaigns will be in accordance with Provincial approvals or Corporate requirements.

M1.3.6 Intervention in case of Non-compliance with Regulatory Requirements

In the event that exceedances of regulatory criteria are observed at sensitive receptors, further mitigation measures will be developed and implemented with input from the MECP, Indigenous communities and local stakeholders as applicable, to allow for the Project to comply with the regulatory criteria.

M1.3.7 Reporting

Regulatory noise and vibration monitoring results, if any, will be provided to the applicable government agencies in regulatory reports. If the environmental monitoring program observes exceedances of the regulatory criteria, the applicable government agencies will be contacted as soon as practicable to notify them of the occurrence.

The results of monitoring completed in response to complaints, will be utilized to respond to the complainant. This may include preparation and issuing of a formal monitoring report.

M1.4 Air Quality

M1.4.1 Overview of Proposed Monitoring Program

The predicted effects of the Project on air quality, taking into account the avoidance measures incorporated into the Project (Section 6.6.3 of the revised EIS). Although there were predicted residual adverse effects on ambient air quality, it was also demonstrated that the Project would be able to achieve compliance with the O.Reg 419/05 point of impingement criteria at the property boundary, which would be required in order to support the regulatory permitting process to obtain an ECA (air and noise) under the EPA in Ontario (see Appendix J-3 of the revised EIS).

Although compliance is demonstrated, regulatory air monitoring requirements could be required by the MECP as part of the Provincial permitting process. The details of a regulatory monitoring program, would therefore be developed as part of the permitting process.

The proposed air quality monitoring program will begin prior to site preparation and construction and would cease once heavy equipment operations cease in the closure phase.

M1.4.2 Responsibilities

Treasury Metals will be responsible for implementing the air quality monitoring program.

M1.4.3 Sampling / Monitoring Methodology

- An ongoing air quality monitoring program is proposed as described in the Follow-up Program. Air quality monitoring will be conducted in the following manner:
- The air monitoring station will be installed near the security gate, south of the Project, and to the west of Normans Road.

M1.4.4 Measurement Parameters

- The air monitoring station near the security gate will possibly include analyzers to measure the following: total suspended particulate matter (TSP); one of either particulate matter nominally smaller than 10 µm (PM₁₀) or particulate matter nominally smaller than 2.5 µm (PM_{2.5}); and nitrogen dioxide (NO₂).
- Passive sampling of NO₂ and SO₂ would monitor average concentrations over 30-day periods through the year.
- Particulate matter will be collected passively over a 30-day period using dust fall jars. These collected samples will be submitted for analysis of total dustfall, as well as for the metals content within the collected particulates.

M1.4.5 General Timelines and Schedule

- Air quality sampling will occur over 30-day periods through the year starting during site preparation and construction and conclude following the closure phase.

M1.4.6 Intervention in case of Non-compliance with Regulatory Requirements

In the event that exceedances of regulatory criteria are observed at sensitive receptors or at the property boundary, further mitigation measures will be developed and implemented with input from the MECP, Indigenous communities and local stakeholders to allow for the Project to comply with O.Reg. 419/05 and the ECA (air and noise).

Outside of the regulatory monitoring, in the event that the air monitoring station observes TSP greater than regulatory criteria, water trucks will be deployed to spray the roads and limit the dust emissions.

M1.4.7 Reporting

Air quality monitoring results will be provided to the MECP in regulatory reports, in accordance with permit requirements if required. If the environmental monitoring program observes exceedances of the regulatory criteria, the applicable government agencies will be contacted as soon as practicable to notify them of the occurrence.

M1.5 Climate

M1.5.1 Overview of Proposed Monitoring Program

There are no regulatory criteria for GHG emissions from the Project and no regulatory monitoring program is proposed.

A meteorological station will be installed in the operations area to record continuous meteorological data. This data will be used in conjunction with the air quality data to determine trends, and will provide supporting information for ongoing Project engineering. Treasury Metals will be responsible for meteorological station operation and monitoring.

M1.6 Surface Water Quality

M1.6.1 Overview of Proposed Monitoring Program

The predicted effects to surface water quality from the Project are summarized in Section 6.8.4 of the revised EIS. It is expected that a comprehensive regulatory surface water quality monitoring program will be developed in cooperation with government agencies, as part of the Project permitting process under the ECA Industrial Sewage Works (ECA-ISW) / PTTW processes governed by the MECP and under Schedule 5, Part 1 of the MDMER). This regulatory program will include requirements for monitoring effluent and water quality of the receiving waterbodies (receiving water stations used during the baseline monitoring as shown in Figure M1.6-1 will be used as practical to allow for comparison to background conditions). The focus of the water quality monitoring program will be on those watercourses where potential effects to surface water quality could be seen as a result of the Project.

The surface water quality monitoring program, will begin prior to the site preparation and construction phase of the Project. The program will continue during operations, and will be reduced during the closure phase to reflect site activities. Monitoring is expected to cease shortly after closure, once regulatory requirements are met and as warranted by water quality results.

The surface water monitoring program outlined below in Sections M1.6.3, M1.6.4 and M1.6.5 as a part of the EA process is subject to change upon finalization of the regulatory monitoring program designated by applicable government agencies to allow for a single, harmonized monitoring program that encompasses all surface water quality monitoring without unnecessary duplication.

M1.6.2 Responsibilities

Treasury Metals will be responsible for implementing the Geochemical monitoring program.

M1.6.3 Sampling / Monitoring Methodology

Treasury Metals proposes to conduct surface water quality monitoring at some of the 12 baseline monitoring locations (Figure M1.6-1) as well as effluent monitoring (to be defined through the permitting process). Water samples taken from each location (or as substituted in the future) will be analyzed on a regular basis for relevant parameters.

Treasury Metals also proposed to monitor the water quality of the pit lake that will develop on completion of mining and initiation of flooding of the open pit. Pit lake water samples will be taken from a safe location on the ramp leading down into the pit by a qualified person using standard surface water sampling procedures. Once the pit lake is flooded, water samples will be taken from the discharge from the pit lake into Blackwater Creek Tributary 1, until such time as agreement has been obtained from the regulatory agencies to cease monitoring.

In all instances, water quality samples will only be taken if field conditions are safe and technically appropriate.

M1.6.4 Measurement Parameters

Table M1.6-1 that follows provides a preliminary program proposed for the construction, operation and closure phases, for confirmation through the permitting process and may be altered due to site conditions and safety considerations:

Table M1.6-1: Preliminary Surface Water Quality Monitoring Program

Sampling Location	Parameter Group					
	Group A ⁽¹⁾	Group B ⁽²⁾	Group C ⁽³⁾	Group D ⁽⁴⁾	Group E ⁽⁵⁾	Group F ⁽⁶⁾
SW-TL1A, SW-JCT, SW-2, SW TL3, SW-4, SW-7, SW-8, SW-9	Monthly	Monthly	Monthly	—	—	—
SW-10, SW-11	Monthly	Monthly	—	—	—	—
SW-5, SW-6	Annually	Annually	Annually	—	—	—
Effluent Discharge(s)	—	Monthly	—	Thrice Weekly	Weekly	Monthly

Notes:

- (1) Group A: pH, acidity, alkalinity, dissolved oxygen, chloride, conductivity, dissolved and total organic carbon, hardness, nitrate, nitrite, phosphate, sulphate, total and un-ionized ammonia, total dissolved solids, total suspended solids and turbidity.
- (2) Group B: Total ICP metals scan
- (3) Group C: free cyanide, total cyanide and weak acid dissociable cyanide
- (4) Group D: pH, total cyanide and total suspended solids
- (5) Group E: copper, lead, nickel, zinc and arsenic
- (6) Group F: Acute toxicity testing (Rainbow Trout and *Daphnia magna*).

In-situ field parameters (temperature, reduction-oxidation potential, pH and, dissolved oxygen) will also be measured during field sampling.

As per information request SW(2)-02, the effluent discharge sampling location may also be monitored for hydrocarbons on a basis with Group B parameters. Hydrocarbons may enter the water management system via run-off from equipment on-site or as a byproduct of blasting materials. Concentrations of hydrocarbons in water leaving the effluent discharge sampling location are anticipated to be below detection limits.

Samples taken from the open pit during closure and the discharge from the open pit during post-closure are anticipated to be analyzed for the parameters described in Table 1.6-1. In-situ field parameters (temperature, reduction-oxidation potential, pH and, dissolved oxygen) will also be measured during field sampling.

M1.6.5 General Timelines and Schedules

The frequency of the monitoring provided in the table is subject to revision as more data becomes available, and in response to permit requirements and may be reduced once a sufficient database is available.

Pit lake monitoring will be conducted following the cessation of groundwater pumping until the open pit is completely flooded as a minimum. Quarterly sampling is proposed over the 7 years that pit is filling, or as detailed in the Closure Plan. Once the pit lake is flooded, water samples will be taken of the discharge from the pit lake into Blackwater Creek Tributary 1, until such time as agreement has been obtained from the regulatory agencies to cease monitoring. The periodicity and details of this sampling will be provided in the Closure Plan.

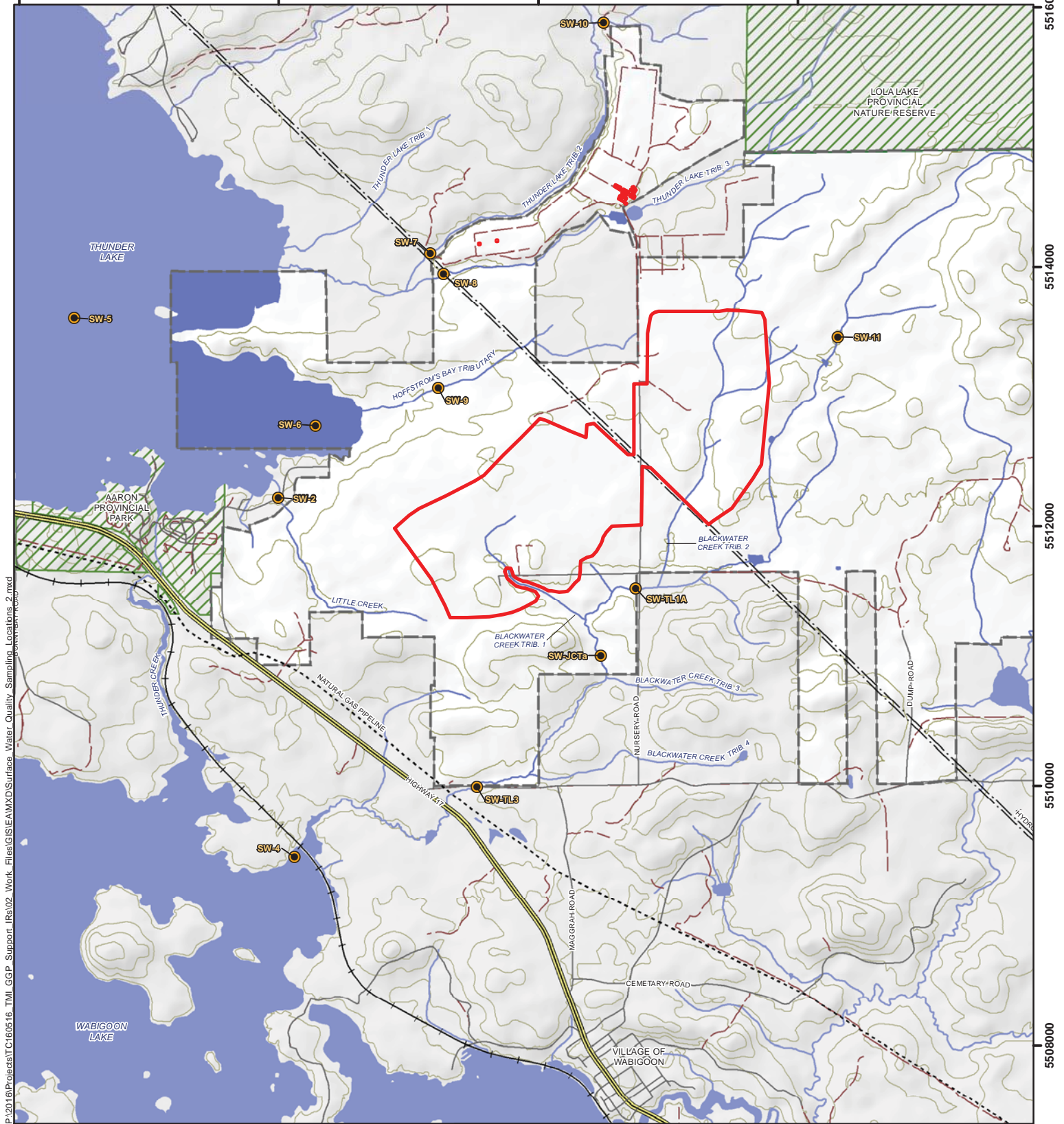
Samples are anticipated to be analyzed for the parameters described in Table 1.6-1. In-situ field parameters (temperature, reduction-oxidation potential, pH and, dissolved oxygen) will also be measured during field sampling. The periodicity and details of this sampling will be provided in the Closure Plan.

M1.6.6 Intervention in case of Non-compliance with Regulatory Requirements

In the event that exceedances of regulatory criteria are observed, the appropriate regulatory authorities will be notified of the exceedance and an investigation will be undertaken to identify the potential cause of the exceedance. Additional monitoring may be completed as required by the permits, as well as to provide greater certainty in the case of unexpected results. Further mitigation measures will be developed as appropriate to allow for the Project to comply with the ECA-ISW, MDMER and other regulatory requirements.

M1.6.7 Reporting

It is anticipated that a regulatory surface water quality monitoring program will be developed during the ECA-ISW process and other permitting applications, which will stipulate regulatory reporting requirements. Surface water quality monitoring results will be reported to the applicable government agencies at the predetermined reporting frequency, generally annually. If the environmental monitoring program observes exceedances of the regulatory criteria, the applicable government agencies will be contacted as soon as practicable to notify them of the occurrence.



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LEGEND

- Surface Water Quality Sampling Locations
- Operations Area
- Railway
- Hydro Line
- Natural Gas Pipeline
- Highway
- Local Street
- Resource / Recreation Trail
- Provincial Park
- Watercourse
- Waterbody
- Contours (10 m interval)
- Property Boundary of Claims and Dispositions
- Area Beyond Property Boundary

NOTES:
 - Topographic data extracted from Land Information Ontario (LIO), MNRF.
 - Watercourses represent pre-development conditions based on LIO database, as modified by KBM.



GOLIATH GOLD PROJECT

Surface Water Quality Sampling Locations

Datum: NAD83
 Projection: UTM Zone 15N



PROJECT N^o: TC160516

FIGURE: M1.6-1



SCALE: 1:40,000

DATE: April 2018

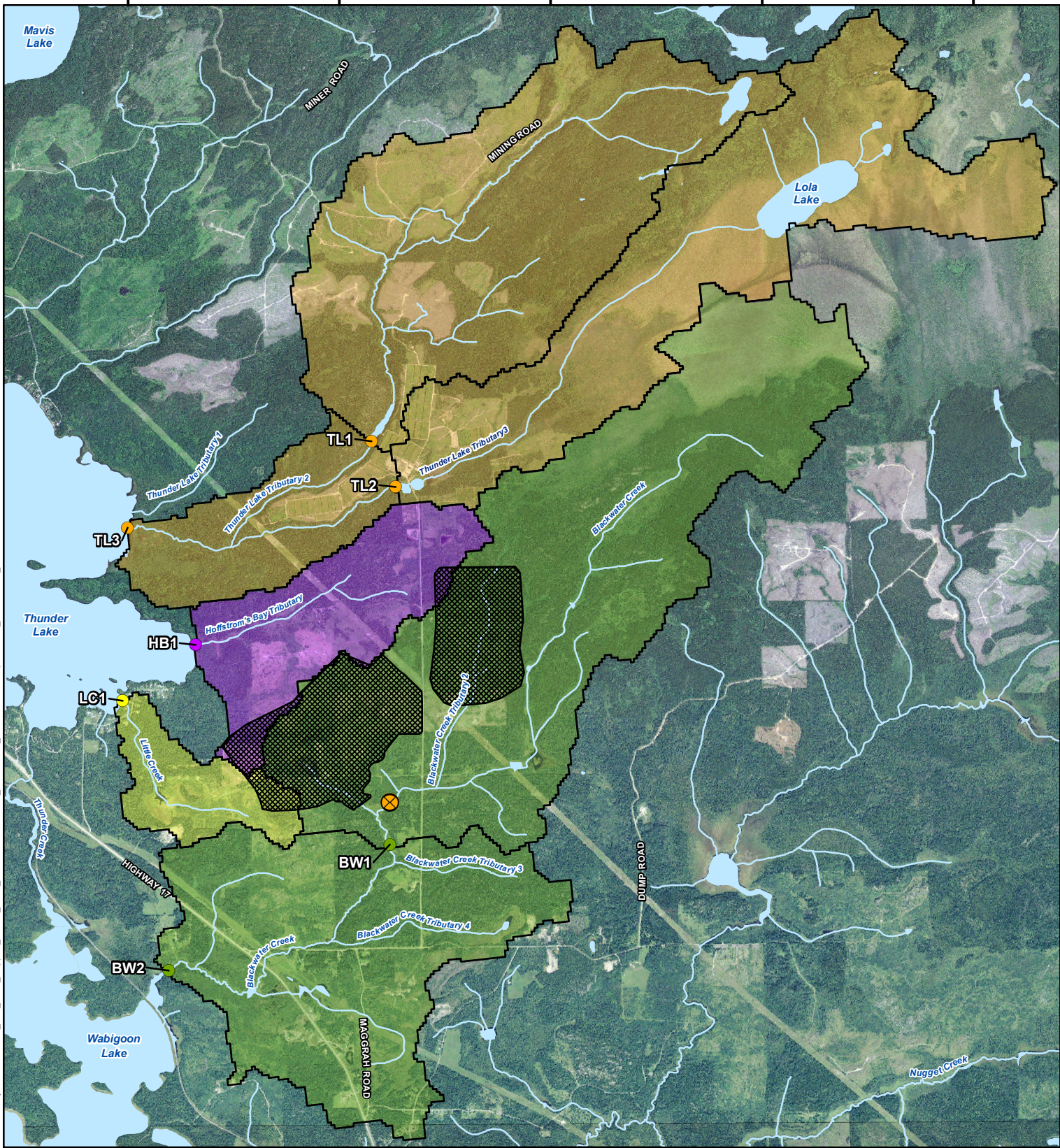
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LEGEND

- | | |
|---|--|
|  Operations Area |  Effluent Discharge Location |
| Sub-Watershed Outlet Locations | Sub-Watershed |
|  Blackwater Creek |  Blackwater Creek |
|  Hoffstrom's Bay Tributary |  Hoffstrom's Bay Tributary |
|  Little Creek |  Little Creek |
|  Thunder Lake Tributary 2 |  Thunder Lake Tributary 2 and 3 |

NOTES:
 - Topographic data extracted from Land Information Ontario, MNRF.
 - Imagery extracted from Agriculture Information Atlas, OMAFRA.



GOLIATH GOLD PROJECT

Proposed Surface Water Flow Monitoring Locations

Datum: NAD83
 Projection: UTM Zone 15N

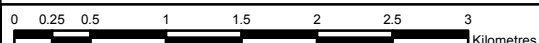


PROJECT N^o: TC160516

Figure M1.7-1

SCALE: 1:50,000

DATE: April 2018



M1.7 Surface Water Quantity (Flow)

M1.7.1 Overview of Proposed Monitoring Program

The predicted effects of the Project on surface water quantity are summarized in Section 6.9.4 of the revised EIS. As the Project will need to obtain permits to take water as part of the mine dewatering activities, as well as for fresh water withdrawals, it is also likely that some form of regulatory monitoring to confirm surface flow patterns will be required. The surface water quantity monitoring program will utilize monitoring locations previously used for establishing baseline conditions for surface water quality (see Figure M1.6-1).

Monitoring will begin prior to site preparation and construction and will continue into closure and potentially, post-closure. Treasury Metals will determine what equipment will be used to measure flow rates in the watercourses closer to the commencement of monitoring to ensure that industry standard equipment is used.

M1.7.2 Responsibilities

Treasury Metals will be responsible for implementing the surface water quantity monitoring program.

M1.7.3 Sampling / Monitoring Methodology

The regulatory monitoring program for surface water quantity will be developed with input from regulatory government agencies, and the proposed monitoring program presented below will need to be finalized through the permitting stage of the Project. Accordingly, the plan described below should be considered preliminary. In all instances, flow measurements will only be taken if field conditions are safe and technically appropriate.

Blackwater Creek

- Discrete flow monitoring would be conducted upstream (SW-TL1a) and downstream (SW_JCTa) of the proposed discharge point in Blackwater Creek (see Figure 1.7-1).
- Volume of effluent discharged into Blackwater Creek on a daily basis

Thunder Lake Tributaries 2 and 3

- Two discrete flow measurement stations downstream of the Project area, one on Thunder Lake Tributary 2 (SW-7) and one on Thunder Lake Tributary 3 (SW-8), as shown on Figure 1.7-1.
- In addition, continuous flows will be recorded as water flows into the irrigation ponds on Thunder Lake Tributaries 2 and 3. These readings will be used to determine the flows available in the irrigation ponds available for use as fresh water withdrawals.

Little Creek and Hoffstrom's Bay Tributary

- Flow readings will be taken periodically in both Little Creek (SW-2) and Hoffstrom's Bay Tributary (SW-9), shown on Figure 1.7-1.

M1.7.4 Measurement Parameters

Flow is calculated as cubic metres per second (m³/s).

M1.7.5 General Timelines and Schedule

The timing and schedule of the surface water quantity program will be developed in response to regulatory requirements. In all instances, flow measurements will only be taken if field conditions are safe and technically appropriate.

M1.7.6 Intervention in case of Non-compliance with Regulatory Requirements

In the event that exceedances of regulatory criteria are observed, the appropriate regulatory authorities will be notified of the exceedance and an investigation will be undertaken to identify the potential cause of the exceedance. Further mitigation measures will be developed and implemented as appropriate to allow for the Project to comply with the ECA-ISW.

M1.7.7 Reporting

It is anticipated that a regulatory surface water quantity monitoring program will be a component of the ECA-ISW and the PTTW process, which will stipulate regulatory reporting requirements. Regular reporting of data is anticipated to occur on an annual basis. If the environmental monitoring program observes exceedances of the regulatory criteria, the applicable government agencies will be contacted as soon as practicable to notify them of the occurrence, with reporting of results as required at that time.

M1.8 Groundwater Quality

M1.8.1 Overview of Proposed Monitoring Program

The predicted effects of the Project on groundwater quality are summarized in Section 6.10.4 of the revised EIS. As part of the baseline groundwater quality data collection, Treasury Metals installed a number of groundwater monitoring wells and developed an extensive groundwater quality monitoring program. Additional wells will be installed as outlined in the following sections prior to the commencement of Project operations, for monitoring groundwater quality and/or levels. This program may be modified based on regulatory requirements that arise through the permitting process. The monitoring program will continue from prior to site preparation and construction into the closure phase.

M1.8.2 Responsibilities

Treasury Metals will be responsible for implementing the groundwater quality monitoring program.

M1.8.3 Sampling / Monitoring Methodology

Groundwater monitoring wells will be either for groundwater sampling or groundwater level recording, with some wells serving both purposes. The primary horizon for groundwater flow is the shallow bedrock (SBR) horizon and, when present, the basal sand (BS) aquifer that occurs at the base of the fine-grained,

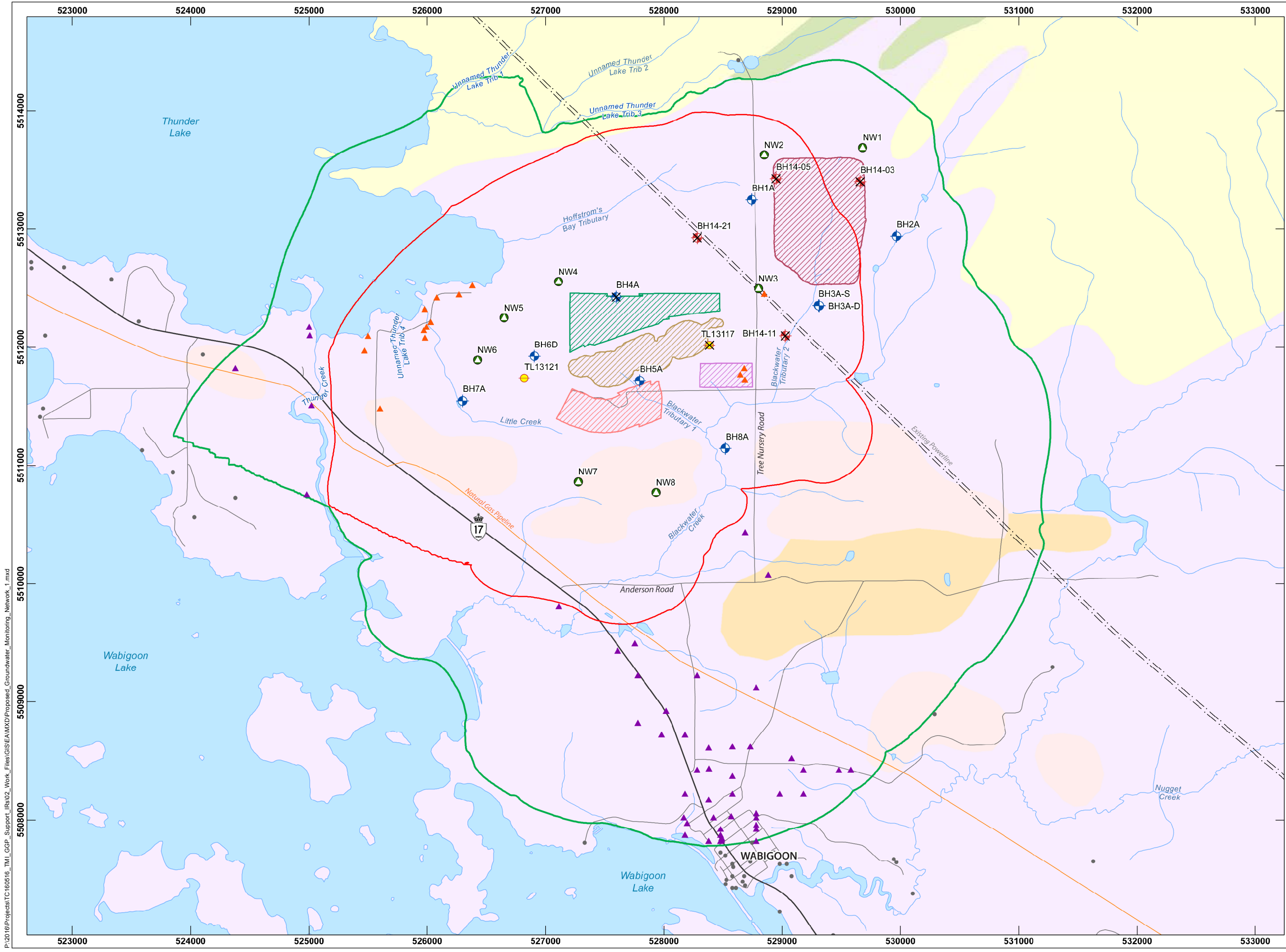
clay dominated glaciolacustrine deposits (the dominant overburden of the Project area). Most monitoring wells will be screened within either the SBR or BS, or possibly both depending on ground conditions encountered during drilling. In the vicinity of the TSF, a sand-clay/silt-sand sequence occurs. In this location, wells will be nested to sample the surficial sand (SS) and BS if the sand-clay/silt-sand sequence is encountered (i.e., similar to the existing BH3A Shallow and BH3A Deep). The well screen in the SS will monitor the performance of the seepage collection ditches in collecting shallow horizontal groundwater flow out of the TSF, whereas the well screen in the BS will provide monitoring for vertical seepage out of the base of the TSF.

It is expected that a total of eight wells / piezometers (six single-screen wells, one nested well and one nested vibrating wire piezometer [VWP]) of the current groundwater monitoring installations will be used for the future groundwater monitoring network (Figure M1.8-1, Table M1.8-1).

An additional eight monitoring locations will be installed, as per Figure M1.8-1 and Table M1.8-1 to expand coverage of the groundwater quality monitoring network:

- Three wells (NW1, NW2 and NW3) are close to the perimeter of the TSF for groundwater quality monitoring. These will be nested with a screen in the SS and the BS/SBR (i.e., top and bottom of sand-clay/silt-sand sequence).
- Three wells (NW4, NW5 and NW6) with single screens in BS/SBR to the west of the open pit in distal locations to monitor groundwater levels between Thunder Lake and the perimeter of the Treasury Metals property. Two of these will also be used for groundwater quality monitoring of the WRSA (NW4 and NW5).
- Two wells (NW7 and NW8) with single screens in BS/SBR are required to the south of the open pit in distal locations to monitor groundwater levels along the perimeter of the Treasury property in the direction of Wabigoon.

All the installations of the groundwater monitoring network will be constructed and/or modified where necessary to include protective casings and markings and, if required, a barricade to prevent damage by heavy equipment during mine construction and operation.



GOLIATH GOLD PROJECT
 DRYDEN, ONTARIO, CANADA

Figure M1.8-1
 PROPOSED GROUNDWATER
 MONITORING NETWORK

Legend

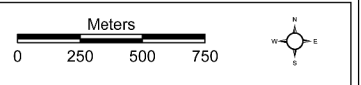
- 2013 Monitoring Well
- 2014 Geotechnical Hole
- Exploration Borehole with Vibrating Wire Piezometer
- MOE Well Outside ZOI
- MOE Well Within 5m ZOI
- MOE Well Within ZOI
- Proposed New Well for GWM Network
- Base Case 5m Drawdown
- Zone of Influence (ZOI)
- Stage 4 TSF Boundary
- Ultimate Pit Shell (Phase III)
- Low-Grade Stockpile
- Overburden Storage
- Waste Rock Storage
- Hydro Line
- Natural Gas Pipeline
- Highway 17
- Local Roadway
- Waterbody
- Watercourse

Landform

- GK: Kame
- GO: Glaciofluvial Outwash
- LP: Glaciolacustrine Plain
- OT: Organics
- RN: Bedrock Knob

Indicates well not proposed for future groundwater monitoring network

NOTES:
 1. UTM Zone 15N, NAD83
 2. Base Data Source: OBM
 3. 1:30 000 scale
 4. Well and Modelling Data by AMEC
 DATE: October, 2014
 DRAWN BY: AT
 CHECKED BY: AT
 REVISION: 00



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Table M1.8-1: Location and Type of Groundwater (Quality and Quantity) Monitoring

Well ID	Location	Type	Screened Units	Monitoring Objective
BH1A	West of TSF, Nursery Road	Quality and level	BS/SBR	Down-gradient water quality of TSF
BH2A	East of TSF, Blackwater Creek	Quality and level	BS/SBR	Upstream of TSF – background groundwater quality in basal sand/shallow bedrock
BH3A-S, BH3A-D	South of TSF, Blackwater Tributary 2	Quality and level	SS BS	Down-gradient water quality of TSF in shallow sand Down-gradient water quality of TSF in basal sand
BH6D	West of Open Pit and WRSA, proximal	Quality and level	BS	Water level proximal to open pit and down-gradient of WRSA
BH7A	South of Open Pit, distal	Level (only)	BS	Water levels distal to open pit, east of Thunder Lake
BH8A	West of Open Pit, proximal	Level (only)	BS	Water levels distal to open pit, north of Wabigoon.
TL13121-S TL13121-D	West of Open Pit, proximal	VWP	IBR – 64 mbg IBR – 223 mbg	Pressure response to dewatering in open pit in intermediate bedrock along mineralized zone
New well (NW) 1 (nested)	North of TSF	Quality	SS and BS/SBR	Northern edge of TSF – nested piezometer assuming presence of Sand-Clay/Silt-Sand sequence
NW2 (nested)	North-west of TSF, Nursery Road	Quality	SS and BS/SBR	Down-gradient water quality – nested piezometer assuming presence of Sand-Clay/Silt-Sand sequence
NW 3 (nested)	South-west of TSF, Nursery Road	Quality	SS and BS/SBR	Down-gradient water quality – nested piezometer assuming presence of sand-clay/silt-sand sequence
NW 4	North-west of Open Pit and WRSA	Quality and level	BS/SBR	Down-gradient water quality of WRSA and water levels distal to open pit, east of Thunder Lake
NW 5	West of Open Pit and WRSA	Quality and level	BS/SBR	Down-gradient water quality of WRSA and water levels distal to open pit, east of Thunder Lake
NW 6	West of Open Pit, distal	Quality and level	BS/SBR	Down-gradient water quality of WRSA and water levels distal to open pit, east of Thunder Lake
NW 7	South of Open Pit, distal	Level (only)	BS/SBR	Water levels distal to open pit, east of Thunder Lake
NW 8	South of Open Pit, distal	Level (only)	BS/SBR	Water levels distal to open pit, north of Wabigoon.

M1.8.4 Measurement Parameters

Water levels will be taken at each groundwater well prior to sampling. Groundwater samples will be analyzed for the following parameters suites:

- Metals (dissolved);
- Cyanide in monitoring wells around TSF (total, free and weak acid dissociable (WAD) for first year, then total and WAD thereafter);
- Major anions and cations; and

- In-situ field parameters (temperature, reduction-oxidation potential, pH, dissolved oxygen).

M1.8.5 General Timelines and Schedules

Groundwater quality wells will be sampled at a frequency of three to four times per year, when the well is not frozen, starting during the site preparation and construction phase and cease in the closure phase. During the closure phase, the wells will be progressively decommissioned at an appropriate timing, in accordance with regulatory requirements. Assuming groundwater quality results are acceptable, sampling is anticipated to cease and the distal wells are anticipated to be decommissioned early in the closure phase. Groundwater quality monitoring proximal to the TSF and WRSA would continue during the closure phase at least until both the TSF and WRSA are capped. On review of the data with acceptable results, the groundwater quality sampling at these and any remaining locations would be terminated and the wells decommissioned as per the Closure Plan.

M1.8.6 Reporting

A regulatory groundwater quality monitoring program will be developed as part of the ECA-ISW / PTTW applications, which will stipulate regulatory reporting requirements. It is likely that this report will be produced annually, summarizing results. In the event that exceedances of regulatory criteria are observed, the appropriate regulatory authorities will be notified of the exceedance and an investigation will be undertaken to identify the potential cause of the exceedance. If appropriate, further mitigation measures may be developed and implemented. This may include the acquisition of a qualified hydrogeologist to identify the source as well as the installation of additional groundwater monitoring wells.

M1.9 Groundwater Quantity

M1.9.1 Overview of Proposed Monitoring Program

The predicted effects of the Project on groundwater quantity were summarized in Section 6.11.4 of the revised EIS. The potential effect on groundwater quantity will be monitored as part of the groundwater quantity monitoring program outlined in this section.

A groundwater quantity (level) monitoring program will be developed as part of the permitting and approvals process under the MOECC to obtain an ECA-ISW / PTTW. In addition, Treasury Metals will conduct groundwater level monitoring in the wells installed for baseline measurements to confirm the predicted location of the drawdown zone from dewatering activities. The groundwater quantity monitoring program will begin prior to the start of dewatering activities, and will cease during the closure phase once the groundwater levels return to near pre-development levels in the post-closure phase. The proposed program may be modified to facilitate reclamation activities during closure, including replacement of wells with alternative locations as needed.

M1.9.2 Responsibilities

Treasury Metals will be responsible for implementing the groundwater quantity monitoring program.

M1.9.3 Sampling / Monitoring Methodology

Manual water level measurements will be re-initiated on a monthly basis in the existing wells once a decision to proceed to development is made (Figure M1.8-1, Table M1.8-1), until the Project advances to a point where the installation of continuous loggers is warranted. Prior to pit dewatering, new wells will be installed, and wells will be equipped with pressure transducers set to record water levels at least once per day, and downloaded on a quarterly basis. Two of the wells will be equipped with a barologger to allow data correction for barometric effects. A data logger will be obtained for the VWP nested piezometer and a similar recording and downloading frequency will be undertaken for this installation.

M1.9.4 Measurement Parameters

Groundwater levels will be measured as metres above sea level (masl)

M1.9.5 General Timelines and Schedules

Pressure transducers will record water levels at least once per day starting during site preparation and construction and cease in the closure phase.

M1.9.6 Intervention in case of Non-compliance with Regulatory Requirements

There are no anticipated regulatory requirements associated with groundwater levels. In the event that groundwater levels are different than predicted, the model will be reassessed and further mitigation measures may be developed and implemented as appropriate.

M1.9.7 Reporting

It is anticipated that a regulatory groundwater quantity monitoring program will be developed during the ECA-ISW / PTTW approvals process, which will stipulate regulatory reporting requirements including monitoring and reporting required. It is anticipated that an annual report will be prepared summarizing the results of the groundwater quantity monitoring program.

M1.10 Wildlife and Wildlife Habitat

M1.10.1 Overview of Proposed Monitoring Program

The predicted effects of the Project on wildlife and wildlife habitat are summarized in Section 6.12.4 of the revised EIS. There is no proposed monitoring of wildlife and wildlife habitat on an ongoing basis, although additional surveys are planned to fill gaps identified in the migratory bird baseline data (Figure M10-1). Further, a follow-up program is planned, which includes monitoring of species composition and abundance and utilization of habitat (Section FUP1.15 of the Goliath Gold Project Follow-up Program Addendum).

M1.10.2 Responsibilities

Treasury Metals will be responsible for conducting additional spring songbird surveys in 2019 (intended to fill gaps, as mentioned above), as well as implementing the wildlife and wildlife habitat monitoring program.

M1.10.3 Sampling / Monitoring Methodology

A songbird field survey program will be initiated in 2019 to fill deficiencies identified in fen habitat. This field program is not intended to assess predicted project effects, but rather contribute to baseline data. The field program will be designed with the guidance of CEEA, ECCC, MNRF and MCP, and will likely involve the installation of acoustic recorder units (ARUs) and point count surveys in fen habitat associated with the Lola Lake Reserve. The final sampling effort of the field program will be determined with the guidance of the aforementioned government agencies. The tentative survey details are as follows:

Five to ten songbird survey stations will be established in the spring of 2019, exclusively targeting fen habitat within the LSA. Final survey locations will depend largely on access. Please refer to Figure M1.10-1 for a rough distribution of possible survey locations. More remote locations will be monitored using ARUs, which will likely be established in the winter while the ground is still frozen, accessed via helicopter. ARUs will be pre-programmed to activate within the breeding bird window (May 24 - July 10). ARUs will be retrieved after a period of 18-24 days of activity (the estimated battery life of the units), again accessed via helicopter. Where possible, ground-based surveys will be undertaken, employing a methodology consistent with the existing baseline songbird surveys described in the revised EIS. Each station location will be surveyed once, which is consistent with the data presented in the EIS. This supplementary monitoring will only be conducted in 2019, which is believed to be sufficient to adequately address any deficiencies identified in the baseline work conducted to date. MNRF will be contacted for guidance regarding future monitoring activities if SAR listed as "threatened" or "endangered" are identified through this monitoring program.

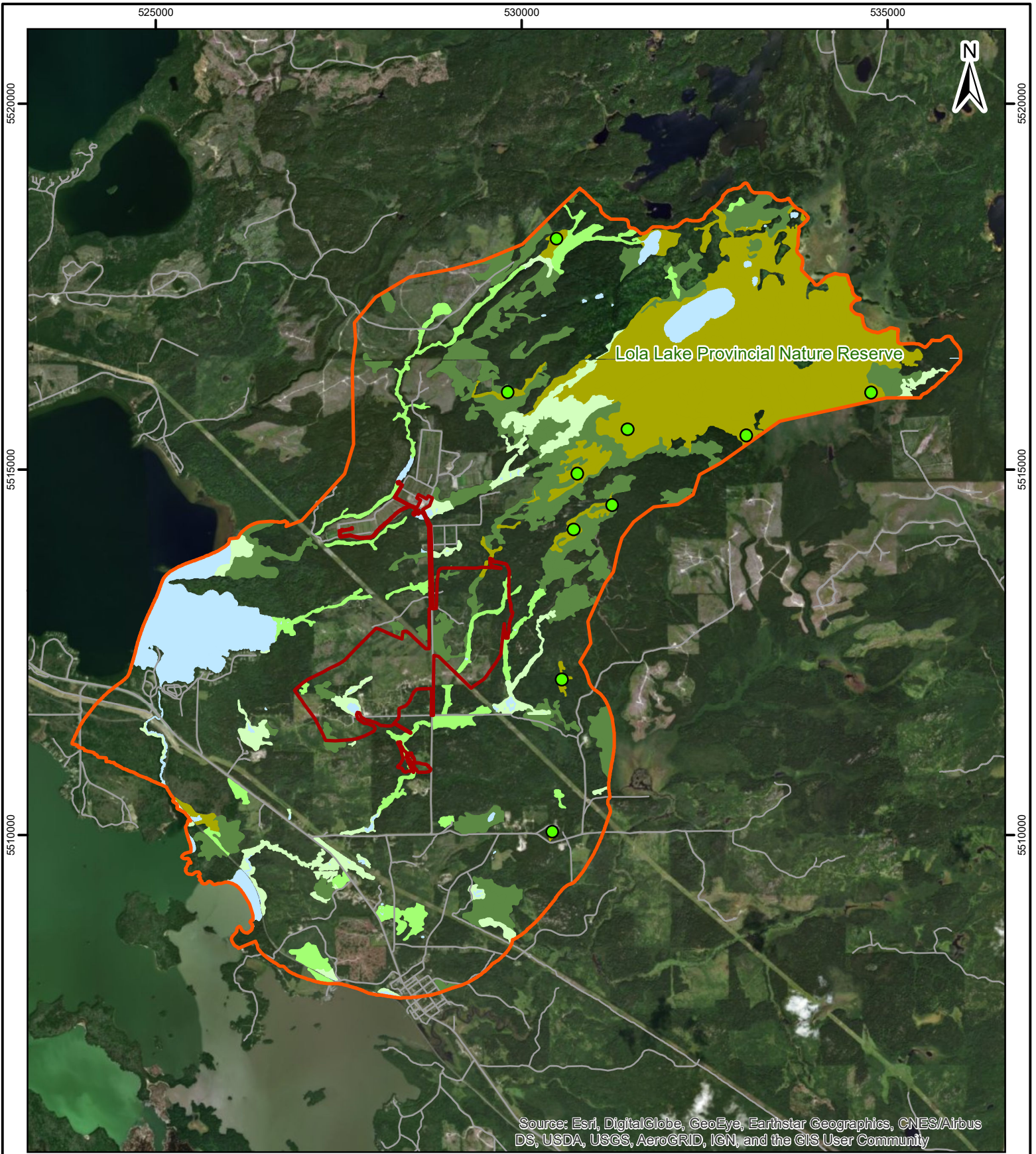
Additionally, monitoring will be conducted of Project-related interactions with wildlife. A log will be kept of wildlife sightings and of wildlife vehicular collisions. The collision log is intended to monitor effectiveness of speed limits on protecting wildlife, and to identify areas of high wildlife collision potential in order to apply additional mitigation. All wildlife observations (including collisions) will include the following:

- Date
- Time
- Location
- Species
- Observation type

Should high collision areas be identified within the Project area, additional mitigation measures (e.g., roadway wildlife exclusion fencing and roadway underpasses for small species) may be considered in discussion with the MNRF.

M1.10.4 Measurement Parameters

- The breeding bird survey will assess the densities of species present within surveyed habitat types.



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure M1.10-1
Potential Songbird Survey Locations

Legend

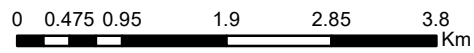
- PSA
- LSA
- Potential Songbird Survey Locations (2019)
- Fen
- Marsh
- Swamp - Coniferous
- Swamp - Deciduous
- Waterbody



Projection: NAD 1983 UTM Zone 15N

Date created: 2018-11-30

SCALE: 1:68,511



- The interactions with wildlife monitoring will look at both species and area of interaction.

M1.10.5 General Timelines and Schedules

- The songbird field survey will be conducted in the spring of 2019 within the active breeding bird window (May 24 - July 10).
- Monitoring interactions with wildlife will occur throughout the life the Project from site preparation and construction to the post-closure phase.

M1.10.6 Intervention in case of Non-compliance with Regulatory Requirements

There are no anticipated regulatory requirements associated with wildlife and wildlife habitat, in consideration of the plan to schedule construction and development activities to avoid sensitive wildlife periods.

M1.10.7 Reporting

No less frequently than annually, Treasury Metals will review and summarize the findings of the wildlife logs. This information will be available at site on request.

M1.11 Migratory Birds

The monitoring for migratory birds has been included in the wildlife and wildlife habitat monitoring program described in Section M1.10.

M1.12 Fish and Fish Habitat

M1.12.1 Overview of Proposed Monitoring Program

The predicted effects from the Project on Fish and Fish Habitat are summarized in Section 6.14.4 of the revised EIS. It is expected that regulatory fish and fish habitat effects monitoring will be completed as a requirement of the MDMER under the *Fisheries Act*. This will consist of effluent and water quality monitoring that will be harmonized with the surface water quality monitoring program outlined in Section 8, as well as biological monitoring studies in the aquatic receiving environment to determine if mine effluent is causing any adverse effects to fish or fish habitat. This fish and fish habitat monitoring program will be developed with the help of a qualified aquatic biologist and submitted to DFO for approval. Additionally, it is expected that monitoring of the fisheries offsetting for the Project will also be required as a condition of the *Fisheries Act* authorization. The nature of this monitoring will be determined when the offsetting measures are finalized.

Anticipated regulatory monitoring requirements, which will be developed with input from ECCC. There are also other potential regulatory requirements for fisheries monitoring that will be advanced during the

permitting process. The expectation is that the various regulatory programs would be harmonized to simplify monitoring and reporting requirements.

M1.12.2 Responsibilities

Treasury Metals will be responsible for implementing the fish and fish habitat monitoring program.

M1.12.3 Sampling / Monitoring Methodology

Biological Effluent Monitoring

- Effluent:
 - Sub-Lethal Toxicity / Acute Toxicity Test of sample taken from end of pipe location will be conducted for benthic invertebrate and fish species
- Blackwater Creek:
 - Sub-Lethal Toxicity / Acute Toxicity Test on benthic invertebrate and fish species from a sample taken from the discharge location on Blackwater Creek
 - Survey of fish species composition using the same techniques from baseline studies once every three years
- Thunder Lake Tributaries 2 and 3:
 - Survey of fish species composition using the same techniques from baseline studies once every three years
- Little Creek and Hoffstrom's Bay Tributary:
 - Survey of fish species composition using the same techniques from baseline studies once every three years
- Control Site:
 - Survey of fish species composition using the same techniques from baseline studies once every three years

Monitoring of mercury in fish is not expected to be required under the MDMER due to low mercury concentrations in effluent (<0.10µg/L), pending confirmation of effluent testing

Fish Habitat Offset Monitoring

Fish surveys of the constructed habitat offset will be conducted to determine effectiveness using the same sampling techniques from baseline sampling, during Year 1 and 5, following the construction of the habitat offset.

M1.12.4 Measurement Parameters

Biological Effluent Monitoring

- Sub-Lethal Toxicity / Acute Toxicity Tests will look at the toxicity of the water being sampled to both fish and benthic invertebrates using the MDMER standards.

- Fish surveys will look at species composition within the waterbodies being surveyed.

Fish Habitat Offset Monitoring

- Fish surveys will look at species composition within the waterbodies being surveyed.

M1.12.5 General Timelines and Schedules

Biological Effluent Monitoring

- Sub-Lethal Toxicity / Acute Toxicity Tests frequency will be confirmed through the regulatory process, but will likely occur on an annual basis.
- Fish surveys will occur at three year intervals.

Fish Habitat Offset Monitoring

- Fish surveys will occur at three year intervals.

M1.12.6 Intervention in case of Non-compliance with Regulatory Requirements

A commitment has been made to treat effluent releases from the Project during operations to Provincial Water Quality Objectives (PWQO) or Canadian Water Quality Guidelines (CWQG) prior to release into Blackwater Creek. If monitoring data should indicate that this commitment is not being fulfilled, Treasury Metals would review and implement further treatment measures and/or optimizations to achieve this commitment. If the changes in flows resulting from Project construction, groundwater drawdown, and operations are greater than anticipated (see Section 13.9 of the revised EIS) and detrimental to fish habitat, or if fish habitat offset measures fail to perform as intended, discussions would be held with DFO as to the potential need for additional fish habitat offsets.

Criteria for considering adaptive management measures would include the following:

- Final effluent quality does not meet PWQO, such that adverse water quality effects to aquatic life in Blackwater Creek are anticipated, or shown to occur;
- Baseflow reductions in Project area creeks due to groundwater drawdown effects, linked to open pit dewatering, are greater than anticipated and detrimental to fish habitat;
- Fish community changes is observed in which a dominant species, defined as a species that comprised more than 20% of the total numbers caught during baseline, does not appear in the catch;
- Benthic invertebrate community indices fall outside of the normal range for similar habitats; and
- Fish habitat offset measures fail to perform as intended.

M1.12.7 Reporting

It is expected that a regulatory fish and fish habitat monitoring program will be developed during the permitting process, which will stipulate regulatory reporting requirements under applicable Federal and

Provincial Acts and regulations. Reporting is typically required to be completed the year following the completion of sampling.

M1.13 Aboriginal Peoples

M1.13.1 Overview of Proposed Monitoring Program

The predicted effects of the Project on Aboriginal peoples were presented in Section 6.21.4 of the revised EIS. The predictions show that, even with the implementation of mitigation measures presented in Section 6.21.5, a number of residual effects will remain to Aboriginal peoples. The monitoring of some of the potential effects to Aboriginal peoples as a result of the Project is effectively captured within the Follow-up Program (Section FUP1.22 of the Goliath Gold Project Follow-up Program Addendum) and other monitoring programs outlined in previous Sections. These include:

- Noise and Vibration Monitoring (see Section M1.3);
- Air Quality Monitoring (see Section M1.4);
- Surface Water Quality Monitoring (see Section M1.6);
- Groundwater Quality Monitoring (see Section M1.8); and
- Wildlife Monitoring (see Section M1.10).

Monitoring is proposed of the potential economic effects of the Project. These proposed monitoring programs are anticipated to include (pending further guidance from Indigenous communities):

- Indigenous employment during site preparations and construction, operations, and closure phases of the Project, as well as any employment during the care and control phase of the post-closure phase; and
- Indigenous business opportunities site preparations and construction, operations, and closure phases of the Project.

M1.13.2 Reporting

All of the applicable monitoring programs that encompass potential effects to Aboriginal peoples from the Project will be reported on either to required government agencies as part of the Follow Up Program report and/or regulatory reporting. The results of the monitoring of economic effects will be reported on an agreed upon framework and frequency, and will be provided to the applicable Indigenous community.

M1.14 Summary

A table has been provided below that summarizes the proposed monitoring programs (Table M1.14-1). Recognizing that these monitoring programs may overlap / supplement the Follow Up Program (The Goliath Gold Project Follow-up Program Addendum), this document should also be considered.

It should be noted that Treasury Metals is aware that regulatory monitoring will be required by government agencies upon EA approval (i.e. ECA monitoring); however, these monitoring programs have not yet been developed and are not included in the summary of EIS monitoring table and this document as indicated in Section M1.1 should be considered preliminary and subject to revision.

Table M1.14-1: Summary of the Environmental Monitoring Programs

Discipline	Permit	Responsibility	Parameter	Monitoring Method	Project Phases	Preliminary Locations
Geology and Geochemistry	Closure Plan	Treasury Metals	Metals (dissolved) In-situ field parameters Major ions (anions and cations)	Static and Kinetic Testing Field Cells	Site-preparation and Construction Operations	On-site
Noise and Vibration (Ambient Noise)	ECA (air and noise)	Treasury Metals	A-weighted equivalent noise levels (L_{eq} in dBA)	24-hour monitoring intervals A series of 1-hour measurements at varying distance	Site preparation and construction Operations Closure	Varying locations around and outside the operations area / response to complaints
Noise and Vibration (Blasting)	ECA (air and noise)	Treasury Metals	Peak sound Pressure (dBA) Peak particle velocity (cm/s)	Measurements taken during blasting events in pit 1	Operations (when open pit mining activities are in pit 1 and relatively close to the surface)	Selected sensitive receptors along east Thunder Lake Road
Air Quality	ECA (air and noise)	Treasury Metals	24-hour TSP Annual TSP 24-hour PM_{10} 24-hour $PM_{2.5}$ 1-hour NO_2 24-hour NO_2	Air sampler may be used that is capable of measuring the require parameters	Site preparation and construction Operations Closure	At the security gate south of the Project
Air Quality (passive)	ECA	Treasury Metals	1-hour NO_2 1-hour SO_2	Passive sampling	Site preparation and construction Operations	West of the Project on Thunder Lake Road and east of the Project on Normans Road
Surface Water Quality	ECA MDMER	Treasury Metals	General Parameters Metals Cyanide (as applicable) Major ions Field measurements	Surface water samples will be taken using industry standard methods	Site preparation and construction Operations Closure Post-closure	Various watercourses (1.6-1) and Effluent
Surface Water Quantity	ECA-ISW PTTW	Treasury Metals	Effluent Discharge Watercourse Flows	Flow measurements will be taken using industry approved methods	Site preparation and construction Operations Closure	Preliminary locations on watercourses (Figure 1.7-1) and Effluent

Discipline	Permit	Responsibility	Parameter	Monitoring Method	Project Phases	Preliminary Locations
Groundwater Quality	ECA-ISW	Treasury Metals	General Parameters Dissolved Metals Cyanide (as applicable) Major ions Field measurements	Samples will be taken three to four times a year (when not frozen)	Site preparation and construction Operations Closure	Preliminary locations shown in Figure M1.8-1 and described in Table M1.8-1
Groundwater Quantity	PTTW	Treasury Metals	Groundwater levels / elevation	Manual water level measurements to be replaced by pressure transducers	Site preparation and construction Operations Closure	Preliminary locations shown in Figure 1.8-1 and described in Table 1.8-1
Wildlife and Wildlife Habitat	None	Treasury Metals	Wildlife (moose, wolf, lynx, and bear) presence and mortality	Log of material wildlife sightings and collisions	Site preparation and construction Operations Closure	Operations area
Fish and Fish Habitat	MDMER	Treasury Metals	Fish species composition Sub-lethal toxicity / Acute toxicity test	Assess the fish species composition in the habitat offset location Use industry standard methods for testing	Site preparation and construction Operations Closure	Fish habitat offset location Effluent discharge location(s)
Aboriginal peoples	None	Treasury Metals	Aboriginal employment and business opportunities	TBD upon consultation with Indigenous communities	TBD upon consultation with Indigenous communities	TBD upon consultation with Indigenous communities